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Theory of Harmony

An introduction for composer,
singer, songwriter
and
musicians of all kinds

Version 1.0

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Preface

The entire Internet is full of transcriptions of pieces of music that use notation so completely unsystematic and arbitrary that it literally leaves you speechless. This is probably due, on the one hand, to the fact that many musicians have no background in music theory, and, on the other hand, to the fact that most of the printed harmony theory that I have come across so far is very unscientific. To make matters worse, music theory is based on a seven-step scale system, which, as we will see later, repeatedly leads to so-called enharmonic ambiguities.

In this theory of harmony, music theoretical connections are derived from the ground up, so that no prior musical knowledge is required. The notation rules used here largely correspond to those used at the Berklee College of Music [1]. This notation is also used in German-speaking countries, which are heavily influenced by Axel Jungbluth's [2] jazz harmony theory in the professional environment.

Chapter 1 (Why does our tonal system consist of 12 tones?) shows what tones and harmonics actually are and which tonal systems can theoretically be built on them. It will then be explained how one can build tonal systems by stacking partials, for example in the Pythagorean tuning, and how it led to the “straightened” tuning commonly used in Western music today, the so-called equal temperament. Particular attention is always paid to how these sound systems fit into the nature-given overtone spectrum of vibratory systems (instruments). The unit cent for the size of an interval is also introduced. Finally, the use of the Fibonacci sequence for frequency intervals shows that the equal-tempered system with 12 tones corresponds to the golden ratio of music and therefore rightfully represents the standard in the Western world today.

In Chapter 2 (Two-, three-, four- and more-note chords) examines which two-, three- and polychords are possible in a system with 12 tones and whether laws for a theory of harmony can be derived from combinatorics alone.

Then we continue with Chapter 3 (Scales and modes), which defines what scales actually are. All theoretically possible scales within a system of 12 tones are listed and analyzed.

Chapter 4 (Chords) shows that chords can be viewed as a subset of tones of a scale that are played simultaneously, i.e. arranged vertically, so to speak. From this systematic approach, coherent chord notations are derived.

In the following chapters, the scales most commonly used today are analyzed and described in more detail: In chapter 5 the Ionian major scale, in chapter 6 the chromatic scale, in chapter 7 the melodic minor scale, in chapter 8 the harmonic minor scale, in chapter 9 the harmonic major scale, in chapter 10 the double harmonic minor scale, in chapter 11 the diminished scale, in chapter 12 the whole-tone scale and in chapter 13 the minor pentatonic and blues scales.

In Chapter 14 (Cadences and Cadence variants), the definition of a cadence is provided, along with the various ways it is used in Western music today. There is deliberately no distinction made between different styles of music such as classical, jazz, rock, pop, country and western, electronic and world music, etc., as these styles of music are merging or at least overlapping more and more these days.

Finally, in Chapter 15 (Slash chords and inversions), the so-called slash chords and inversions are systematically analyzed. The bass note of a chord is varied, which changes the functional relationship and greatly expands the spectrum of possible cadences (clichés). This makes this theory of harmony particularly interesting for composers, singers and songwriters.

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1 Why does our tonal system consist of 12 tones?

That's a good question. In principle, with today's electronic tools you can produce any number of tones within an octave. Here, however, we focus on finding a system with a manageable number of tones that meets the following two conditions:

a) The partials of the tones within the system should correspond to tones within the system again.

For this purpose, firstly, it is described what partials are, how they arise, and in what form they occur in the classical sound production of natural instruments.

b) The tone interval, i.e. the frequency ratio between two consecutive tones, should always be the same so that we can move through all keys in the same way within this tonal system, regardless of the fundamental tone.

This leads us to the so-called equal temperament tunings, where the system is "straightened out," so to speak, using mathematics.

So much is revealed in advance: There is no system with a finite number of tones that fulfills condition 1. However, we will see that the equal-tempered system with 12 tones, commonly used in the Western world today, comes quite close to meeting this requirement.

1.1 Analysis of the overtone spectrum

1.1.1 Sound waves and resonance positions

To get started, let's first take a closer look at the physical background of vibrations and sound production and their wave-like propagation. In principle, there are two types of waves: Die transverse wave [3] (vibrations transverse to the direction of propagation), and the longitudinal wave [4] (vibrations along the direction of propagation). Sound waves [5] are longitudinal waves that propagate through a medium such as air. The oscillations themselves are air pressures that change periodically over time and spread through air at a rate of approximately 340 meters per second. They cause our eardrums to vibrate, allowing us humans to perceive them in a spectrum ranging from about 20 Hz to 20,000 Hz. The unit Hz (Hertz) denotes the number of vibrations per second. Typical sound sources are, for example, the vibration of a membrane or string.

There are three possibilities for the ends or attachments of a vibratory system:

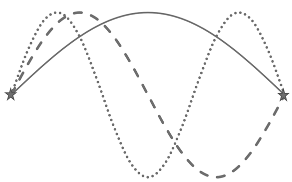
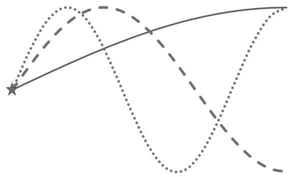
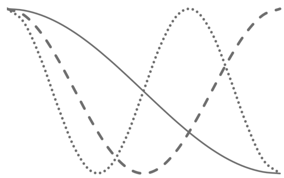
Option 1	Option 2	Option 3
Both ends are fixed (e.g., guitar or piano strings, drums)	**One end is fixed, one is loose** (e.g., closed-end pan flute or "stopped" organ pipe)	**Both ends are loose** (e.g. pan flute or organ pipe open at both ends)
		
Resonance [5a] occurs at the simple, double, triple, etc. frequencies, i.e. at the **1st, 2nd, 3rd, ... partials**.	Resonance [5a] occurs at the simple, triple, fivefold, etc. frequencies, i.e. for the **odd-numbered 1st, 3rd, 5th, ... partials**.	Resonance [5a] occurs at the simple, double, triple, etc. frequencies, i.e. at the **1st, 2nd, 3rd, ... partials**.

Figure 1 - Resonance

Conclusion:

A system capable of oscillation oscillates in its resonance frequencies.

The fundamental frequency is called the 1st partial, the 1st overtone corresponds to the 2nd partial, the 2nd overtone to the 3rd partial, etc.

1.1.2 The overtone spectrum

Particularly on string instruments, the partials or overtones [7] are also called flageolet tones [8].

Example Flageolet tones on the guitar

 [6]

Every string, wind, and drum instrument has corresponding methods for playing overtones, but strictly speaking, they are there all the time. You only dampen the louder fundamental vibration and other overtones so that you can hear the desired overtone better. Here, for example, is the spectrum of the A string (110 Hz) of a western guitar:

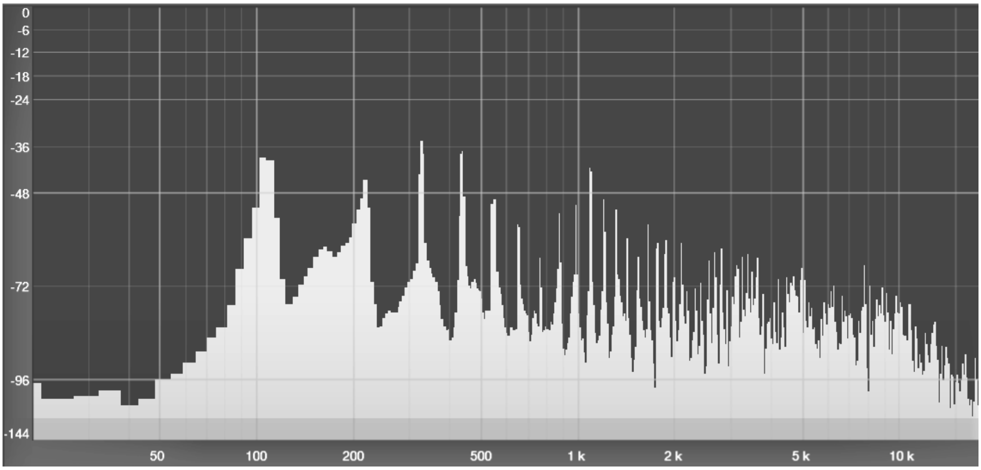


Figure 2 - Spectrum of the A string of an acoustic guitar

You can see that in addition to the fundamental frequency of 110 Hz (the 1st peak), the partials also resonate, some even with the same intensity. The peculiarities in the sound of an instrument arise from the attenuation and amplification of the various partials. In stringed instruments, the volume of the partials is also largely determined by the strength, type and position of the string strike.

With appropriate practice you can also sing the overtones with your voice, see for example this video from Anne-Maria Hefele [9].

1.1.3 The unit cent

Tone intervals correspond to certain frequency ratios. For example, the octave corresponds to a frequency ratio of 2. Two octaves correspond to a frequency ratio of $2 * 2 = 2^2$, three octaves $2 * 2 * 2 = 2^3$, etc. n octaves therefore correspond to a frequency ratio of 2^n. In the same way, half an octave (tritone) corresponds to a frequency ratio of $2^{1/2}$ and a semitone as the twelfth part of the octave corresponds to a frequency ratio of $2^{1/12}$. Furthermore, six semitones correspond to a frequency ratio of $2^{6*1/12} = 2^{1/2}$ and thus again to a tritone.

This relationship applies to any interval, i.e. the (linear) calculation with intervals obviously takes place in the exponent of the respective frequency ratios. This suggests that you should work with the logarithm of the frequency ratios.

The unit cent [10d] was introduced for this purpose. It is a measure of distance between two frequencies or tones and is defined as follows:

100 cents = 1 semitone or

1200 cents = 1 octave.

If you want to express a frequency ratio f2/f1 in cents, you calculate

$$\frac{i}{[cents]} = 1200 \cdot \frac{ln\left(\frac{f_2}{f_1}\right)}{ln(2)}$$

Equation 1 - Definition of the unit cent for frequency ratios

You can use any logarithm for this, as will be explained further below, but this logarithm must be consistently used throughout the equation.

Derivation:

The arbitrary determination that 100 cents should correspond to a semitone or 1200 cents to an, the following applies to a frequency ratio *i* in [cents]:

$$\frac{f2}{f1} = 2^{\frac{i}{1200\,[cents]}}$$

This means:

$$\log\left(\frac{f2}{f1}\right) = log\left(2^{\frac{i}{1200\,[cents]}}\right) = \frac{i}{1200\,[cents]} \cdot log(2)$$

and thus:

$$\frac{i}{[cents]} = 1200 \cdot \frac{log\left(\frac{f_2}{f_1}\right)}{log(2)}$$

Which logarithm you use doesn't matter, by the way, as we know from mathematics that the following rule applies:

$$\frac{log(x)}{log(y)} = \frac{ln(x)}{ln(y)} = \frac{log_2(x)}{log_2(y)} = \quad \ldots$$

Conclusion

By using the unit cent, intervals can be described as the distance between two frequencies, which is independent of the actual frequency. For example, the distance of 1200 cents always describes the distance between a tone and its octave tone, regardless of its frequency (pitch). Intervals can therefore also be easily added and subtracted. In the tuning described in chapter 1.4 (The equal temperament tone system with 12 tones), the octave is divided into 12 equal parts (semitones). 100 cents then correspond to a semitone, 3 times 100 cents correspond to three semitones or a minor third and a minor third (300 cents) and a major third (400 cents) make 700 cents, i.e. seven semitones or a fifth and so on.

1.1.4 The overtone spectrum up to the 32nd partial

Table 2 below shows the overtone spectrum of a fundamental from 110 Hz to the 32nd partial (31st overtone). The term partial is used here to avoid the term overtone. The 1st overtone already corresponds to the 2nd partial (twice the frequency) and it is easy to get confused with the numbering. It starts with a fundamental frequency (the 1st partial) of 110 Hz (A-string on the guitar), the 2nd frequency (2nd partial) is 220 Hz, the 3rd frequency (3rd partial) is 330 Hz and so on. The frequencies are entered in column 3.

The interval designations in column 2 serve as a guide. They are usually used in a system with 12 tones per octave and are introduced later in chapter 2 (Two-, three-, four- and more-note chords). The added plus and minus signs are used for better differentiation.

In column 4, the frequencies are each octaved down by as many octaves until they fit back into the octave from 110 Hz to 220 Hz. Column 4a shows the distance of these frequencies from the fundamental tone in the unit [cents], which was introduced in chapter 1.1.3 (The unit cent).

Column 5 shows the frequency ratio of the respective partial tone to the fundamental tone.

If you octave the lower note of a dyad, i.e. invert the interval, you get the so-called complementary interval. There is exactly one inversion for each duple tone, because a second inversion would result in the original interval again. The sum of the interval and its complementary interval therefore leads to the octave by definition. Perfect sine waves without overtones are virtually non-existent in nature. Even if you generate a perfect sine wave with a sine wave generator, harmonics will reappear at the loudspeaker membrane at the latest. This is why the complementary intervals are always present and audible.

Mathematics helps to determine the complementary frequency ratio. As described in chapter 1.1.3 (The unit cent), intervals and frequency ratios can be added and subtracted by using the logarithm. For example, the 3rd partial, the fifth, has a frequency ratio of 3:2. The frequency ratio x of the complementary interval is then calculated as follows:

$$\log\left(\frac{3}{2}\right) + \log(x) = \log(2)$$

Solved for x:

$$x = e^{\log(2)-\log\left(\frac{3}{2}\right)} = e^{\log\left(\frac{2}{\left(\frac{3}{2}\right)}\right)} = \frac{2}{\left(\frac{3}{2}\right)} = \frac{4}{3}$$

or in general:

$$Complementary\ frequency\ ratio = \frac{2}{frequency\ ratio}$$

Equation 2 - Complementary frequency ratio

For the fifth with its frequency ratio of 3:2, this results in a complementary frequency ratio of 2:(3:2)= 4:3.

Column 6 contains the designations of the respective complementary interval and column 7 the calculated complementary frequency ratios.

Column 8 shows the size of the complementary interval in the unit [cents]. By definition, the sum of the distances of the respective partial from the fundamental (column 4a) and the complementary interval (column 8) is 1200 cents.

Column 9 shows the deviation of the complementary intervals from the best matching partial within the first 32 partials. The indices (->) indicate which partial most closely matches which complementary interval. For example, the complementary interval of the 3rd partial at 498.0 cents corresponds approximately to the accordingly octaved down interval of the 21st partial at 470.8 cents. The deviation is 27.2 cents.

1	2	3	4	4a	5	6	7	8	9
Partial no.	Corresponds (approx.) the interval	Frequency [Hz]	Transposed down to the octave 110...220 Hz	Distance to root frequency [cents]	Frequency ratio	Complementary interval	Complementary frequency ratio	Complementary interval [cents]	Deviation from the nearest partial tone [cents]
1	Root tone	110	110	0	1:1	Octave	2:1	1200	0 ✓
2	Octave	220	110		2:1				
3	Fifth	330	165.0	702.0	3:2	Fourth-	4:3	498.0	->21 27.2 →
4	Octave	440	110		2:1				
5	Major third	550	137.5	386.3	5:4	Minor sixth++	8:5	813.7	->13 -26.8→
6	Fifth	660	165		3:2				
7	Minor seventh-	770	192.5	968.8	7:4	Major second	8:7	231.2	->9 27.3→
8	Octave	880	110		1:1				
9	Major second	990	123.8	203.9	9:8	Minor seventh-	16:9	996.1	->7 27.3→
10	Major third	1100	137.5		5:4				
11	Tritone--	1210	151.3	551.3	11:8	Tritone+	16:11	648.7	->23 20.4→
12	Fifth	1320	165		3:2				
13	Minor sixth++	1430	178.8	840.5	13:8	Major third	16:13	359.5	->5 -26.8→
14	Minor seventh-	1540	192.5		7:4				
15	Major seventh	1650	206.3	1088	15:8	Minor second	16:15	112.0	->17 7.0 ✓
16	Octave	1760	110		2:1				
17	Minor second	1870	116.9	105.0	17:16	Major seventh	32:17	1095	->15 7.0 ✓
18	Major second	1980	123.8		9:8				
19	Minor third	2090	130.6	297.5	19:16	Major sixth	32:19	902.5	->27 -3.4 ✓
20	Major third	2200	137.5		5:4				
21	Fourth-	2310	144.4	470.8	21:16	Fifth	32:21	729.2	->3 27.2 →
22	Tritone--	2420	151.3		11:8				
23	Tritone+	2530	158.1	628.3	23:16	Tritone--	32:23	571.7	->11 20.4 →
24	Fifth	2640	165		3:2				
25	Minor sixth-	2750	171.9	772.6	25:16	Major third	32:25	427.4	->5 41.1 ↓
26	Minor sixth++	2860	178.8		13:8				
27	Major sixth	2970	185.6	905.9	27:16	Minor third	32:27	294.1	->19 -3.4 ✓
28	Minor seventh-	3080	192.5		7:4				
29	Minor seventh+	3190	199.4	1030	29:16	Major second	32:29	170.0	->9 -33.9 →
30	Major seventh	3300	206.3		15:8				
31	Major seventh++	3410	213.1	1145	31:16	Minor second	32:31	55.0	->17 -50.0 ↓
32	Octave	3520	110		2:1				

Table 1 - Overtone spectrum up to the 32nd partial tone including the complementary intervals

Conclusion

Even the complementary intervals of the first overtones do not match the overtone spectrum of the root tone 100%. Some of them are quite clearly next to a suitable overtone.

