Symmetry in Music

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by Peter Traj

The diagram below shows an octave divided with scales and chords. If you play the notes up and down (a chord progression is better) and alternate between them you find the diatonic makes a tonal center and the rest negate it.

Symmetry in Music
(courtesy Peter Traj)
(click to enlarge)

The diatonic scale divides the octave asymmetrically but the rest donâ€™t. Broken symmetry must be creating the center by injecting tension then exhausting it which we perceive as goal-directed motion. The best tonailty-defining 'tensor' we have is the interval of a tritone which cuts the octave symmetrically (in half) but is completely discordant to the tonal center.

Symmetry is usually consonant, free of tension, and stabalizing but in the tritone itâ€™s the opposite; itâ€™s dissonant, full of tension, and destabalizing. How does symmetry do a back flip in the tritone? The answer is messy so wonâ€™t go there.

The tritone is the main interval for establishing tonality because it wants to unfold into a tonal center. But if you play tritones in succession you get tension after tension which never find resolve and this is what the symmetrical scales do.

Take the tritone in the key of C (F â€“ 😎. It is like a twisted up anti-tonic just waiting to snap into tonality. It is a tonic-in-waiting (in super-position) and collapses to create a tonal center on one of two possible notes: C or F#, which are polar opposites. The diagram below shows this better.

Symmetry in Music
(courtesy Peter Traj)
(click to enlarge)

Once a center is established its octaves becomes tonal posts (home base) and terminate motion. The octaves provide vertical structure (harmony) while the other intervals move more horizontally (melodically) especially at the level of major 2nds.

If C is home then F# is Siberia as any composer will agree that a key built a tritone away from an arbitrary key is the furthest away from it you can get. They are polar opposites (light/dark, white/black, etc.) and thatâ€™s how composers use them. The note on the Tritone (F#) was called the Diabolus (devil) and students were taught to â€˜prepareâ€™ it by surround it with consonant intervals and give it less time in the mix to keep it under control.

There are two main symmetries apart from full chromatic; the diminished and the whole-tone. Neither has a tonal center nor wants one because they contain a succession of tritones that keep killing off a tonal center. Look at the whole-tone scale:

C D E F# G# A# C

Every note has a tritone three steps away (C-F#)(D-G#)(E-A#) so every 3rd step kicks an anti-tonality-grenade and the tension stays bound!

The diminished chord is similar with a tritone every 2nd step:

C Eb Gb A C

But the diatonic scale has just one tritone between F and B:

CDEFGABC

This is why the scale-notes resolve to a definite center and why the tonality is not constantly destroyed by a â€˜tritonicâ€™ land mine.

All other scales move the tritone around for variety but the diatonic has the strongest center.
Here is a good way to look at the octave:

Symmetry in Music
(courtesy Peter Traj)
(click to enlarge)

At the top of the diagram is the chromatic scale. It juxtaposes itself into two whole-tone scales (yellow is C and orange is C#). Below that is the diatonic scale extracted. Notice we take three notes from the whole tone scale at the top and four notes from the one below. The ratio is 3:4. It is like pulling back on a bow with an arrow.

The tritone at B-F can then exhaust into a major 3rd which just happens to be whatâ€™s left between the tritone and the tonic. So right there we have a snap shot of tonality. The 3:4 is a perfect 4th (F) and its inverse 4:3 a perfect 5th (G) and together with the tonal center (C) they form the base of all form in music, (the tonic-to-dominant relation) with the inverse of the dominant taking the subdominant degree as the diagram below shows:

Symmetry in Music
(courtesy Peter Traj)
(click to enlarge)

If reality is a field of harmonics then the structure of localized systems (atoms, planets, solar systems etc.) should follow the laws of diatonic ratio and music theory would be the workshop manual and the cook book. But I have no idea how to use this knowledge practically? Maybe we can structure four lasers into a F#7 chord and shine it on the right hemisphere of Richard Dawkins and Lawrence Kraussâ€™s brain to see if it is salvageable? Their left brains are in fully evolved but their right side is near beyond salvation!

And thatâ€™s as far as I can go without getting messy. It is a huge subject and Iâ€™m still learning. But feel free to ask questions and challenge anything I have saidâ€”I do not take this stuff personallyâ€”and love criticism because it always leads to a better understanding.

See Also

Center
Chromatic
Diatonic
Fulcrum
Interval
Music
Neutral Center
Scale
Table 11.01 - Scale of Infinite Ninths its Structure and Base another look at symmetry in music
Universal Heart Beat