

# Modes of limited transposition

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**Modes of limited transposition** are musical modes or scales that fulfill specific criteria relating to their symmetry and the repetition of their interval groups. They were compiled by the French composer Olivier Messiaen, and published in his book *La technique de mon langage musical* ("The Technique of my Musical Language").

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## Technical criteria

Based on our present chromatic system, a tempered system of 12 sounds, these modes are formed of several symmetrical groups, the last note of each group always being common with the first of the following group. At the end of a certain number of chromatic transpositions which varies with each mode, they are no longer transposable, giving exactly the same notes as the first.<sup>[1]</sup>

There are two complementary ways to view the modes: considering their possible transpositions, and considering the different modes contained within them.

## Definition by chromatic transposition

Transposing the diatonic major scale up in semitones results in a different set of notes being used each time. C major consists of C, D, E, F, G, A, B, and the scale a semitone higher (D<sup>b</sup> major) consists of D<sup>b</sup>, E<sup>b</sup>, F, G<sup>b</sup>, A<sup>b</sup>, B<sup>b</sup>, C. When transposing a mode of limited transposition this is not the case. For example, the mode of limited transposition that Messiaen labelled "Mode 1", which is the whole tone scale, contains the notes C, D, E, F<sup>#</sup>, G<sup>#</sup>, A<sup>#</sup>; transposing this mode up a semitone produces C<sup>#</sup>, D<sup>#</sup>, F, G, A, B. Transposing this up another semitone produces D, E, F<sup>#</sup>, G<sup>#</sup>, A<sup>#</sup>, C. Since transposing the mode up a whole tone produces the same set of notes, mode 1 has only 2 transpositions.

Any scale having 12 different transpositions is not a mode of limited transposition.

## Definition by shifting modal degrees

Consider the intervals of the major scale: tone, tone, semitone, tone, tone, tone, semitone. Starting the scale on a different degree will always create a new mode with individual interval layouts—for example starting on the second degree of a major scale gives the "Dorian mode"—tone, semitone, tone, tone, tone, semitone, tone. This is not so of the modes of limited transposition, which can be modally shifted only a limited number of times. For example, mode 1, the whole tone scale, contains the intervals tone, tone, tone, tone, tone, tone. Starting on any degree of the mode gives the same sequence of intervals, and therefore the whole tone scale has only 1 mode. Messiaen's mode 2, or the diminished scale, consists of semitone, tone, semitone, tone, semitone, tone, semitone, tone, which can be arranged only 2 ways, starting with either a tone or a semitone. Therefore mode 2 has two modes.

Any scale having the same number of modes as notes is not a mode of limited transposition.

## Messiaen's list

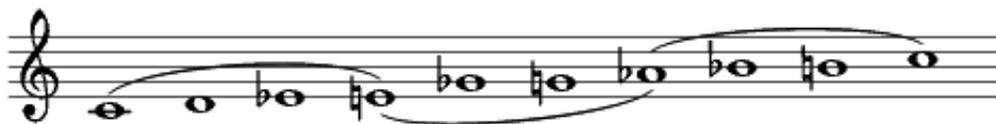
Messiaen's *first mode*, also called the whole-tone scale, is divided into six groups of two notes each. The intervals it contains are tone, tone, tone, tone, tone, tone - it has two transpositions and one mode.



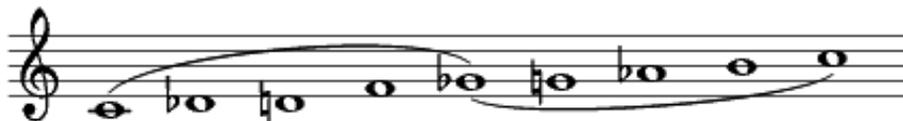
The *second mode*, also called octatonic/diminished/semitone-tone/tone-semitone, may be divided into four groups of three notes each. It contains the intervals semitone, tone, semitone, tone, semitone, tone, semitone, tone - it has three transpositions, like the diminished 7th chord, and two modes:



The *third mode* is divided into three groups of four notes each. It contains the intervals tone, semitone, semitone, tone, semitone, semitone, tone, semitone, semitone - it has four transpositions, like the augmented triad, and three modes.



The *fourth mode* contains the intervals semitone, semitone, minor third, semitone, semitone, semitone, minor third, semitone - it has six transpositions, like the tritone, and four modes.