The search for a system in which all tones fit the hearable overtone spectrum of the respective tones seems to be a hopeless undertaking.

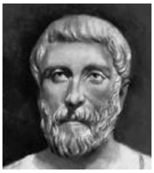
Furthermore, we can see from the table that there are exactly 2^n overtones within an octave, depending on the octave position n.

I.e.

- in the 0th octave position there is only one (2^0) overtone (partial 2, the octave),
- in the 1st octave position there are 2 (2^1) overtones (partials 3 to 4, fifth and octave),
- in the 2nd octave position there are 4 (2^2) overtones (partials 5 to 8, major third, fifth, minor seventh-, octave),
- in the 3rd octave position there are 8 (2^3) overtones (partials 9 to 16, major second, major third, tritone--, fifth, minor sixth++, minor seventh-, major seventh, octave),
- in the 4th octave position there are 16 (2^4) overtones (partials 17 to 32, minor second, major second, minor third, major third, fourth-, tritone+, minor sixth-, fifth, minor sixth-, minor sixth++, major sixth, minor seventh-, minor seventh+, major seventh, major seventh++, octave),
  etc.

So there are infinitely many overtones to a root tone. The audible number of overtones is limited by the fact that the human ear can only hear frequencies up to a maximum of around 20,000 Hz.

1.2 Layering partials



1.2.1 Thought experiment

Let's build a tone system according to the following thought experiment: We tune the 1st string to the fundamental frequency of, for example, 110 Hz. Then we always take the same partial (3rd, 5th, 7th…) and tune the next string to this partial (transposed downwards accordingly so that it fits back into the octave position between the root and its octave tone). Then we repeat this process until we reach the octave tone of the fundamental. We take the same partial from step to step, i.e. all intervals created are the same size.

Annotation

Partial and overtone basically mean the same thing. The 1st partial is by definition equal to the fundamental. The 1st overtone corresponds to the 2nd partial, the 2nd overtone equals the 3rd partial, and so on.

This procedure of stacking the same partial tone on top of each other never clearly converges to the octave tone, but only approximately. So the question is, after how many steps do you stop the process? I stop the process here as soon as the octave tone is hit with an accuracy of a quarter semitone (deviation less than 25 cents), or the octave is not hit better within 24 steps, or if the partials repeat, that is, if there is already one similar partial tone at a distance of less than a quarter semitone (deviation less than 25 cents).

Success criteria:

The tones generated should represent the overtone spectrum of the fundamental tone as well as possible, i.e. they should be as consonant as possible with its overtone spectrum.

1.2.2 Tuning after even partials (2nd, 4th, etc.).

The even (2nd, 4th, etc.) partials all lead to the octave or an octave tone of an odd partial, so we don't need to consider them any further.

1.2.3 Tuning after the 3rd partial (Fifth) - Pythagorean tuning

We take the 3rd partial tone, the fifth, and tune the next string to this tone, take the 3rd partial vibration (fifth) from it again, etc. and see where that takes us. The perfect fifth is obtained, as we explained in Chapter 1.1 (Analysis of the overtone spectrum) by multiplying the respective frequency by a factor of 3/2. From the second multiplication step at the latest, the frequency is above the octave frequency. In order for it to fit back into the interval between the fundamental and octave tone, the result is divided by two, i.e. the tone is transposed down an octave. This is done in each step, i.e. the frequency is always divided by 2 until it is back in the interval between the fundamental and octave tone. For example, the fundamental of 110 Hz multiplied by 3/2 results in the 3rd partial, the fifth, at 165 Hz. 165 Hz times 3/2 equals 247.6 Hz and is therefore already above the octave tone with 2 times 110 Hz = 220 Hz. So we octave it down an octave, i.e. divide 247.5 Hz by 2 and get 123.8 Hz. We enter this value in step 2, column 2. We carry out this procedure 12 times in a row. The result is shown in the following table:

			Deviation [cents] from partial no.															
		Partial	2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
		Interval designation	Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0																
1	165.0	702.0	-498.0	0	315.7	-266.8	498.1	150.7	-138.5	-386.0	597.0	404.5	231.2	73.7	-70.6	-203.9	-328.0	-443.0
2	123.8	203.9	-996.1	-498.1	-182.4	-764.9	0	-347.4	-636.6	-884.1	98.9	-93.6	-266.9	-424.4	-568.7	-702.0	-826.1	-941.1
3	185.6	905.9	-294.1	203.9	519.6	-62.9	702.0	354.6	65.4	-182.1	800.9	608.4	435.1	277.6	133.3	0	-124.1	-239.1
4	139.2	407.8	-792.2	-294.2	21.5	-561.0	203.9	-143.5	-432.7	-680.2	302.8	110.3	-63.0	-220.5	-364.8	-498.1	-622.2	-737.2
5	208.8	1110.0	-90.0	408.0	723.7	141.2	906.1	558.7	269.5	22.0	1005.0	812.5	639.2	481.7	337.4	204.1	80.0	-35.0
6	156.6	611.7	-588.3	-90.3	225.4	-357.1	407.8	60.4	-228.8	-476.3	506.7	314.2	140.9	-16.6	-160.9	-294.2	-418.3	-533.3
7	117.5	113.7	-1086.3	-588.3	-272.6	-855.1	-90.2	-437.6	-726.8	-974.3	8.7	-183.8	-357.1	-514.6	-658.9	-792.2	-916.3	-1031.3
8	176.2	815.6	-384.4	113.6	429.3	-153.2	611.7	264.3	-24.9	-272.4	710.6	518.1	344.8	187.3	43.0	-90.3	-214.4	-329.4
9	132.1	317.6	-882.4	-384.4	-68.7	-651.2	113.7	-233.7	-522.9	-770.4	212.6	20.1	-153.2	-310.7	-455.0	-588.3	-712.4	-827.4
10	198.2	1020	-180.0	318.0	633.7	51.2	816.1	468.7	179.5	-68.0	915.0	722.5	549.2	391.7	247.4	114.1	-10.0	-125.0
11	148.7	521.5	-678.5	-180.5	135.2	-447.3	317.6	-29.8	-319.0	-566.5	416.5	224.0	50.7	-106.8	-251.1	-384.4	-508.5	-623.5
12	223.0	1223	23.0	521.0	836.7	254.2	1019.1	671.7	382.5	135.0	1118.0	925.5	752.2	594.7	450.4	317.1	193.0	78.0

Table 2 - Layering the 3rd partial (fifth) on top of each other - Pythagorean tuning

The header shows the harmonics or partials 3, 5, etc. to 31 described in the previous chapter and their distances from the fundamental frequency in the unit [cents].

Column 3 shows the distance of the frequency in column 2 in [cents]. The value is independent of the actual start frequency.

In the table itself, the deviations of the generated tones from the overtone spectrum of the fundamental are listed in the unit [cents]. For example, the deviation of the 6th generated tone (step 6) with its 611.7 cents from the 23rd partial with its distance from the fundamental of 628.3 cents results in:

$$\frac{i}{[Cent]} = 611.7 - 628.3 = \ -16.6$$

The value -16.6 is entered at Step 6 and the 23rd partial.

And voilà: After 12 steps we arrive again about an octave higher at a distance of 1223 cents.

The tuning by stacking fifths is called Pythagorean tuning [15] and the inaccuracy of 23 cents to the octave tone reached Pythagorean comma [11]. It corresponds approximately to a quarter semitone.

The distance to the perfect fifth is by definition zero here, and the major third is 21.5 cents above the 5th partial of the fundamental tone.

This Pythagorean tuning with 12 tones eventually led to equal temperament, see Chapter 1.4 (The equal temperament tone system with 12 tones), where the frequency ratio of two successive tones is always the same, and thus the intervals always sound the same regardless of the starting tone. Equal temperament with 12 tones is commonly used in the Western world today. We will introduce it later.

1.2.4 Tuning after the 5th partial (major thirds)

We continue the thought experiment with the layering of the 5th partial (major third). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	**Frequency [Hz]**	**Distance [cents]**	**1200**	**702.0**	**386.3**	**968.8**	**203.9**	**551.3**	**840.5**	**1088**	**105.0**	**297.5**	**470.8**	**628.3**	**772.6**	**905.9**	**1030**	**1145**
0	**110.0**	**0.0**																
1	**137.5**	**386.3**	-813.7	-315.7	0.0	-582.5	182.4	-165.0	-454.2	-701.7	281.3	88.8	-84.5	-242.0	-386.3	-519.6	-643.7	-758.7
2	**171.9**	**772.6**	-427.4	70.6	386.3	-196.2	568.7	221.3	-67.9	-315.4	667.6	475.1	301.8	144.3	0.0	-133.3	-257.4	-372.4
3	**214.8**	**1159**	-41.0	457.0	772.7	190.2	955.1	607.7	318.5	71.0	1054.0	861.5	688.2	530.7	386.4	253.1	129.0	14.0

Table 3 - Layering the 5th partial (major third) on top of each other

This results in a tone system with three tones, each spaced a major third apart, whereby the octave is -41.1 cents, almost half a semitone, too low. It consists of the major third, the minor sixth and the octave. The distance between the major third and the natural 5th partial (major third) is by definition equal to 0. The octave is already close to the 31st partial, the major seventh++. Continuing the process within the first 24 steps, however, does not lead to a better match of the octave.

1.2.5 Tuning after the 7th partial (minor seventh-)

We continue the thought experiment with the layering of the 7th partial (minor seventh-). The following table shows the result:

			Deviation [cents] from partial no.															
		Partial	2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
		Interval designation	Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	**110.0**	**0.0**																
1	**192.5**	**968.8**	-231.2	266.8	582.5	0.0	764.9	417.5	128.3	-119.2	863.8	671.3	498.0	340.5	196.2	62.9	-61.2	-176.2
2	**168.4**	**737.7**	-462.3	35.7	351.4	-231.1	533.8	186.4	-102.8	-350.3	632.7	440.2	266.9	109.4	-34.9	-168.2	-292.3	-407.3
3	**147.4**	**506.5**	-693.5	-195.5	120.2	-462.3	302.6	-44.8	-334.0	-581.5	401.5	209.0	35.7	-121.8	-266.1	-399.4	-523.5	-638.5
4	**129.0**	**275.3**	-924.7	-426.7	-111.0	-693.5	71.4	-276.0	-565.2	-812.7	170.3	-22.2	-195.5	-353.0	-497.3	-630.6	-754.7	-869.7
5	**225.7**	**1244**	44.0	542.0	857.7	275.2	1040.1	692.7	403.5	156.0	1139.0	946.5	773.2	615.7	471.4	338.1	214.0	99.0

Table 4 - Layering the 7th partial (minor seventh-) on top of each other

This results in a tone system with five tones, whereby we end up 44.1 cents too high in the octave, i.e. almost half a semitone too high. It consists of the minor seventh, the minor sixth, the fourth, the minor third and the octave. The deviation from the 3rd partial, the fifth, is 36 cents. The deviation from the 7th partial is by definition equal to 0. Continuing the process does not lead to a better match of the octave within the first 24 steps.

1.2.6 Tuning after the 9th partial (major second)

We continue the thought experiment with the layering of the 9th partial (major second). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	123.8	203.9	-996.1	-498.1	-182.4	-764.9	0.0	-347.4	-636.6	-884.1	98.9	-93.6	-266.9	-424.4	-568.7	-702.0	-826.1	-941.1
2	139.2	407.8	-792.2	-294.2	21.5	-561.0	203.9	-143.5	-432.7	-680.2	302.8	110.3	-63.0	-220.5	-364.8	-498.1	-622.2	-737.2
3	156.6	611.7	-588.3	-90.3	225.4	-357.1	407.8	60.4	-228.8	-476.3	506.7	314.2	140.9	-16.6	-160.9	-294.2	-418.3	-533.3
4	176.2	815.6	-384.4	113.6	429.3	-153.2	611.7	264.3	-24.9	-272.4	710.6	518.1	344.8	187.3	43.0	-90.3	-214.4	-329.4
5	198.2	1020	-180.0	318.0	633.7	51.2	816.1	468.7	179.5	-68.0	915.0	722.5	549.2	391.7	247.4	114.1	-10.0	-125.0
6	223.0	1223	23.0	521.0	836.7	254.2	1019.1	671.7	382.5	135.0	1118.0	925.5	752.2	594.7	450.4	317.1	193.0	78.0

Table 5 - Layering the 9th partial (major second) on top of each other

This results in a tonal system with 6 tones that contains exactly half of the tones from the Pythagorean system built up from the 3rd partial. It consists of the major second, the major third, the tritone, the minor sixth, the minor seventh and the octave. The octave tone is 23 cents too high, but continuing the process does not lead to a better hit of the octave within the first 24 steps.

1.2.7 Tuning after the 11th partial (tritone--)

We continue the thought experiment with the layering of the 11th partial (tritone--). The following table shows the result:

			Deviation [cents] from partial no.															
	Partial		**2**	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**
	Interval designation		**Octave**	**Fifth**	**Major 3rd**	**Minor 7th-**	**Major 2nd**	**Tritone--**	**Minor 6th++**	**Major 7th**	**Minor 2nd**	**Minor 3rd**	**Fourth-**	**Tritone+**	**Minor 6th-**	**Major 6th**	**Minor 7th+**	**Major 7th++**
Step	**Frequency [Hz]**	**Distance [cents]**	**1200**	**702.0**	**386.3**	**968.8**	**203.9**	**551.3**	**840.5**	**1088**	**105.0**	**297.5**	**470.8**	**628.3**	**772.6**	**905.9**	**1030**	**1145**
0	**110.0**	**0.0**																
1	**151.3**	**551.3**	-648.7	-150.7	165.0	-417.5	347.4	0.0	-289.2	-536.7	446.3	253.8	80.5	-77.0	-221.3	-354.6	-478.7	-593.7
2	**208.0**	**1103**	-97.0	401.0	716.7	134.2	899.1	551.7	262.5	15.0	998.0	805.5	632.2	474.7	330.4	197.1	73.0	-42.0
3	**143.0**	**454.0**	-746.0	-248.0	67.7	-514.8	250.1	-97.3	-386.5	-634.0	349.0	156.5	-16.8	-174.3	-318.6	-451.9	-576.0	-691.0
4	**196.6**	**1005**	-195.0	303.0	618.7	36.2	801.1	453.7	164.5	-83.0	900.0	707.5	534.2	376.7	232.4	99.1	-25.0	-140.0
5	**135.2**	**356.6**	-843.4	-345.4	-29.7	-612.2	152.7	-194.7	-483.9	-731.4	251.6	59.1	-114.2	-271.7	-416.0	-549.3	-673.4	-788.4
6	**185.8**	**907.9**	-292.1	205.9	521.6	-60.9	704.0	356.6	67.4	-180.1	802.9	610.4	437.1	279.6	135.3	2.0	-122.1	-237.1
7	**127.8**	**259.2**	-940.8	-442.8	-127.1	-709.6	55.3	-292.1	-581.3	-828.8	154.2	-38.3	-211.6	-369.1	-513.4	-646.7	-770.8	-885.8
8	**175.7**	**810.5**	-389.5	108.5	424.2	-158.3	606.6	259.2	-30.0	-277.5	705.5	513.0	339.7	182.2	37.9	-95.4	-219.5	-334.5
9	**120.8**	**161.9**	-1038.1	-540.1	-224.4	-806.9	-42.0	-389.4	-678.6	-926.1	56.9	-135.6	-308.9	-466.4	-610.7	-744.0	-868.1	-983.1
10	**166.1**	**713.2**	-486.8	11.2	326.9	-255.6	509.3	161.9	-127.3	-374.8	608.2	415.7	242.4	84.9	-59.4	-192.7	-316.8	-431.8
11	**114.2**	**64.5**	-1135.5	-637.5	-321.8	-904.3	-139.4	-486.8	-776.0	-1023.5	-40.5	-233.0	-406.3	-563.8	-708.1	-841.4	-965.5	-1080.5
12	**157.0**	**615.8**	-584.2	-86.2	229.5	-353.0	411.9	64.5	-224.7	-472.2	510.8	318.3	145.0	-12.5	-156.8	-290.1	-414.2	-529.2
13	**215.9**	**1167**	-33.0	465.0	780.7	198.2	963.1	615.7	326.5	79.0	1062.0	869.5	696.2	538.7	394.4	261.1	137.0	22.0

Table 6 - Layering the 11th partial (tritone--) on top of each other

This results in a tone system with 13 tones, the octave comes out 33 cents too low. It contains all 12 intervals of our usual 12-tone system: tritone, major seventh, fourth, minor seventh, major third, major sixth, minor third, minor sixth, major second, fifth, minor second and octave. The system also contains two tritones, it hits both the 11th and 23rd partial. Continuing the process does not lead to a better hit of the octave within the first 24 steps.

1.2.8 Tuning after the 13th partial (minor sixth++)

We continue the thought experiment with the layering of the 13th partial (minor sixth++). The following table shows the result:

			Deviation [cents] from partial no.															
	Partial		2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
	Interval designation		Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	**Frequency [Hz]**	**Distance [cents]**	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	**110.0**	**0.0**																
1	**178.8**	**840.5**	-359.5	138.5	454.2	-128.3	636.6	289.2	0.0	-247.5	735.5	543.0	369.7	212.2	67.9	-65.4	-189.5	-304.5
2	**145.2**	**481.1**	-718.9	-220.9	94.8	-487.7	277.2	-70.2	-359.4	-606.9	376.1	183.6	10.3	-147.2	-291.5	-424.8	-548.9	-663.9
3	**118.0**	**121.6**	-1078.4	-580.4	-264.7	-847.2	-82.3	-429.7	-718.9	-966.4	16.6	-175.9	-349.2	-506.7	-651.0	-784.3	-908.4	-1023.4
4	**191.8**	**962.1**	-237.9	260.1	575.8	-6.7	758.2	410.8	121.6	-125.9	857.1	664.6	491.3	333.8	189.5	56.2	-67.9	-182.9
5	**155.8**	**602.6**	-597.4	-99.4	216.3	-366.2	398.7	51.3	-237.9	-485.4	497.6	305.1	131.8	-25.7	-170.0	-303.3	-427.4	-542.4
6	**126.6**	**243.2**	-956.8	-458.8	-143.1	-725.6	39.3	-308.1	-597.3	-844.8	138.2	-54.3	-227.6	-385.1	-529.4	-662.7	-786.8	-901.8
7	**205.7**	**1084**	-116.0	382.0	697.7	115.2	880.1	532.7	243.5	-4.0	979.0	786.5	613.2	455.7	311.4	178.1	54.0	-61.0
8	**167.1**	**724.2**	-475.8	22.2	337.9	-244.6	520.3	172.9	-116.3	-363.8	619.2	426.7	253.4	95.9	-48.4	-181.7	-305.8	-420.8
9	**135.8**	**364.7**	-835.3	-337.3	-21.6	-604.1	160.8	-186.6	-475.8	-723.3	259.7	67.2	-106.1	-263.6	-407.9	-541.2	-665.3	-780.3
10	**220.7**	**1205**	5.0	503.0	818.7	236.2	1001.1	653.7	364.5	117.0	1100.0	907.5	734.2	576.7	432.4	299.1	175.0	60.0

Table 7 - Layering the 13th partial (minor sixth++) on top of each other

This results in a tone system with 10 tones, which reproduces the overtone spectrum of the fundamental tone very well. It is accurate to within 5 cents of the octave, the fifth and major third are well represented and the deviation from the 13th partial, the minor sixth, is zero by definition. Compared to our usual 12-tone system, two intervals are missing, namely the minor third and the major sixth.

1.2.9 Tuning after the 15th partial (major seventh)

We continue the thought experiment with the layering of the 15th partial (major seventh). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	206.3	1088	-112.0	386.0	701.7	119.2	884.1	536.7	247.5	0.0	983.0	790.5	617.2	459.7	315.4	182.1	58.0	-57.0
2	193.4	976.5	-223.5	274.5	590.2	7.7	772.6	425.2	136.0	-111.5	871.5	679.0	505.7	348.2	203.9	70.6	-53.5	-168.5
3	181.3	864.8	-335.2	162.8	478.5	-104.0	660.9	313.5	24.3	-223.2	759.8	567.3	394.0	236.5	92.2	-41.1	-165.2	-280.2
4	169.9	753.1	-446.9	51.1	366.8	-215.7	549.2	201.8	-87.4	-334.9	648.1	455.6	282.3	124.8	-19.5	-152.8	-276.9	-391.9
5	159.3	641.3	-558.7	-60.7	255.0	-327.5	437.4	90.0	-199.2	-446.7	536.3	343.8	170.5	13.0	-131.3	-264.6	-388.7	-503.7
6	149.4	529.6	-670.4	-172.4	143.3	-439.2	325.7	-21.7	-310.9	-558.4	424.6	232.1	58.8	-98.7	-243.0	-376.3	-500.4	-615.4
7	140.0	417.9	-782.1	-284.1	31.6	-550.9	214.0	-133.4	-422.6	-670.1	312.9	120.4	-52.9	-210.4	-354.7	-488.0	-612.1	-727.1
8	131.3	306.1	-893.9	-395.9	-80.2	-662.7	102.2	-245.2	-534.4	-781.9	201.1	8.6	-164.7	-322.2	-466.5	-599.8	-723.9	-838.9
9	123.1	194.4	-1005.6	-507.6	-191.9	-774.4	-9.5	-356.9	-646.1	-893.6	89.4	-103.1	-276.4	-433.9	-578.2	-711.5	-835.6	-950.6
10	115.4	82.7	-1117.3	-619.3	-303.6	-886.1	-121.2	-468.6	-757.8	-1005.3	-22.3	-214.8	-388.1	-545.6	-689.9	-823.2	-947.3	-1062.3
11	216.3	1171	-29.0	469.0	784.7	202.2	967.1	619.7	330.5	83.0	1066.0	873.5	700.2	542.7	398.4	265.1	141.0	26.0

Table 8 - Layering the 15th partial (major seventh) on top of each other

This results in a tone system with 11 tones, which represents the overtone spectrum of the fundamental tone well. The deviation from the 15th partial, the major seventh, is zero by definition. Compared to our usual 12-tone system, three tones are missing, namely the fifth, fourth and major sixth. Instead, the following intervals exist two times: the tritone (partials 11 and 23), the minor sixth (partials 13 and 25) and the major seventh (partials 15 and 31). The octave comes out 29 cents too low. Continuing the process does not lead to a better hit of the octave within the first 24 steps.

1.2.10 Tuning after the 17th partial (minor second)

We continue the thought experiment with the layering of the 17th partial (minor second). The following table shows the result:

			Deviation [cents] from partial no.															
	Partial		2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
		Interval designation	Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	116.9	105.0	-1095.0	-597.0	-281.3	-863.8	-98.9	-446.3	-735.5	-983.0	0.0	-192.5	-365.8	-523.3	-667.6	-800.9	-925.0	-1040.0
2	124.2	209.9	-990.1	-492.1	-176.4	-758.9	6.0	-341.4	-630.6	-878.1	104.9	-87.6	-260.9	-418.4	-562.7	-696.0	-820.1	-935.1
3	131.9	314.9	-885.1	-387.1	-71.4	-653.9	111.0	-236.4	-525.6	-773.1	209.9	17.4	-155.9	-313.4	-457.7	-591.0	-715.1	-830.1
4	140.2	419.8	-780.2	-282.2	33.5	-549.0	215.9	-131.5	-420.7	-668.2	314.8	122.3	-51.0	-208.5	-352.8	-486.1	-610.2	-725.2
5	148.9	524.8	-675.2	-177.2	138.5	-444.0	320.9	-26.5	-315.7	-563.2	419.8	227.3	54.0	-103.5	-247.8	-381.1	-505.2	-620.2
6	158.3	629.7	-570.3	-72.3	243.4	-339.1	425.8	78.4	-210.8	-458.3	524.7	332.2	158.9	1.4	-142.9	-276.2	-400.3	-515.3
7	168.1	734.7	-465.3	32.7	348.4	-234.1	530.8	183.4	-105.8	-353.3	629.7	437.2	263.9	106.4	-37.9	-171.2	-295.3	-410.3
8	178.7	839.6	-360.4	137.6	453.3	-129.2	635.7	288.3	-0.9	-248.4	734.6	542.1	368.8	211.3	67.0	-66.3	-190.4	-305.4
9	189.8	944.6	-255.4	242.6	558.3	-24.2	740.7	393.3	104.1	-143.4	839.6	647.1	473.8	316.3	172.0	38.7	-85.4	-200.4
10	201.7	1050	-150.0	348.0	663.7	81.2	846.1	498.7	209.5	-38.0	945.0	752.5	579.2	421.7	277.4	144.1	20.0	-95.0
11	214.3	1155	-45.0	453.0	768.7	186.2	951.1	603.7	314.5	67.0	1050.0	857.5	684.2	526.7	382.4	249.1	125.0	10.0
12	227.7	1259	59.0	557.0	872.7	290.2	1055.1	707.7	418.5	171.0	1154.0	961.5	788.2	630.7	486.4	353.1	229.0	114.0

Table 9 - Layering the 17th partial (minor second) on top of each other

This constellation also results in a tone system with 12 tones. The octave comes out 59 cents too high. The 3rd and 5th overtone do not find a good correspondence in this system. If you continue the process, you end up with the octave again at the 23rd step, this time a little more precisely at 14 cents too high. The 3rd and 5th overtone, i.e. the fifth and major third, are also better hit in the second run.

1.2.11 Tuning after the 19th partial (minor third)

We continue the thought experiment with the layering of the 19th partial (minor third). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	130.6	297.5	-902.5	-404.5	-88.8	-671.3	93.6	-253.8	-543.0	-790.5	192.5	0.0	-173.3	-330.8	-475.1	-608.4	-732.5	-847.5
2	155.1	595.0	-605.0	-107.0	208.7	-373.8	391.1	43.7	-245.5	-493.0	490.0	297.5	124.2	-33.3	-177.6	-310.9	-435.0	-550.0
3	184.2	892.5	-307.5	190.5	506.2	-76.3	688.6	341.2	52.0	-195.5	787.5	595.0	421.7	264.2	119.9	-13.4	-137.5	-252.5
4	218.7	1190	-10.0	488.0	803.7	221.2	986.1	638.7	349.5	102.0	1085.0	892.5	719.2	561.7	417.4	284.1	160.0	45.0

Table 10 - Layering the 19th partial (minor third) on top of each other

This leads to a tonal system with 4 tones, all of which harmonize quite well with the overtone spectrum of the fundamental tone. The 3rd, 5th and 7th overtones are not hit.

1.2.12 Tuning after the 21st partial (fourth-)

We continue the thought experiment with the layering of the 21st partial (fourth-). The following table shows the result:

			Deviation [cents] from partial no.															
	Partial		2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
	Interval designation		Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	144.4	470.8	-729.2	-231.2	84.5	-498.0	266.9	-80.5	-369.7	-617.2	365.8	173.3	0.0	-157.5	-301.8	-435.1	-559.2	-674.2
2	189.5	941.6	-258.4	239.6	555.3	-27.2	737.7	390.3	101.1	-146.4	836.6	644.1	470.8	313.3	169.0	35.7	-88.4	-203.4
3	124.4	212.3	-987.7	-489.7	-174.0	-756.5	8.4	-339.0	-628.2	-875.7	107.3	-85.2	-258.5	-416.0	-560.3	-693.6	-817.7	-932.7
4	163.2	683.1	-516.9	-18.9	296.8	-285.7	479.2	131.8	-157.4	-404.9	578.1	385.6	212.3	54.8	-89.5	-222.8	-346.9	-461.9
5	214.2	1154	-46.0	452.0	767.7	185.2	950.1	602.7	313.5	66.0	1049.0	856.5	683.2	525.7	381.4	248.1	124.0	9.0
6	140.6	424.7	-775.3	-277.3	38.4	-544.1	220.8	-126.6	-415.8	-663.3	319.7	127.2	-46.1	-203.6	-347.9	-481.2	-605.3	-720.3
7	184.5	895.5	-304.5	193.5	509.2	-73.3	691.6	344.2	55.0	-192.5	790.5	598.0	424.7	267.2	122.9	-10.4	-134.5	-249.5
8	121.1	166.2	-1033.8	-535.8	-220.1	-802.6	-37.7	-385.1	-674.3	-921.8	61.2	-131.3	-304.6	-462.1	-606.4	-739.7	-863.8	-978.8
9	158.9	637.0	-563.0	-65.0	250.7	-331.8	433.1	85.7	-203.5	-451.0	532.0	339.5	166.2	8.7	-135.6	-268.9	-393.0	-508.0
10	208.6	1108	-92.0	406.0	721.7	139.2	904.1	556.7	267.5	20.0	1003.0	810.5	637.2	479.7	335.4	202.1	78.0	-37.0
11	136.9	378.6	-821.4	-323.4	-7.7	-590.2	174.7	-172.7	-461.9	-709.4	273.6	81.1	-92.2	-249.7	-394.0	-527.3	-651.4	-766.4
12	179.7	849.4	-350.6	147.4	463.1	-119.4	645.5	298.1	8.9	-238.6	744.4	551.9	378.6	221.1	76.8	-56.5	-180.6	-295.6
13	117.9	120.2	-1079.8	-581.8	-266.1	-848.6	-83.7	-431.1	-720.3	-967.8	15.2	-177.3	-350.6	-508.1	-652.4	-785.7	-909.8	-1024.8
14	154.8	590.9	-609.1	-111.1	204.6	-377.9	387.0	39.6	-249.6	-497.1	485.9	293.4	120.1	-37.4	-181.7	-315.0	-439.1	-554.1
15	203.1	1062	-138.0	360.0	675.7	93.2	858.1	510.7	221.5	-26.0	957.0	764.5	591.2	433.7	289.4	156.1	32.0	-83.0
16	133.3	332.5	-867.5	-369.5	-53.8	-636.3	128.6	-218.8	-508.0	-755.5	227.5	35.0	-138.3	-295.8	-440.1	-573.4	-697.5	-812.5
17	174.9	803.3	-396.7	101.3	417.0	-165.5	599.4	252.0	-37.2	-284.7	698.3	505.8	332.5	175.0	30.7	-102.6	-226.7	-341.7
18	114.8	74.1	-1125.9	-627.9	-312.2	-894.7	-129.8	-477.2	-766.4	-1013.9	-30.9	-223.4	-396.7	-554.2	-698.5	-831.8	-955.9	-1070.9
19	150.7	544.8	-655.2	-157.2	158.5	-424.0	340.9	-6.5	-295.7	-543.2	439.8	247.3	74.0	-83.5	-227.8	-361.1	-485.2	-600.2
20	197.8	1016	-184.0	314.0	629.7	47.2	812.1	464.7	175.5	-72.0	911.0	718.5	545.2	387.7	243.4	110.1	-14.0	-129.0
21	129.8	286.4	-913.6	-415.6	-99.9	-682.4	82.5	-264.9	-554.1	-801.6	181.4	-11.1	-184.4	-341.9	-486.2	-619.5	-743.6	-858.6
22	170.3	757.2	-442.8	55.2	370.9	-211.6	553.3	205.9	-83.3	-330.8	652.2	459.7	286.4	128.9	-15.4	-148.7	-272.8	-387.8
23	223.6	1228	28.0	526.0	841.7	259.2	1024.1	676.7	387.5	140.0	1123.0	930.5	757.2	599.7	455.4	322.1	198.0	83.0

Table 11 - Layering the 21st partial (fourth-) on top of each other

This initially leads to a tone system with 5 tones, but which is 46 cents, i.e. half a semitone too low in the octave. Continuing the process leads to a tone system with 23 tones, which is 28 cents too high in the octave.