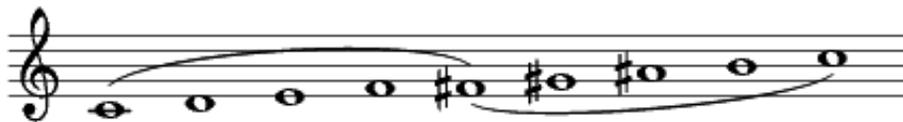


The *fifth mode* contains the intervals semitone, major third, semitone, semitone, major third, semitone - it has six

transpositions, like the tritone, and three modes.



The *sixth mode* has the intervals tone, tone, semitone, semitone, tone, tone, semitone, semitone - it has six transpositions, like the tritone, and four modes.



The *seventh mode* contains the intervals semitone, semitone, semitone, tone, semitone, semitone, semitone, semitone, tone, semitone - it has six transpositions, like the tritone, and five modes.



## Expansion and alteration of the modes

### Are there others?

Messiaen wrote, "Their series is closed, it is mathematically impossible to find others, at least in our tempered system of 12 semitones."<sup>[1]</sup> More modes can be found that fit the criteria, but they are truncations of the original seven modes.

### Truncation

Truncation involves the removal of notes from one of the modes to leave a new truncated mode. Both the notes removed and the notes remaining must preserve the symmetry of the parent mode, and must therefore fulfil the conditions for limited transposition. For example, consider mode 1.

- C D E F# G# A#

Removing alternate notes creates a new truncated mode of limited transposition.

- C E G#

Removing two notes for every one kept creates a new truncated mode of limited transposition.

- C F#

Keeping two notes for every one removed creates another truncated mode of limited transposition.

- C E F# A#

Only Messiaen's mode 7 and mode 3 are not truncated modes: the other modes may be constructed from them.

Mode 7 contains modes 2, 4 and 6, and mode 3 contains mode 1. Mode 5 is a truncated form of mode 6.

### Pure intervallic truncations

- Tritones, truncation of modes 1, 2, 3, 4, 5, 6 and 7: augmented fourth, augmented fourth - 1 mode and 6 transpositions
- Major thirds, truncation of modes 1, 3, 6 and 7: major third, major third, major third - 1 mode and 4 transpositions
- Minor thirds, truncation of modes 2, 4, 6 and 7: minor third, minor third, minor third, minor third - 1 mode and 3 transpositions
- Whole tones (mode 1), truncation of modes 3, 6 and 7: tone, tone, tone, tone, tone, tone - 1 mode and 2 transpositions

### Other truncations

- Truncation of modes 2, 4, 6 and 7: semitone, tone, minor third, semitone, tone, minor third - 3 modes, 6 transpositions
- Truncation of modes 1, 2, 3, 4, 5, 6 and 7: major third, tone, major third, tone - 2 modes, 6 transpositions
- Truncation of modes 2, 3, 4, 5, 6 and 7: perfect fourth, semitone, perfect fourth, semitone - 2 modes, 6 transpositions
- Truncation of mode 3: minor third, semitone, minor third, semitone, minor third, semitone - 2 modes, 4 transpositions. See augmented scale.
- Truncation of modes 2, 4, 6 and 7: minor third, tone, semitone, minor third, tone, semitone - 3 modes, 6 transpositions

## Use and sound

Messiaen found ways of employing all of the modes of limited transposition harmonically, melodically, and sometimes polyphonically. The whole-tone and octatonic scales have enjoyed quite widespread use since the turn of the 20th century, particularly by Debussy and Stravinsky, respectively.

The symmetry inherent in these modes (which means no note can be perceived as the tonic), together with certain rhythmic devices, Messiaen described as containing "the charm of impossibilities".

The composer Tōru Takemitsu made frequent use of Messiaen's modes, particularly the third mode.<sup>[2]</sup>

## Sources

- <sup>a</sup> <sup>b</sup> Messiaen, O. *The technique of my musical language*, p.58. Alphonse Leduc, Paris, 1944.
- <sup>\*</sup>Burt, Peter (2001). *The Music of Toru Takemitsu*. Cambridge University Press. p. 34. ISBN 0521782201.

## Further reading

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## External Links

- My Messiaen Modes - A visual representation of the modes of limited transposition (<http://messiaen.jacksonhardaker.com/>)

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