1.2.13 Tuning after the 23rd partial (tritone+)

We continue the thought experiment with the layering of the 23rd partial (tritone+). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	158.1	628.3	-571.7	-73.7	242.0	-340.5	424.4	77.0	-212.2	-459.7	523.3	330.8	157.5	0.0	-144.3	-277.6	-401.7	-516.7
2	227.3	1257	57.0	555.0	870.7	288.2	1053.1	705.7	416.5	169.0	1152.0	959.5	786.2	628.7	484.4	351.1	227.0	112.0
3	163.4	684.8	-515.2	-17.2	298.5	-284.0	480.9	133.5	-155.7	-403.2	579.8	387.3	214.0	56.5	-87.8	-221.1	-345.2	-460.2
4	117.4	113.1	-1086.9	-588.9	-273.2	-855.7	-90.8	-438.2	-727.4	-974.9	8.1	-184.4	-357.7	-515.2	-659.5	-792.8	-916.9	-1031.9
5	168.8	741.4	-458.6	39.4	355.1	-227.4	537.5	190.1	-99.1	-346.6	636.4	443.9	270.6	113.1	-31.2	-164.5	-288.6	-403.6
6	121.3	169.6	-1030.4	-532.4	-216.7	-799.2	-34.3	-381.7	-670.9	-918.4	64.6	-127.9	-301.2	-458.7	-603.0	-736.3	-860.4	-975.4
7	174.4	797.9	-402.1	95.9	411.6	-170.9	594.0	246.6	-42.6	-290.1	692.9	500.4	327.1	169.6	25.3	-108.0	-232.1	-347.1
8	125.4	226.2	-973.8	-475.8	-160.1	-742.6	22.3	-325.1	-614.3	-861.8	121.2	-71.3	-244.6	-402.1	-546.4	-679.7	-803.8	-918.8
9	180.2	854.5	-345.5	152.5	468.2	-114.3	650.6	303.2	14.0	-233.5	749.5	557.0	383.7	226.2	81.9	-51.4	-175.5	-290.5
10	129.5	282.7	-917.3	-419.3	-103.6	-686.1	78.8	-268.6	-557.8	-805.3	177.7	-14.8	-188.1	-345.6	-489.9	-623.2	-747.3	-862.3
11	186.2	911.0	-289.0	209.0	524.7	-57.8	707.1	359.7	70.5	-177.0	806.0	613.5	440.2	282.7	138.4	5.1	-119.0	-234.0
12	133.8	339.3	-860.7	-362.7	-47.0	-629.5	135.4	-212.0	-501.2	-748.7	234.3	41.8	-131.5	-289.0	-433.3	-566.6	-690.7	-805.7
13	192.4	967.6	-232.4	265.6	581.3	-1.2	763.7	416.3	127.1	-120.4	862.6	670.1	496.8	339.3	195.0	61.7	-62.4	-177.4
14	138.3	395.8	-804.2	-306.2	9.5	-573.0	191.9	-155.5	-444.7	-692.2	290.8	98.3	-75.0	-232.5	-376.8	-510.1	-634.2	-749.2
15	198.7	1024	-176.0	322.0	637.7	55.2	820.1	472.7	183.5	-64.0	919.0	726.5	553.2	395.7	251.4	118.1	-6.0	-121.0
16	142.8	452.4	-747.6	-249.6	66.1	-516.4	248.5	-98.9	-388.1	-635.6	347.4	154.9	-18.4	-175.9	-320.2	-453.5	-577.6	-692.6
17	205.3	1081	-119.0	379.0	694.7	112.2	877.1	529.7	240.5	-7.0	976.0	783.5	610.2	452.7	308.4	175.1	51.0	-64.0
18	147.6	508.9	-691.1	-193.1	122.6	-459.9	305.0	-42.4	-331.6	-579.1	403.9	211.4	38.1	-119.4	-263.7	-397.0	-521.1	-636.1
19	212.2	1137	-63.0	435.0	750.7	168.2	933.1	585.7	296.5	49.0	1032.0	839.5	666.2	508.7	364.4	231.1	107.0	-8.0
20	152.5	565.5	-634.5	-136.5	179.2	-403.3	361.6	14.2	-275.0	-522.5	460.5	268.0	94.7	-62.8	-207.1	-340.4	-464.5	-579.5
21	219.2	1194	-6.0	492.0	807.7	225.2	990.1	642.7	353.5	106.0	1089.0	896.5	723.2	565.7	421.4	288.1	164.0	49.0

Table 12 - Layering the 23rd partial (tritone+) on top of each other

This leads to a tone system with 21 tones per octave, which represents the overtone spectrum well. One could also argue that this results in a tonal system with only two tones, which would fit the tritone interval and miss the octave by 57 cents too high. What is interesting, however, is that many partial tones are hit twice, about half a semitone apart, resulting in many quarter tones.

1.2.14 Tuning after the 25th partial (minor sixth-)

We continue the thought experiment with the layering of the 25th partial (minor sixth-). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	171.9	772.6	-427.4	70.6	386.3	-196.2	568.7	221.3	-67.9	-315.4	667.6	475.1	301.8	144.3	0.0	-133.3	-257.4	-372.4
2	134.3	345.3	-854.7	-356.7	-41.0	-623.5	141.4	-206.0	-495.2	-742.7	240.3	47.8	-125.5	-283.0	-427.3	-560.6	-684.7	-799.7
3	209.8	1118	-82.0	416.0	731.7	149.2	914.1	566.7	277.5	30.0	1013.0	820.5	647.2	489.7	345.4	212.1	88.0	-27.0
4	163.9	690.5	-509.5	-11.5	304.2	-278.3	486.6	139.2	-150.0	-397.5	585.5	393.0	219.7	62.2	-82.1	-215.4	-339.5	-454.5
5	128.1	263.1	-936.9	-438.9	-123.2	-705.7	59.2	-288.2	-577.4	-824.9	158.1	-34.4	-207.7	-365.2	-509.5	-642.8	-766.9	-881.9
6	200.1	1036	-164.0	334.0	649.7	67.2	832.1	484.7	195.5	-52.0	931.0	738.5	565.2	407.7	263.4	130.1	6.0	-109.0
7	156.3	608.4	-591.6	-93.6	222.1	-360.4	404.5	57.1	-232.1	-479.6	503.4	310.9	137.6	-19.9	-164.2	-297.5	-421.6	-536.6
8	122.1	181.0	-1019.0	-521.0	-205.3	-787.8	-22.9	-370.3	-659.5	-907.0	76.0	-116.5	-289.8	-447.3	-591.6	-724.9	-849.0	-964.0
9	190.8	953.6	-246.4	251.6	567.3	-15.2	749.7	402.3	113.1	-134.4	848.6	656.1	482.8	325.3	181.0	47.7	-76.4	-191.4
10	149.1	526.3	-673.7	-175.7	140.0	-442.5	322.4	-25.0	-314.2	-561.7	421.3	228.8	55.5	-102.0	-246.3	-379.6	-503.7	-618.7
11	116.5	98.9	-1101.1	-603.1	-287.4	-869.9	-105.0	-452.4	-741.6	-989.1	-6.1	-198.6	-371.9	-529.4	-673.7	-807.0	-931.1	-1046.1
12	182.0	871.5	-328.5	169.5	485.2	-97.3	667.6	320.2	31.0	-216.5	766.5	574.0	400.7	243.2	98.9	-34.4	-158.5	-273.5
13	142.2	444.2	-755.8	-257.8	57.9	-524.6	240.3	-107.1	-396.3	-643.8	339.2	146.7	-26.6	-184.1	-328.4	-461.7	-585.8	-700.8
14	222.1	1217	17.0	515.0	830.7	248.2	1013.1	665.7	376.5	129.0	1112.0	919.5	746.2	588.7	444.4	311.1	187.0	72.0

Table 13 - Layering the 25th partial (minor sixth-) on top of each other

This results in a tone system with 14 tones that represents all 31 partials. However, the 5th partial, the major third, is 41 cents too low.

1.2.15 Tuning after the 27th partial (major sixth)

We continue the thought experiment with the layering of the 27th partial (major sixth). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	**110.0**	**0.0**																
1	**185.6**	**905.9**	-294.1	203.9	519.6	-62.9	702.0	354.6	65.4	-182.1	800.9	608.4	435.1	277.6	133.3	0.0	-124.1	-239.1
2	**156.6**	**611.7**	-588.3	-90.3	225.4	-357.1	407.8	60.4	-228.8	-476.3	506.7	314.2	140.9	-16.6	-160.9	-294.2	-418.3	-533.3
3	**132.1**	**317.6**	-882.4	-384.4	-68.7	-651.2	113.7	-233.7	-522.9	-770.4	212.6	20.1	-153.2	-310.7	-455.0	-588.3	-712.4	-827.4
4	**223.0**	**1223**	23.0	521.0	836.7	254.2	1019.1	671.7	382.5	135.0	1118.0	925.5	752.2	594.7	450.4	317.1	193.0	78.0

Table 14 - Layering the 27th partial (major sixth) on top of each other

This leads to a tone system with 4 tones, which harmonizes well with the overtone spectrum of the fundamental tone, but in which the fifth and major third, among others, have no equivalent.

1.2.16 Tuning after the 29th partial (minor seventh+)

We continue the thought experiment with the layering of the 29th partial (minor seventh+). The following table shows the result:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	199.4	1030	-170.0	328.0	643.7	61.2	826.1	478.7	189.5	-58.0	925.0	732.5	559.2	401.7	257.4	124.1	0.0	-115.0
2	180.7	859.2	-340.8	157.2	472.9	-109.6	655.3	307.9	18.7	-228.8	754.2	561.7	388.4	230.9	86.6	-46.7	-170.8	-285.8
3	163.7	688.7	-511.3	-13.3	302.4	-280.1	484.8	137.4	-151.8	-399.3	583.7	391.2	217.9	60.4	-83.9	-217.2	-341.3	-456.3
4	148.4	518.3	-681.7	-183.7	132.0	-450.5	314.4	-33.0	-322.2	-569.7	413.3	220.8	47.5	-110.0	-254.3	-387.6	-511.7	-626.7
5	134.5	347.9	-852.1	-354.1	-38.4	-620.9	144.0	-203.4	-492.6	-740.1	242.9	50.4	-122.9	-280.4	-424.7	-558.0	-682.1	-797.1
6	121.9	177.5	-1022.5	-524.5	-208.8	-791.3	-26.4	-373.8	-663.0	-910.5	72.5	-120.0	-293.3	-450.8	-595.1	-728.4	-852.5	-967.5
7	220.9	1207	7.0	505.0	820.7	238.2	1003.1	655.7	366.5	119.0	1102.0	909.5	736.2	578.7	434.4	301.1	177.0	62.0

Table 15 - Layering the 29th partial (minor seventh+) on top of each other

This leads to a tone system with seven notes, in which, however, the 5th partial, the major third, is not well hit.

1.2.17 Tuning after the 31st partial (major seventh++)

Another interesting aspect is the layering of the respective 31st partial (major seventh+). Admittedly, it is a rather theoretical construct, as, for example, on the guitar, harmonics can only be produced up to approximately the 10th partial. However, it leads to the following interesting system with 22 tones:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110.0	0.0																
1	213.1	1145	-55.0	443.0	758.7	176.2	941.1	593.7	304.5	57.0	1040.0	847.5	674.2	516.7	372.4	239.1	115.0	0.0
2	206.5	1090	-110.0	388.0	703.7	121.2	886.1	538.7	249.5	2.0	985.0	792.5	619.2	461.7	317.4	184.1	60.0	-55.0
3	200.0	1035	-165.0	333.0	648.7	66.2	831.1	483.7	194.5	-53.0	930.0	737.5	564.2	406.7	262.4	129.1	5.0	-110.0
4	193.8	980.1	-219.9	278.1	593.8	11.3	776.2	428.8	139.6	-107.9	875.1	682.6	509.3	351.8	207.5	74.2	-49.9	-164.9
5	187.7	925.2	-274.8	223.2	538.9	-43.6	721.3	373.9	84.7	-162.8	820.2	627.7	454.4	296.9	152.6	19.3	-104.8	-219.8
6	181.8	870.2	-329.8	168.2	483.9	-98.6	666.3	318.9	29.7	-217.8	765.2	572.7	399.4	241.9	97.6	-35.7	-159.8	-274.8
7	176.2	815.2	-384.8	113.2	428.9	-153.6	611.3	263.9	-25.3	-272.8	710.2	517.7	344.4	186.9	42.6	-90.7	-214.8	-329.8
8	170.7	760.3	-439.7	58.3	374.0	-208.5	556.4	209.0	-80.2	-327.7	655.3	462.8	289.5	132.0	-12.3	-145.6	-269.7	-384.7
9	165.3	705.3	-494.7	3.3	319.0	-263.5	501.4	154.0	-135.2	-382.7	600.3	407.8	234.5	77.0	-67.3	-200.6	-324.7	-439.7
10	160.2	650.4	-549.6	-51.6	264.1	-318.4	446.5	99.1	-190.1	-437.6	545.4	352.9	179.6	22.1	-122.2	-255.5	-379.6	-494.6
11	155.1	595.4	-604.6	-106.6	209.1	-373.4	391.5	44.1	-245.1	-492.6	490.4	297.9	124.6	-32.9	-177.2	-310.5	-434.6	-549.6
12	150.3	540.4	-659.6	-161.6	154.1	-428.4	336.5	-10.9	-300.1	-547.6	435.4	242.9	69.6	-87.9	-232.2	-365.5	-489.6	-604.6
13	145.6	485.5	-714.5	-216.5	99.2	-483.3	281.6	-65.8	-355.0	-602.5	380.5	188.0	14.7	-142.8	-287.1	-420.4	-544.5	-659.5
14	141.1	430.5	-769.5	-271.5	44.2	-538.3	226.6	-120.8	-410.0	-657.5	325.5	133.0	-40.3	-197.8	-342.1	-475.4	-599.5	-714.5
15	136.6	375.5	-824.5	-326.5	-10.8	-593.3	171.6	-175.8	-465.0	-712.5	270.5	78.0	-95.3	-252.8	-397.1	-530.4	-654.5	-769.5
16	132.4	320.6	-879.4	-381.4	-65.7	-648.2	116.7	-230.7	-519.9	-767.4	215.6	23.1	-150.2	-307.7	-452.0	-585.3	-709.4	-824.4
17	128.2	265.6	-934.4	-436.4	-120.7	-703.2	61.7	-285.7	-574.9	-822.4	160.6	-31.9	-205.2	-362.7	-507.0	-640.3	-764.4	-879.4
18	124.2	210.6	-989.4	-491.4	-175.7	-758.2	6.7	-340.7	-629.9	-877.4	105.6	-86.9	-260.2	-417.7	-562.0	-695.3	-819.4	-934.4
19	120.3	155.7	-1044.3	-546.3	-230.6	-813.1	-48.2	-395.6	-684.8	-932.3	50.7	-141.8	-315.1	-472.6	-616.9	-750.2	-874.3	-989.3
20	116.6	100.7	-1099.3	-601.3	-285.6	-868.1	-103.2	-450.6	-739.8	-987.3	-4.3	-196.8	-370.1	-527.6	-671.9	-805.2	-929.3	-1044.3
21	112.9	45.7	-1154.3	-656.3	-340.6	-923.1	-158.2	-505.6	-794.8	-1042.3	-59.3	-251.8	-425.1	-582.6	-726.9	-860.2	-984.3	-1099.3
22	218.8	1191	-9.0	489.0	804.7	222.2	987.1	639.7	350.5	103.0	1086.0	893.5	720.2	562.7	418.4	285.1	161.0	46.0

Table 16 - Layering the 31st partial (major seventh++) on top of each other

This tonal system with 22 tones replicates the overtone spectrum of the fundamental tone very well. What is also interesting here is that many partial tones are hit twice, but at a distance of about half a semitone each, so that many quarter tones result. In Indian music [12], for example, the octave is divided into 22 micro intervals, so-called shrutis [13]. A seven-step scale system is also used. Analogous to the so-called solmization [14] used in the Western world, in which the seven-step major scale, for example C, D, E, F, G, A and H with the syllables do, re, mi, fa, so, la and si is sung, in Indian music there are the seven syllables (Svaras) Sa, Ri, Ga, Ma, Pa, Dha and Ni, which in turn are divided into the 22 shrutis Sa, Ri1, Ri2, Ri3, Ri4, Ga1, Ga2, Ga3, Ga4, Ma1, Ma2, Ma3, Ma4, Pa, Dha1, Dha2, Dha3, Dha4, Ni1, Ni2, Ni3, and Ni4.

Conclusion

By layering the 1st, 3rd, 5th, etc. partials, you can build tonal systems with a limited number of tones within an octave.

Here we have taken a closer look at and evaluated the deviations of these tones from the overtone spectrum up to the 31st partial of the fundamental tone.

The Pythagorean tuning [15], which results from layering the third partial, the fifth, contains 12 tones, all of which harmonize quite well with the overtone spectrum of the fundamental tone. This type of tuning seems to be the most sensible in this category.

12 tones per octave can be easily distinguished from one another and a functional assignment into, for example, third, fifth, seventh is quite easy. In addition, the overtone spectrum of the fundamental tone is represented quite well.

1.3 Equal temperament tone systems

Equal temperament tone systems [16] are characterized by the fact that the frequency ratio of two consecutive tones is always the same and leads to an octave after N steps.

In other words, you can get from one frequency to the next (from one tone to the next) by multiplying by the same factor. This requirement is known from mathematics. In the so-called geometric sequence, the ratio of two consecutive numbers is always the same. It follows the formula:

$$f_n = f_1 \cdot q^{(n-1)}$$

With N = number of tones per octave this means:

$$\frac{f_{N+1}}{f_1} = q^N = 2$$

And thus:

$$q = e^{\frac{ln(2)}{N}} = 2^{1/N}$$

or

$$\mathrm{q} = \sqrt[N]{2}$$

For example, for a system with 12 tones per octave, q, the factor from one tone frequency to the next, is equal to:
$q = 2^{1/12} = \sqrt[12]{2} = 1.05946\ldots \approx 1.06$

This results in the formula for the frequencies of an equal temperament tone system with N tones:

$$f_n = f_1 \cdot 2^{\frac{n-1}{N}}$$

Equation 3 - Formula for the frequencies of an equal temperament tuning system with N tones.

The advantage of equal temperament tone systems is that all intervals are always the same, regardless of the starting tone. The system can therefore be transposed into any key.

Below, we apply this formula to create equal temperament tone systems with one, two, three, etc. tones..

1.3.1 Equal temperament tone system with 1 tone per octave

The following table shows the deviation of the one generated tone, the octave, from the 3rd, 5th, etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 17 - Equal temperament tone system with 1 tone per octave

This trivial tone system with one tone per octave consists only of the fundamental itself.

1.3.2 Equal temperament tone system with 2 tones per octave

The following table shows the deviation of the 2 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	155.6	600	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
2	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 18 - Equal temperament tone system with 2 tones per octave

This equal temperament tone system with 2 notes per octave contains the fundamental and the tritone.

1.3.3 Equal temperament tone system with 3 tones per octave

The following table shows the deviation of the 3 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	138.6	400	-800.0	-302.0	13.7	-568.8	196.1	-151.3	-440.5	-688.0	295.0	102.5	-70.8	-228.3	-372.6	-505.9	-630.0	-745.0
2	174.6	800	-400.0	98.0	413.7	-168.8	596.1	248.7	-40.5	-288.0	695.0	502.5	329.2	171.7	27.4	-105.9	-230.0	-345.0
3	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 19 - Equal temperament tone system with 3 tones per octave

This equal temperament tone system with three notes per octave consists of the fundamental, the major third and the minor sixth. It is the straightening of the tuning by layering the 5th partial, the major third, see chapter 1.2.4 (Tuning after the 5th partial (major thirds)).

1.3.4 Equal temperament tone system with 4 tones per octave

The following table shows the deviation of the 4 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	130.8	300	-900.0	-402.0	-86.3	-668.8	96.1	-251.3	-540.5	-788.0	195.0	2.5	-170.8	-328.3	-472.6	-605.9	-730.0	-845.0
2	155.6	600	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
3	185.0	900	-300.0	198.0	513.7	-68.8	696.1	348.7	59.5	-188.0	795.0	602.5	429.2	271.7	127.4	-5.9	-130.0	-245.0
4	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 20 - Equal temperament tone system with 4 tones per octave

This equal temperament tone system with four notes per octave consists of the fundamental, the minor third, the major sixth and the tritone.

1.3.5 Equal temperament tone system with 5 tones per octave

The following table shows the deviation of the 5 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
	Partial		2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
	Interval designation		Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	126.4	240	-960.0	-462.0	-146.3	-728.8	36.1	-311.3	-600.5	-848.0	135.0	-57.5	-230.8	-388.3	-532.6	-665.9	-790.0	-905.0
2	145.1	480	-720.0	-222.0	93.7	-488.8	276.1	-71.3	-360.5	-608.0	375.0	182.5	9.2	-148.3	-292.6	-425.9	-550.0	-665.0
3	166.7	720	-480.0	18.0	333.7	-248.8	516.1	168.7	-120.5	-368.0	615.0	422.5	249.2	91.7	-52.6	-185.9	-310.0	-425.0
4	191.5	960	-240.0	258.0	573.7	-8.8	756.1	408.7	119.5	-128.0	855.0	662.5	489.2	331.7	187.4	54.1	-70.0	-185.0
5	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 21 - Equal temperament tone system with 5 tones per octave

This equal temperament tone system with five notes per octave consists of the fundamental, the fifth, the minor seventh, the major second and the fourth, whereby the deviation from the 9th partial, the major second, is 36.1 cents.

1.3.6 Equal temperament tone system with 6 tones per octave

The following table shows the deviation of the 6 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
		Partial	**2**	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**
		Interval designation	**Octave**	**Fifth**	**Major 3rd**	**Minor 7th-**	**Major 2nd**	**Tritone--**	**Minor 6th++**	**Major 7th**	**Minor 2nd**	**Minor 3rd**	**Fourth-**	**Tritone+**	**Minor 6th-**	**Major 6th**	**Minor 7th+**	**Major 7th++**
Step	**Frequency [Hz]**	**Distance [cents]**	**1200**	**702.0**	**386.3**	**968.8**	**203.9**	**551.3**	**840.5**	**1088**	**105.0**	**297.5**	**470.8**	**628.3**	**772.6**	**905.9**	**1030**	**1145**
0	**110**	**0**																
1	**123.5**	**200**	-1000.0	-502.0	-186.3	-768.8	-3.9	-351.3	-640.5	-888.0	95.0	-97.5	-270.8	-428.3	-572.6	-705.9	-830.0	-945.0
2	**138.6**	**400**	-800.0	-302.0	13.7	-568.8	196.1	-151.3	-440.5	-688.0	295.0	102.5	-70.8	-228.3	-372.6	-505.9	-630.0	-745.0
3	**155.6**	**600**	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
4	**174.6**	**800**	-400.0	98.0	413.7	-168.8	596.1	248.7	-40.5	-288.0	695.0	502.5	329.2	171.7	27.4	-105.9	-230.0	-345.0
5	**196.0**	**1000**	-200.0	298.0	613.7	31.2	796.1	448.7	159.5	-88.0	895.0	702.5	529.2	371.7	227.4	94.1	-30.0	-145.0
6	**220.0**	**1200**	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 22 - Equal temperament tone system with 6 tones per octave

This equal temperament tone system with six notes per octave consists of the fundamental, the major second, the major third, the tritone, the minor sixth and the minor seventh. It is the straightening of the tuning by layering the 9th partial, the major second, see chapter 1.2.6 (Tuning after the 9th partial (major second)).

1.3.7 Equal temperament tone system with 7 tones per octave

The following table shows the deviation of the 7 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	121.4	171.4	-1028.6	-530.6	-214.9	-797.4	-32.5	-379.9	-669.1	-916.6	66.4	-126.1	-299.4	-456.9	-601.2	-734.5	-858.6	-973.6
2	134.1	342.9	-857.1	-359.1	-43.4	-625.9	139.0	-208.4	-497.6	-745.1	237.9	45.4	-127.9	-285.4	-429.7	-563.0	-687.1	-802.1
3	148.0	514.3	-685.7	-187.7	128.0	-454.5	310.4	-37.0	-326.2	-573.7	409.3	216.8	43.5	-114.0	-258.3	-391.6	-515.7	-630.7
4	163.5	685.7	-514.3	-16.3	299.4	-283.1	481.8	134.4	-154.8	-402.3	580.7	388.2	214.9	57.4	-86.9	-220.2	-344.3	-459.3
5	180.5	857.1	-342.9	155.1	470.8	-111.7	653.2	305.8	16.6	-230.9	752.1	559.6	386.3	228.8	84.5	-48.8	-172.9	-287.9
6	199.3	1029	-171.0	327.0	642.7	60.2	825.1	477.7	188.5	-59.0	924.0	731.5	558.2	400.7	256.4	123.1	-1.0	-116.0
7	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 23 - Equal temperament tone system with 7 tones per octave

This equal temperament tone system with seven notes per octave consists of the root, the major second, the major third, the tritone and fifth, the minor sixth and the minor seventh. The major third is 43.5 cents below the 5th partial.

1.3.8 Equal temperament tone system with 8 tones per octave

The following table shows the deviation of the 8 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	120.0	150	-1050.0	-552.0	-236.3	-818.8	-53.9	-401.3	-690.5	-938.0	45.0	-147.5	-320.8	-478.3	-622.6	-755.9	-880.0	-995.0
2	130.8	300	-900.0	-402.0	-86.3	-668.8	96.1	-251.3	-540.5	-788.0	195.0	2.5	-170.8	-328.3	-472.6	-605.9	-730.0	-845.0
3	142.7	450	-750.0	-252.0	63.7	-518.8	246.1	-101.3	-390.5	-638.0	345.0	152.5	-20.8	-178.3	-322.6	-455.9	-580.0	-695.0
4	155.6	600	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
5	169.6	750	-450.0	48.0	363.7	-218.8	546.1	198.7	-90.5	-338.0	645.0	452.5	279.2	121.7	-22.6	-155.9	-280.0	-395.0
6	185.0	900	-300.0	198.0	513.7	-68.8	696.1	348.7	59.5	-188.0	795.0	602.5	429.2	271.7	127.4	-5.9	-130.0	-245.0
7	201.7	1050	-150.0	348.0	663.7	81.2	846.1	498.7	209.5	-38.0	945.0	752.5	579.2	421.7	277.4	144.1	20.0	-95.0
8	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 24 - Equal temperament tone system with 8 tones per octave

This equal temperament tone system with 8 notes per octave consists of the fundamental, the minor second, the minor third, the fourth, the tritone, the minor and major sixth and the minor seventh. The fifth and major third are missing in this system and the minor second lies 45 cents above the 17. partial.

1.3.9 Equal temperament tone system with 9 tones per octave

The following table shows the deviation of the 9 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
		Partial	2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
		Interval designation	Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	118.8	133.3	-1066.7	-568.7	-253.0	-835.5	-70.6	-418.0	-707.2	-954.7	28.3	-164.2	-337.5	-495.0	-639.3	-772.6	-896.7	-1011.7
2	128.3	266.7	-933.3	-435.3	-119.6	-702.1	62.8	-284.6	-573.8	-821.3	161.7	-30.8	-204.1	-361.6	-505.9	-639.2	-763.3	-878.3
3	138.6	400	-800.0	-302.0	13.7	-568.8	196.1	-151.3	-440.5	-688.0	295.0	102.5	-70.8	-228.3	-372.6	-505.9	-630.0	-745.0
4	149.7	533.3	-666.7	-168.7	147.0	-435.5	329.4	-18.0	-307.2	-554.7	428.3	235.8	62.5	-95.0	-239.3	-372.6	-496.7	-611.7
5	161.7	666.7	-533.3	-35.3	280.4	-302.1	462.8	115.4	-173.8	-421.3	561.7	369.2	195.9	38.4	-105.9	-239.2	-363.3	-478.3
6	174.6	800	-400.0	98.0	413.7	-168.8	596.1	248.7	-40.5	-288.0	695.0	502.5	329.2	171.7	27.4	-105.9	-230.0	-345.0
7	188.6	933.3	-266.7	231.3	547.0	-35.5	729.4	382.0	92.8	-154.7	828.3	635.8	462.5	305.0	160.7	27.4	-96.7	-211.7
8	203.7	1067	-133.0	365.0	680.7	98.2	863.1	515.7	226.5	-21.0	962.0	769.5	596.2	438.7	294.4	161.1	37.0	-78.0
9	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 25- Equal temperament tone system with 9 tones per octave

This equal temperament tone system with 9 notes per octave consists of the fundamental, the minor second, the minor and major third, the tritone and fifth, the minor and major sixth and the major seventh. The fifth is not well hit and lies 35.3 cents below the 3rd partial.

1.3.10 Equal temperament tone system with 10 tones per octave

The following table shows the deviation of the 10 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	117.9	120	-1080.0	-582.0	-266.3	-848.8	-83.9	-431.3	-720.5	-968.0	15.0	-177.5	-350.8	-508.3	-652.6	-785.9	-910.0	-1025.0
2	126.4	240	-960.0	-462.0	-146.3	-728.8	36.1	-311.3	-600.5	-848.0	135.0	-57.5	-230.8	-388.3	-532.6	-665.9	-790.0	-905.0
3	135.4	360	-840.0	-342.0	-26.3	-608.8	156.1	-191.3	-480.5	-728.0	255.0	62.5	-110.8	-268.3	-412.6	-545.9	-670.0	-785.0
4	145.1	480	-720.0	-222.0	93.7	-488.8	276.1	-71.3	-360.5	-608.0	375.0	182.5	9.2	-148.3	-292.6	-425.9	-550.0	-665.0
5	155.6	600	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
6	166.7	720	-480.0	18.0	333.7	-248.8	516.1	168.7	-120.5	-368.0	615.0	422.5	249.2	91.7	-52.6	-185.9	-310.0	-425.0
7	178.7	840	-360.0	138.0	453.7	-128.8	636.1	288.7	-0.5	-248.0	735.0	542.5	369.2	211.7	67.4	-65.9	-190.0	-305.0
8	191.5	960	-240.0	258.0	573.7	-8.8	756.1	408.7	119.5	-128.0	855.0	662.5	489.2	331.7	187.4	54.1	-70.0	-185.0
9	205.3	1080	-120.0	378.0	693.7	111.2	876.1	528.7	239.5	-8.0	975.0	782.5	609.2	451.7	307.4	174.1	50.0	-65.0
10	220	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 26 - Equal temperament tone system with 10 tones per octave

This equal temperament tone system with 10 notes per octave consists of the fundamental, the minor and major second, the major third, the fourth and fifth, the tritone, the minor sixth, the minor and major seventh. The minor third and the major sixth are missing.

1.3.11 Equal temperament tone system with 11 tones per octave

The following table shows the deviation of the 11 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
Partial			2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Interval designation			Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	117.2	109.1	-1090.9	-592.9	-277.2	-859.7	-94.8	-442.2	-731.4	-978.9	4.1	-188.4	-361.7	-519.2	-663.5	-796.8	-920.9	-1035.9
2	124.8	218.2	-981.8	-483.8	-168.1	-750.6	14.3	-333.1	-622.3	-869.8	113.2	-79.3	-252.6	-410.1	-554.4	-687.7	-811.8	-926.8
3	132.9	327.3	-872.7	-374.7	-59.0	-641.5	123.4	-224.0	-513.2	-760.7	222.3	29.8	-143.5	-301.0	-445.3	-578.6	-702.7	-817.7
4	141.5	436.4	-763.6	-265.6	50.1	-532.4	232.5	-114.9	-404.1	-651.6	331.4	138.9	-34.4	-191.9	-336.2	-469.5	-593.6	-708.6
5	150.7	545.5	-654.5	-156.5	159.2	-423.3	341.6	-5.8	-295.0	-542.5	440.5	248.0	74.7	-82.8	-227.1	-360.4	-484.5	-599.5
6	160.5	654.5	-545.5	-47.5	268.2	-314.3	450.6	103.2	-186.0	-433.5	549.5	357.0	183.7	26.2	-118.1	-251.4	-375.5	-490.5
7	171.0	763.6	-436.4	61.6	377.3	-205.2	559.7	212.3	-76.9	-324.4	658.6	466.1	292.8	135.3	-9.0	-142.3	-266.4	-381.4
8	182.1	872.7	-327.3	170.7	486.4	-96.1	668.8	321.4	32.2	-215.3	767.7	575.2	401.9	244.4	100.1	-33.2	-157.3	-272.3
9	194.0	981.8	-218.2	279.8	595.5	13.0	777.9	430.5	141.3	-106.2	876.8	684.3	511.0	353.5	209.2	75.9	-48.2	-163.2
10	206.6	1091	-109.0	389.0	704.7	122.2	887.1	539.7	250.5	3.0	986.0	793.5	620.2	462.7	318.4	185.1	61.0	-54.0
11	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 27 - Equal temperament tone system with 11 tones per octave

This equal tone system with 11 tones per octave consists of the fundamental tone, the minor and major second, the minor third, the fourth, the tritone, the minor sixth and the minor and major seventh. The fifth and major third are missing and the tritone (11th and 23rd partial tone) and the minor sixth (13th and 25th partial tone) are each hit twice.

1.3.12 Equal temperament tone system with 12 tones per octave

The following table shows the deviation of the 12 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
		Partial	**2**	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**
		Interval designation	**Octave**	**Fifth**	**Major 3rd**	**Minor 7th-**	**Major 2nd**	**Tritone--**	**Minor 6th++**	**Major 7th**	**Minor 2nd**	**Minor 3rd**	**Fourth-**	**Tritone+**	**Minor 6th-**	**Major 6th**	**Minor 7th+**	**Major 7th++**
Step	**Frequency [Hz]**	**Distance [cents]**	**1200**	**702.0**	**386.3**	**968.8**	**203.9**	**551.3**	**840.5**	**1088**	**105.0**	**297.5**	**470.8**	**628.3**	**772.6**	**905.9**	**1030**	**1145**
0	**110**	**0**																
1	**116.5**	**100**	-1100.0	-602.0	-286.3	-868.8	-103.9	-451.3	-740.5	-988.0	-5.0	-197.5	-370.8	-528.3	-672.6	-805.9	-930.0	-1045.0
2	**123.5**	**200**	-1000.0	-502.0	-186.3	-768.8	-3.9	-351.3	-640.5	-888.0	95.0	-97.5	-270.8	-428.3	-572.6	-705.9	-830.0	-945.0
3	**130.8**	**300**	-900.0	-402.0	-86.3	-668.8	96.1	-251.3	-540.5	-788.0	195.0	2.5	-170.8	-328.3	-472.6	-605.9	-730.0	-845.0
4	**138.6**	**400**	-800.0	-302.0	13.7	-568.8	196.1	-151.3	-440.5	-688.0	295.0	102.5	-70.8	-228.3	-372.6	-505.9	-630.0	-745.0
5	**146.8**	**500**	-700.0	-202.0	113.7	-468.8	296.1	-51.3	-340.5	-588.0	395.0	202.5	29.2	-128.3	-272.6	-405.9	-530.0	-645.0
6	**155.6**	**600**	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
7	**164.8**	**700**	-500.0	-2.0	313.7	-268.8	496.1	148.7	-140.5	-388.0	595.0	402.5	229.2	71.7	-72.6	-205.9	-330.0	-445.0
8	**174.6**	**800**	-400.0	98.0	413.7	-168.8	596.1	248.7	-40.5	-288.0	695.0	502.5	329.2	171.7	27.4	-105.9	-230.0	-345.0
9	**185.0**	**900**	-300.0	198.0	513.7	-68.8	696.1	348.7	59.5	-188.0	795.0	602.5	429.2	271.7	127.4	-5.9	-130.0	-245.0
10	**196.0**	**1000**	-200.0	298.0	613.7	31.2	796.1	448.7	159.5	-88.0	895.0	702.5	529.2	371.7	227.4	94.1	-30.0	-145.0
11	**207.7**	**1100**	-100.0	398.0	713.7	131.2	896.1	548.7	259.5	12.0	995.0	802.5	629.2	471.7	327.4	194.1	70.0	-45.0
12	**220.0**	**1200**	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 28 - Equal temperament tone system with 12 tones per octave

The deviations of the equal temperament tone system with 12 tones per octave from the overtone spectrum are quite moderate. There is no corresponding tone in the system for the 11th and 13th partial tones.

1.3.13 Equal temperament tone system with 13 tones per octave

The following table shows the deviation of the 13 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
	Partial		2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
		Interval designation	Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	116.0	92.3	-1107.7	-609.7	-294.0	-876.5	-111.6	-459.0	-748.2	-995.7	-12.7	-205.2	-378.5	-536.0	-680.3	-813.6	-937.7	-1052.7
2	122.4	184.6	-1015.4	-517.4	-201.7	-784.2	-19.3	-366.7	-655.9	-903.4	79.6	-112.9	-286.2	-443.7	-588.0	-721.3	-845.4	-960.4
3	129.1	276.9	-923.1	-425.1	-109.4	-691.9	73.0	-274.4	-563.6	-811.1	171.9	-20.6	-193.9	-351.4	-495.7	-629.0	-753.1	-868.1
4	136.1	369.2	-830.8	-332.8	-17.1	-599.6	165.3	-182.1	-471.3	-718.8	264.2	71.7	-101.6	-259.1	-403.4	-536.7	-660.8	-775.8
5	143.6	461.5	-738.5	-240.5	75.2	-507.3	257.6	-89.8	-379.0	-626.5	356.5	164.0	-9.3	-166.8	-311.1	-444.4	-568.5	-683.5
6	151.5	553.8	-646.2	-148.2	167.5	-415.0	349.9	2.5	-286.7	-534.2	448.8	256.3	83.0	-74.5	-218.8	-352.1	-476.2	-591.2
7	159.8	646.2	-553.8	-55.8	259.9	-322.6	442.3	94.9	-194.3	-441.8	541.2	348.7	175.4	17.9	-126.4	-259.7	-383.8	-498.8
8	168.5	738.5	-461.5	36.5	352.2	-230.3	534.6	187.2	-102.0	-349.5	633.5	441.0	267.7	110.2	-34.1	-167.4	-291.5	-406.5
9	177.7	830.8	-369.2	128.8	444.5	-138.0	626.9	279.5	-9.7	-257.2	725.8	533.3	360.0	202.5	58.2	-75.1	-199.2	-314.2
10	187.5	923.1	-276.9	221.1	536.8	-45.7	719.2	371.8	82.6	-164.9	818.1	625.6	452.3	294.8	150.5	17.2	-106.9	-221.9
11	197.7	1015	-185.0	313.0	628.7	46.2	811.1	463.7	174.5	-73.0	910.0	717.5	544.2	386.7	242.4	109.1	-15.0	-130.0
12	208.6	1108	-92.0	406.0	721.7	139.2	904.1	556.7	267.5	20.0	1003.0	810.5	637.2	479.7	335.4	202.1	78.0	-37.0
13	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 29 - Equal temperament tone system with 13 tones per octave

This equal temperament tone system with 13 notes per octave contains all intervals, but the 3rd partial (the fifth) and 7th partial (the minor seventh) are not well represented.

This procedure can be continued to generate equal-range tone systems with any number of tones. On my website [10e] you can find the results for tone systems with 14 to 21 tones per octave.

1.3.14 Equal temperament tone system with 22 tones per octave

The following table shows the deviation of the 22 generated tones from the 3rd, 5th etc. to the 31st partial in cents:

			Deviation [cents] from partial no.															
		Partial	2	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
		Interval designation	Octave	Fifth	Major 3rd	Minor 7th-	Major 2nd	Tritone--	Minor 6th++	Major 7th	Minor 2nd	Minor 3rd	Fourth-	Tritone+	Minor 6th-	Major 6th	Minor 7th+	Major 7th++
Step	Frequency [Hz]	Distance [cents]	1200	702.0	386.3	968.8	203.9	551.3	840.5	1088	105.0	297.5	470.8	628.3	772.6	905.9	1030	1145
0	110	0																
1	113.5	54.5	-1145.5	-647.5	-331.8	-914.3	-149.4	-496.8	-786.0	-1033.5	-50.5	-243.0	-416.3	-573.8	-718.1	-851.4	-975.5	-1090.5
2	117.2	109.1	-1090.9	-592.9	-277.2	-859.7	-94.8	-442.2	-731.4	-978.9	4.1	-188.4	-361.7	-519.2	-663.5	-796.8	-920.9	-1035.9
3	120.9	163.6	-1036.4	-538.4	-222.7	-805.2	-40.3	-387.7	-676.9	-924.4	58.6	-133.9	-307.2	-464.7	-609.0	-742.3	-866.4	-981.4
4	124.8	218.2	-981.8	-483.8	-168.1	-750.6	14.3	-333.1	-622.3	-869.8	113.2	-79.3	-252.6	-410.1	-554.4	-687.7	-811.8	-926.8
5	128.8	272.7	-927.3	-429.3	-113.6	-696.1	68.8	-278.6	-567.8	-815.3	167.7	-24.8	-198.1	-355.6	-499.9	-633.2	-757.3	-872.3
6	132.9	327.3	-872.7	-374.7	-59.0	-641.5	123.4	-224.0	-513.2	-760.7	222.3	29.8	-143.5	-301.0	-445.3	-578.6	-702.7	-817.7
7	137.1	381.8	-818.2	-320.2	-4.5	-587.0	177.9	-169.5	-458.7	-706.2	276.8	84.3	-89.0	-246.5	-390.8	-524.1	-648.2	-763.2
8	141.5	436.4	-763.6	-265.6	50.1	-532.4	232.5	-114.9	-404.1	-651.6	331.4	138.9	-34.4	-191.9	-336.2	-469.5	-593.6	-708.6
9	146.1	490.9	-709.1	-211.1	104.6	-477.9	287.0	-60.4	-349.6	-597.1	385.9	193.4	20.1	-137.4	-281.7	-415.0	-539.1	-654.1
10	150.7	545.5	-654.5	-156.5	159.2	-423.3	341.6	-5.8	-295.0	-542.5	440.5	248.0	74.7	-82.8	-227.1	-360.4	-484.5	-599.5
11	155.6	600	-600.0	-102.0	213.7	-368.8	396.1	48.7	-240.5	-488.0	495.0	302.5	129.2	-28.3	-172.6	-305.9	-430.0	-545.0
12	160.5	654.5	-545.5	-47.5	268.2	-314.3	450.6	103.2	-186.0	-433.5	549.5	357.0	183.7	26.2	-118.1	-251.4	-375.5	-490.5
13	165.7	709.1	-490.9	7.1	322.8	-259.7	505.2	157.8	-131.4	-378.9	604.1	411.6	238.3	80.8	-63.5	-196.8	-320.9	-435.9
14	171.0	763.6	-436.4	61.6	377.3	-205.2	559.7	212.3	-76.9	-324.4	658.6	466.1	292.8	135.3	-9.0	-142.3	-266.4	-381.4
15	176.5	818.2	-381.8	116.2	431.9	-150.6	614.3	266.9	-22.3	-269.8	713.2	520.7	347.4	189.9	45.6	-87.7	-211.8	-326.8
16	182.1	872.7	-327.3	170.7	486.4	-96.1	668.8	321.4	32.2	-215.3	767.7	575.2	401.9	244.4	100.1	-33.2	-157.3	-272.3
17	187.9	927.3	-272.7	225.3	541.0	-41.5	723.4	376.0	86.8	-160.7	822.3	629.8	456.5	299.0	154.7	21.4	-102.7	-217.7
18	194.0	981.8	-218.2	279.8	595.5	13.0	777.9	430.5	141.3	-106.2	876.8	684.3	511.0	353.5	209.2	75.9	-48.2	-163.2
19	200.2	1036	-164.0	334.0	649.7	67.2	832.1	484.7	195.5	-52.0	931.0	738.5	565.2	407.7	263.4	130.1	6.0	-109.0
20	206.6	1091	-109.0	389.0	704.7	122.2	887.1	539.7	250.5	3.0	986.0	793.5	620.2	462.7	318.4	185.1	61.0	-54.0
21	213.2	1145	-55.0	443.0	758.7	176.2	941.1	593.7	304.5	57.0	1040.0	847.5	674.2	516.7	372.4	239.1	115.0	0.0
22	220.0	1200	0.0	498.0	813.7	231.2	996.1	648.7	359.5	112.0	1095.0	902.5	729.2	571.7	427.4	294.1	170.0	55.0

Table 30- Equal temperament tone system with 22 tones per octave

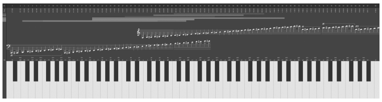
This equal temperament tone system with 22 notes per octave represents the overtone spectrum very well. It is, so to speak, the straightening of the system via the layering of the 31st partial presented in the last chapter. Also interesting here is the appearance of a half semitone, i.e. a quarter tone to the minor second (step 1) and between the minor and major second (step 3). These quarter tones do not appear in the overtone spectrum up to the 31st partial. However, they are used in the Arabic and Indian regions. Equal temperament tone systems are not used there. The 22 micro-intervals used in Indian music, the so-called shrutis [13], are all of different sizes.

Conclusion

With the help of the geometric sequence known from mathematics, so-called equal temperament tone systems [16] can be generated with any number of tones. Equal temperament tone systems are characterized by the fact that the frequency ratio of two consecutive tones is always the same and the sequence leads to the octave after n steps.

This system has the advantage that the same intervals, e.g. between the root note and the 3rd note, are always the same regardless of the starting note and the starting frequency. This means that any piece of music can be transposed as desired. Equal temperament tuning with 12 notes per octave has become established in the western world. It reproduces the overtone spectrum and especially the 3rd partial, the fifth, very well. Tone systems with fewer than 12 notes per octave have the disadvantage that they contain too few of the easily audible overtones. Tone systems with more than 12 tones naturally reproduce the overtone spectrum better. However, the different tones differ less and less as the number within an octave increases, making functional classification more difficult.

1.4 The equal temperament tone system with 12 tones



In chapter 1.3 (Equal temperament tone systems) the general formula for equal temperament tone systems with any number of tones was presented.

Ther following formula applies tot he equal temperament tuning with 12 tones:

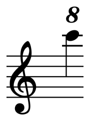
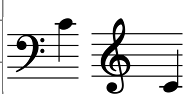
$$f_n = f_1 \cdot q^{(n-1)} \; with \; q^{12} = 2 \; and \; thus \; q = \sqrt[12]{2} = 1.05946 \ldots$$

Equation 4 - Formula for the frequencies of a 12 tone equal temperament tuning

In the Western world, equal temperament tuning with 12 notes has become established and is commonly used. The following figure shows in tabular form the equal temperament tuning of a modern 88-key piano that was introduced in the late 1880s. The table also contains the official names and frequencies of the tones (c, c sharp, d flat etc.) in German and international (English) usage.

The first columns show the typical range of a bass and guitar as well as the bass, tenor, alto and soprano voices. Column 7 contains the key number (1 to 88) of the corresponding key. To the right are the corresponding notes in the treble and bass clefs for the note C in the corresponding octave position. The next columns show the international (EN) and the German (DE) designation of the tones. The last column shows the frequencies calculated using the above formula based on the tone a1 at 440 Hz. For other tunings, the frequencies change accordingly.

- Tone range of a four-string bass (with extension for electric bass)
- Typical range of a bass voice
- Range of a guitar (with extension for electric guitar)
- Typical range of a tenor voice
- Typical range of an alto voice
- Typical range of an soprano voice

No.	Key	Note	Designation EN	Frequency f [Hz]
88			C8	4186
87			B7	3951
86			A$^{\#}$7 / B^{b}7	3729
85			A7	3520
84			G$^{\#}$7 / A^{b}7	3322
83			G7	3136
82			F$^{\#}$7 / G^{b}7	2960
81			F7	2794
80			E7	2637
79			D$^{\#}$7 / E^{b}7	2489
78			D7	2349
77			C$^{\#}$7 / D^{b}7	2217
76			C7	2093
75			B6	1976
74			A$^{\#}$6 / B^{b}6	1865
73			A6	1760
72			G$^{\#}$6 / A^{b}6	1661
71			G6	1568
70			F$^{\#}$6 / G^{b}6	1480
69			F6	1397
68			E6	1319
67			D$^{\#}$6 / E^{b}6	1245
66			D6	1175
65			C$^{\#}$6 / D^{b}6	1109
64			C6	1047
63			B5	987.8
62			A$^{\#}$5 / B^{b}5	932.3
61			A5	880.0
60			G$^{\#}$5 / A^{b}5	830.6
59			G5	784.0
58			F$^{\#}$5 / G^{b}5	740.0
57			F5	698.5
56			E5	659.3
55			D$^{\#}$5 / E^{b}5	622.3
54			D5	587.3
53			C$^{\#}$5 / D^{b}5	554.4
52			C5	523.3
51			B4	493.9
50			A$^{\#}$4 / B^{b}4	466.2
49			A4	440.0
48			G$^{\#}$4 / A^{b}4	415.3
47			G4	392.0
46			F$^{\#}$4 / G^{b}4	370.0
45			F4	349.2
44			E4	329.6
43			D$^{\#}$4 / E^{b}4	311.1
42			D4	293.7
41			C$^{\#}$4 / D^{b}4	277.2
40			C4	261.6
39			B3	246.9
38			A$^{\#}$3 / B^{b}3	233.1
37			A3	220.0
36			G$^{\#}$3 / A^{b}3	207.7
35			G3	196.0
34			F$^{\#}$3 / G^{b}3	185.0

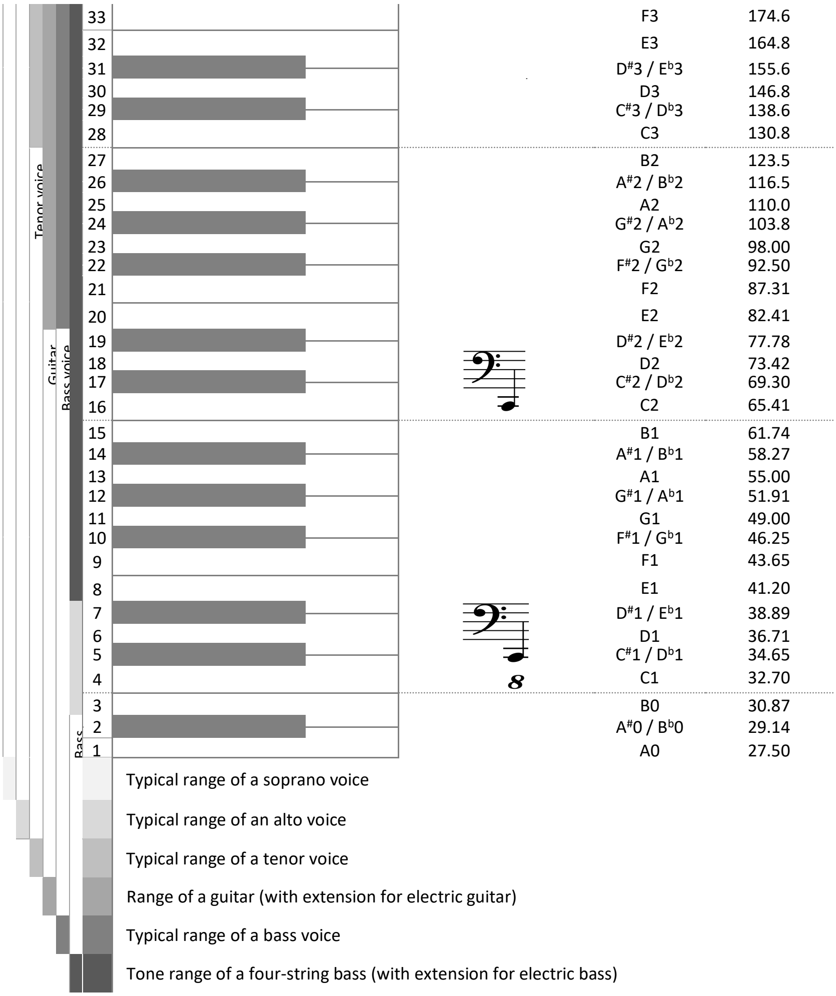


Figure 3 - Names of the tones and their frequencies based on tone a1 at 440 Hz

Conclusion

So that all 12 intervals are the same regardless of the starting tone, i.e. the frequency ratio of two consecutive tones is the same, the equal temperament tuning was introduced.

Our hearing has become accustomed to this equal temperament tuning despite the deviations from the natural overtones. You have to make this compromise if you simply want to transpose compositions into different keys.

1.5 Deviations of just intonation, Pythagorean and equal temperament tuning

Various musical tunings [10] have been used throughout the history of music. The so-called just intonation [10a], for example, focuses on the fact that the fifth, major third, major second and major seventh correspond to the natural overtones. However, in the other intervals there are clear deviations from the corresponding overtones too. The Pythagorean tuning [15], which will be described in more detail later, builds a tone system on the perfect fifth. Other well-known tunings are the meantone temperament [10c] and the well temperament [10b], which ultimately led to the equal temperament [16].

In the Western world today, equal temperament with 12 tones is commonly used. It consists of 12 equal intervals, i.e. that is, the frequency ratio of two consecutive tones is always the same. This has the advantage that you can transpose pieces of music into any key. All other tunings have the disadvantage that they only sound “clean” in certain keys.

The following table shows again the overtone spectrum (up to the 32nd partial) of a root tone of 110 Hz and the deviations of the individual tones from a suitable overtone in just intonation, Pythagorean and equal temperament.

1	2	3	4	5	6	7	8	9	10	11	12	13
Partial no.	Corresponds (approx.) the interval *)	Frequency [Hz]	Transposed down to the octave 110...220 Hz	Distance to root frequency [cents]	Frequency ratio	Just intonation (frequency ratio)	Just intonation [cents]	Deviation from the nearest partial tone [cents]	Pythagorean tuning [cents]	Deviation from the nearest partial tone [cents]	Equal temperament [cents]	Deviation from the nearest partial tone [cents]
1	Root tone	110	110	0	1:1	1:1	0	0 ✓	0	0 ✓	0	0 ✓
2	Octave	220	110		2:1		1200	0	1223	23	1200	0
3	Fifth	330	165.0	702.0	3:2	3:2	702.0	0 ✓	702.0	0 ✓	700	-2.00✓
4	Octave	440	110		2:1							
5	Major third	550	137.5	386.3	5:4	5:4	386.3	0 ✓	407.8	21.5 →	400	13.7 ✓
6	Fifth	660	165		3:2							
7	Minor seventh-	770	192.5	968.8	7:4	16:9	996.1	27.3 →	1020	50.7 ↓	1000	31.2↓
8	Octave	880	110		1:1							
9	Major second	990	123.8	203.9	9:8	9:8	203.9	0 ✓	203.9	0.00 ✓	200	-3.90✓
10	Major third	1100	137.5		5:4							
11	Tritone--	1210	151.3	551.3	11:8	10:7	617.5	66.2 ↓	521.5	-29.8→	600	48.7 ↓
12	Fifth	1320	165		3:2							
13	Minor sixth++	1430	178.8	840.5	13:8	8:5	813.7	-26.8→	815.6	-24.9→	800	-40.5↓
14	Minor seventh-	1540	192.5		7:4							
15	Major seventh	1650	206.3	1088	15:8	15:8	1088	0 ✓	1110	21.5 →	1100	11.7 ✓
16	Octave	1760	110		2:1							
17	Minor second	1870	116.9	105.0	17:16	16:15	111.7	6.8 ✓	113.7	8.70 ✓	100	-5.00✓
18	Major second	1980	123.8		9:8							
19	Minor third	2090	130.6	297.5	19:16	6:5	315.6	18.1 ✓	317.6	20.1 →	300	2.50 ✓
20	Major third	2200	137.5		5:4							
21	Fourth-	2310	144.4	470.8	21:16	4:3	498.0	27.3 →	521.5	50.7 ↓	500	29.2 →
22	Tritone--	2420	151.3		11:8							
23	Tritone+	2530	158.1	628.3	23:16	10:7	617.5	-10.8 ✓	611.7	-16.5 ✓	600	-28.3→
24	Fifth	2640	165		3:2							
25	Minor sixth-	2750	171.9	772.6	25:16	8:5	813.7	41.1 ↓	815.6	43.0 ↓	800	27.4 →
26	Minor sixth++	2860	178.8		13:8							
27	Major sixth	2970	185.6	905.9	27:16	5:3	884.4	-21.5→	905.9	0.00 ✓	900	-5.90✓
28	Minor seventh-	3080	192.5		7:4							
29	Minor seventh+	3190	199.4	1030	29:16	9:5	1018	-12.0 ✓	1020	-10.0 ✓	1000	-29.6→
30	Major seventh	3300	206.3		15:8							
31	Major seventh++	3410	213.1	1145	31:16	15:8	1088	-56.8↓	1110	-35.3↓	1100	-45.0↓
32	Octave	3520	110		2:1							

Table 31 - Deviations of the just intonation, Pythagorean and equal temperament tuning from the overtone spectrum of the root tone

Columns 1 and 2 of Table 31 show the partial tone number and the corresponding name of the partial tone. Column 3 contains the associated frequencies, in column 4 these are transposed downwards into the octave range of the root tone. Column 5 shows the frequency of column 4 as the distance from the root tone in cents and is therefore independent of the frequency of the root tone. Column 6 shows the corresponding frequency ratio of the partial to the fundamental. The numerator always contains the partial tone number and the denominator contains a multiple of 2, so that the result is again in the octave range of the root tone, i.e. between the root tone and its octave tone.

Column 7 contains the frequency ratios as defined by the so-called just intonation tuning. Column 8 shows the corresponding distances in cents of the tones from the fundamental for the just intonation tuning. Column 9 contains the deviations from the appropriate partial tone.

Columns 10 and 11 show the tones that match the partials of the root tone in the Pythagorean tuning as distances to the root tone in cents and the corresponding deviations.

Columns 12 and 13 show the tones that match the partials of the root tone in equal temperament tuning as distances to the root tone in cents and the corresponding deviations.

Conclusion

In all tunings, the tones deviate more or less from the overtone spectrum of the root tone.

Some tones of the just intonation, Pythagorean and equal temperament tuning differ significantly from the overtones of the root tone. This is particularly noticeable with the 7th, 11th and 13th partials.

1.6 The Fibonacci sequence and the golden ratio

The Fibonacci sequence [17] is a sequence of numbers in which the sum of two consecutive numbers results in the next number in the sequence, e.g. 0, 1, 1, 2, 3, 5, 8, 13, 21, 34... .

The ratio of two consecutive numbers converges to the irrational number [74] 1.618033..., the so-called golden ratio [18] q, where the 1st number is in the denominator and the following number in the numerator, i.e. in this example, 1/1, 2/1, 3/2, 5/3, 8/5, 13/8, 21/13, 34/21..., i.e. 1, 2, 1.5, 1.67, 1.6, 1,625, 1,615, 1,619... . The exact number for the golden ratio q is:

$$q = \frac{1+\sqrt{5}}{2} = 1.61803398874989 \ldots$$

Equation 5 - The formula for the golden ratio

The Fibonacci numbers can be clearly represented two-dimensionally in the form of squares with the Fibonacci numbers as edge lengths:

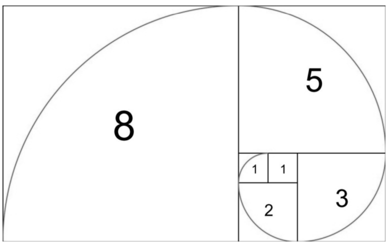


Figure 4 - Two-dimensional representation of the Fibonacci numbers

The proportions of the golden ratio can be found everywhere in nature and especially in growth processes, which is why it is considered the measure of all things when it comes to naturalness and beauty:

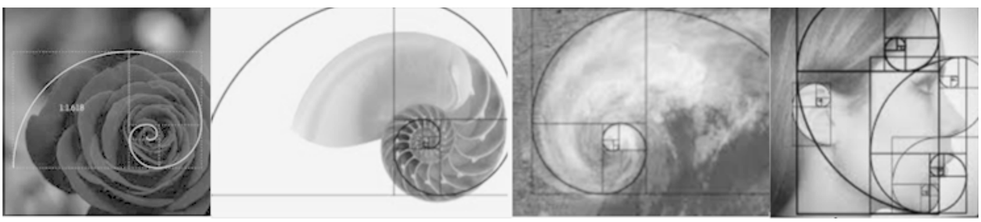


Figure 5 - Examples of the golden ratio in nature

Many artists and architects have proportioned their works according to the rules of the golden ratio:

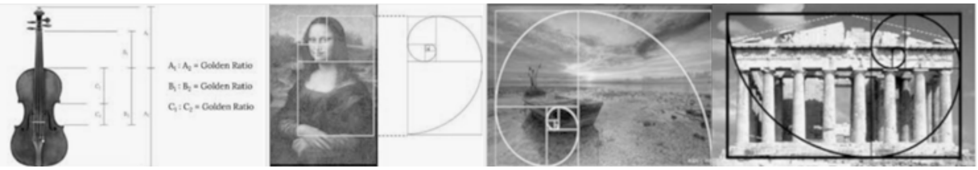


Figure 6 - The principle of the golden ratio in famous works

Here we now apply the principle of the golden ratio to sound frequencies. For example, we start again at a frequency f1=110 Hz, form the following frequency values as a Fibonacci sequence according to the sum of the previous frequencies, i.e.: 0, 110 Hz, 110 Hz, 220 Hz, 330 Hz, 550 Hz etc. and enter them in the 2nd column of the following table. Then we transpose the frequency f1 down as often as necessary, that is, we divide the frequency by 2 until it lies within the octave range from 110 Hz to 220 Hz, call this frequency f2 and enter it in the 3rd column. In the 4th column we enter the frequency ratio f2(n)/f2(n-1), i.e. the ratio of two consecutive frequencies f2. You can see that it quickly converges to the golden ratio of 1.618033...:

Step	Fibonacci frequency f_1/[Hz]	Appropriately transposed down f_2/[Hz]	$f_2(n)/ f_2(n-1)$ [Hz]
0	110	110.00	
1	110	110.00	1
2	220	220.00	2
3	330	165.00	1.5
4	550	137.50	1.666667
5	880	110.00	1.600000
6	1430	178.75	1.625000
7	2310	144.38	1.615385
8	3740	116.88	1.619048
9	6050	189.06	1.617647
10	9790	152.97	1.618182
11	15840	123.75	1.617978
12	25630	200.23	1.618056
13	41470	161.99	1.618026
14	67100	131.05	1.618037
15	108570	212.05	1.618033
16	175670	171.55	1.618034
17	284240	138.79	1.618034
18	459910	112.28	1.618034
19	744150	181.68	1.618034
20	1204060	146.98	1.618034
21	1948210	118.91	1.618034
22	3152270	192.40	1.618034
23	5100480	155.65	1.618034
24	8252750	125.93	1.618034
25	13353230	203.75	1.618034
26	21605980	164.84	1.618034
27	34959210	133.36	1.618034
28	56565190	215.78	1.618034
29	91524400	174.57	1.618034
30	148089590	141.23	1.618034
31	239613990	114.26	1.618034
32	387703580	184.87	1.618034
33	627317570	149.56	1.618034
34	1015021150	121.00	1.618034

Step	Fibonacci frequency f_1/[Hz]	Appropriately transposed down f_2/[Hz]	$f_2(n)/ f_2(n-1)$ [Hz]
35	1642338720	195.78	1.618034
36	2657359870	158.39	1.618034
37	4299698590	128.14	1.618034
38	6957058460	207.34	1.618034
39	11256757050	167.74	1.618034
40	18213815510	135.70	1.618034
41	29470572560	219.57	1.618034
42	47684388070	177.64	1.618034
43	77154960630	143.71	1.618034
44	124839348700	116.27	1.618034
45	201994309330	188.12	1.618034
46	326833658030	152.19	1.618034
47	528827967360	123.13	1.618034
48	855661625390	199.22	1.618034
49	1384489592750	161.18	1.618034
50	2240151218140	130.39	1.618034
51	3624640810890	210.98	1.618034
52	5864792029030	170.69	1.618034
53	9489432839920	138.09	1.618034
54	15354224868950	111.72	1.618034
55	24843657708870	180.76	1.618034
56	40197882577820	146.24	1.618034
57	65041540286690	118.31	1.618034
58	105239422864510	191.43	1.618034
59	170280963151200	154.87	1.618034
60	275520386015710	125.29	1.618034
61	445801349166910	202.73	1.618034
62	721321735182620	164.01	1.618034
63	1167123084349530	132.69	1.618034
64	1888444819532150	214.69	1.618034
65	3055567903881680	173.69	1.618034
66	4944012723413830	140.52	1.618034
67	7999580627295510	113.68	1.618034
68	12943593350709300	183.94	1.618034
69	20943173978004800	148.81	1.618034
70	33886767328714200	120.39	1.618034
71	54829941306719000	194.80	1.618034
72	88716708635433200	157.59	1.618034
73	143546649942152000	127.50	1.618034
74	232263358577586000	206.29	1.618034
75	375810008519738000	166.89	1.618034
76	608073367097323000	135.02	1.618034
77	983883375617061000	218.47	1.618034
78	1591956742714380000	176.74	1.618034
79	2575840118331450000	142.99	1.618034
80	4167796861045830000	115.68	1.618034
81	6743636979377270000	187.17	1.618034
82	10911433840423100000	151.43	1.618034
83	17655070819800400000	122.51	1.618034
84	28566504660223500000	198.22	1.618034
85	46221575480023900000	160.36	1.618034
86	74788080140247300000	129.74	1.618034
87	121009655620271000000	209.92	1.618034
88	195797735760519000000	169.83	1.618034
89	316807391380790000000	137.39	1.618034

Table 32 - The first 89 Fibonacci frequencies starting from the fundamental tone of a frequency of 110 Hz

At first glance, the tabular form does not reveal anything unusual. We therefore represent the frequency f2 graphically:

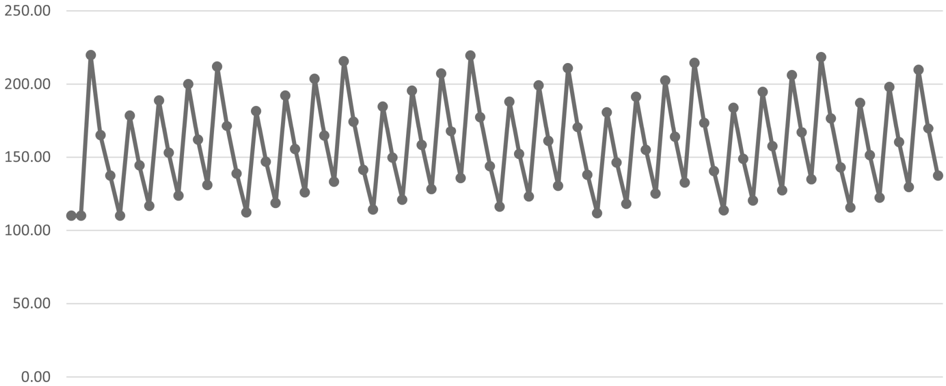


Figure 7 - Graphical representation of the first 89 Fibonacci frequencies starting from the fundamental tone of a frequency of 110 Hz

At first glance you can see a certain regularity, at second glance that in the Fibonacci sequence, after it has gone through the initial phase and the quotient of two successive frequencies approaches more and more the golden ratio, every third tone is a member of a series of 12 tones per octave:

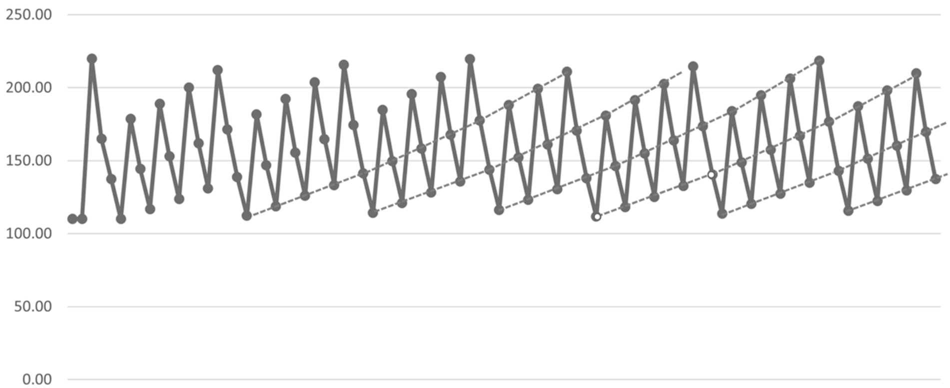


Figure 8 - Graphical representation of the first 89 Fibonacci frequencies with identification of the sequences with 12 tones

From the Moivre-Binet approximation formula for calculating the numbers of a Fibonacci sequence

$$f_n = f_0 \cdot \frac{q^n}{\sqrt{5}}$$

Equation 6 - Moivre-Binet approximate formula for calculating the numbers of a Fibonacci sequence

the following rule applies to each of the 12 marked tones in the steady state:

$$f_n = f_0 \cdot \frac{q^{3(n+2)}}{\sqrt{5} \cdot 2^{2(n+2)}} \text{ with n} = 1 \dots 12 \text{ and } \text{q} = \frac{1+\sqrt{5}}{2} = 1.61803398874989$$

Equation 7 - Approximate formula for calculating the 12 Fibonacci frequencies

In the following table, this formula is used for a starting frequency of 110 Hz, for example. The resulting Fibonacci tuning contains the following 12 tones:

Fibonacci tuning				**Equal temperament tuning**		
$f_n = f_0 \cdot \frac{q^{3(n+2)}}{\sqrt{5} \cdot 2^{2(n+2)}}$ mit $\text{q} = \frac{1+\sqrt{5}}{2} = 1.6180 \dots$ *(n>0)*				$f_n = f_0 \cdot q^n$ with $q = \sqrt[12]{2} = 1.05946 \dots$		
Step n	**Frequency f_n [Hz]**	**Interval name**		**Step n**	**Frequency f_n [Hz]**	**Interval name**
0	110	Prime		0	110	Prime
1	116.9	Minor second		1	116.5	Minor second
2	123.8	Major second		2	123.5	Major second
3	131.1	Minor third		3	130.8	Minor third
4	138.8	Major third		4	138.6	Major third
5	147.0	Fourth		5	146.8	Fourth
6	155.7	Tritone		6	155.6	Tritone
7	164.8	Fifth		7	164.8	Fifth
8	174.6	Minor sixth		8	174.6	Minor sixth
9	184.9	Major sixth		9	185.0	Major sixth
10	195.8	Minor seventh		10	196.0	Minor seventh
11	207.3	Major seventh		11	207.7	Major seventh
12	219.6	Octave		12	220	Octave

Table 33 -Comparison of the equal temperament and the Fibonacci tuning

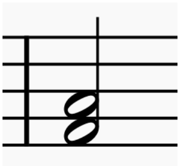
The close correspondence with the equally temperament tuning of 12 tones shown on the right is striking. Astonishing, isn't it?

Conclusion

Thus, one can justifiably claim that the equal temperament tuning with 12 tones used today corresponds to the golden ratio in music and is therefore rightfully the standard set in the Western world.

2 Two-, three-, four- and more-note chords

2.1 Two-note chords (intervals) within an octave



The two-note chords (intervals [19]) that can be produced with 12 tones within an octave are listed in the following table and provided with the corresponding interval designations (minor/major second, etc.):

Semitone steps	Designation of the Interval	Interval [1)] (shortcut)	Degree of dissonance [2)]
1	Minor second	b9	xxxxxxxxxx
2	Major second	9	xxxxxx
3	Minor third	m3 or #9	xxxxx
4	Major third	M3	xxx
5	Fourth	4 or 11	x
6	Tritone	#11 or b5	xxxxxx
7	Fifth	5	x
8	Minor sixth	b13 or #5	xxx
9	Major sixth	6 or 13	xxxxx
10	Minor seventh	7	xxxxxx
11	Major seventh	maj7	xxxxxxxxxx
12	Octave/Prime		

Table 34 - Two-note chords (intervals) within an octave and their degree of dissonance

1) These interval shortcuts will be introduced later in chapter 4.3 (Interval designations).

2) The representation of the degree of dissonance is very simplified. The so-called interval complementation, i.e. those that together form an octave, were rated equally because they are the same distance from the fundamental or octave tone. What can be said in any case is that the fourth and fifth (apart from the prime/octave) sound the least dissonant compared to all other intervals within an octave.

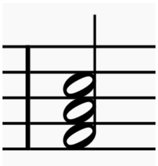
In chapter 4.3 (Interval designations) the intervals that go beyond an octave are also introduced.

If you octave the lower tone, i.e. reverse the interval, you get the so-called complementary interval or inversion. There is only one inversion in a two-note chord, because the second inversion results in the original interval again. By definition, the sum of the interval and its complementary interval leads to the octave:

Interval complement				
Minor second	+	Major seventh	=	Octave
Major second	+	Minor seventh	=	Octave
Minor third	+	Major sixth	=	Octave
Major third	+	Minor sixth	=	Octave
Fourth	+	Fifth	=	Octave
Tritone	+	Tritone	=	Octave

Table 35 - Interval complements (inversions) within an octave

2.2 Three-note chords within an octave



From the application of combinatorics [20] and use of binomial coefficients [20a] we know that there are a total of

$$\binom{12}{3} - \binom{11}{3} = \frac{12!}{(12-3)!\ \cdot\ 3!} - \frac{11!}{(11-3)!\ \cdot\ 3!} = 55$$

different three-note chords to one and the same fundamental tone within an octave (12 choose 3 minus the 11 choose 3 that do not begin with the fundamental tone).

You can cluster the 55 triads into 19 groups of three because there are two inversions for each triad. An inversion means that the lower note is octaved and the next note is at the bottom. This is possible exactly twice with a three-note chord because the 3rd inversion then corresponds to the original three-note chord. In this way you get the following complete list of all possible three-note chords within an octave (The combination 4-4-4, i.e. major third-major third-major third, also results in 4-4-4 in the two inversions, so that the equation works out again: 55 = 3 * 19 - 2).

[21]

Three-note chords (triads)

Figure 9 - Possible three-note chords (triads) *within an octave. 3-4-5, for example, means: 3 semitones - 4 semitones - 5 semitones, i.e. minor third - major third - fourth with the last interval going to the octave, i.e. in total there are always 3+4+5=12 semitones.*

Not all three-note chords (triads) [22] have been given a name, only the most common ones shown in the first six bars.

A distinction is made between the following five commonly used triad types:

a) the **minor** triad as a combination of a minor with a following major third, here in the example Cm with the structure 3-4-5, see bar 1, as well as its two inversions 4-5-3 and 5-3-4

b) the **major triad** as a combination of a major third followed by a minor third, here in the example C with the structure 4-3-5, see bar 2, as well as its two inversions 3-5-4 and 5-4-3

c) the **diminished triad** with two minor thirds following one another, here in the example C° with the structure 3-3-6, see measure 3, as well as its two inversions 3-6-3 and 6-3-3

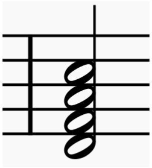
d) the **suspended triad (sus4)** with a fourth and following major second, here in the example C^{sus4} with the structure 5-2-5, see bar 4, as well as its two inversions 2-5-5 and 5-5-2 and

e) the **augmented triad** with three major thirds, here in the example C^{+} with the structure 4-4-4, see measure 5. Due to the symmetry, its two possible inversions each result in an augmented triad, here E^{+} and G^{+}

f) the **major^{b5} triad** with a major third and following major second, here in the example $C^{(b5)}$ with the structure 4-2-6, see measure 6, as well as its two inversions 2-6-4 and 6-4-2.

All other triads also occur in common chord structures.

2.3 Four-note chords within an octave



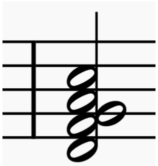
From the application of combinatorics [20] and use of binomial coefficients [20a] we know that there are a total of

$$\binom{12}{4} - \binom{11}{4} = \frac{12!}{(12-4)!\ \cdot\ 4!} - \frac{11!}{(11-4)!\ \cdot\ 4!} = 165$$

different four-note chords to one and the same root tone (12 choose 4 minus the 11 choose 4, which do not begin with the root tone.

The names of the four-note chords will be defined later using the scales in question from which we derive chords, see chapter 4 (Chords).

2.4 Five- and more-note chords



From the application of combinatorics [20] and use of binomial coefficients [20a] we know that there are a total of

$$\binom{12}{n} - \binom{11}{n} = \frac{12!}{(12-n)!\ \cdot n!} - \frac{11!}{(11-n)!\ \cdot n!}$$

Equation 8 - Number of possible n-note chords within an octave

330 different five-note chords, 462 six- and seven-note chords, 330 eight-note chords, 165 nine-note chords, 55 ten-note chords, 11 eleven-note chords and one twelve-note chord to one and the same root tone.

The designation of the five- and more-note chords will later be derived from the respective scale, see chapter 4 (Chords).

Conclusion

The use of combinatorics to determine all possible two-, three-, four- and more-tone chords does not bring us any closer to the goal of systematically introducing a theory of harmony.

The number of possible different chords (within an octave) is limited by combinatorics. There are
- 11 two-note chords,
- 55 three-note chords,
- 165 four-note chords,
- 330 five-note chords,
- 462 six- and seven-note chords,
- 330 eight-note chords,
- 165 nine-note chords,
- 55 ten-note chords and

- 11 eleven-note chords and
- one twelve-note chord.

3 Scales and modes

3.1 Definition of scales and modes

We define a scale [25] here as a sequence of tones increasing in pitch, which start from a fundamental tone and reach the octave tone within an octave in 1 to 12 ascending steps.

To determine the number of scales theoretically possible within an octave, you can use the following thought experiment:

Imagine the 12 tones as a 12-digit binary number, i.e. 12 bits in a row with the possible values 0 or 1, where the tone is played at 1 and not at 0. The chromatic scale (see chapter 6 The chromatic scale), i.e. the scale with 12 ascending semitones, for example, results from a sequence of 12 ones:

The chromatic scale: 1 1 1 1 1 1 1 1 1 1 1 1

All other possibilities arise from the combination of zeros and ones, where the first digit is always a 1 because the root note is always played. For the major scale, for example, the following combination results:

The (Ionian) major scale: 1 0 1 0 1 1 0 1 0 1 0 1

Example c major: C, (), D, (), E, F, (), G, (), A, (), B.

From mathematics we know that, for example, there are 10^3, i.e. 1000 three-digit natural numbers (0 to 999) in our usual 10-number system. Similarly, in the binary system there are $2^{12} = 4096$ possible twelve-digit binary numbers (000000000000 to 111111111111). In our case, the 1st digit is always a 1 as the root note, so the tone is always played. This means the number of possible scales is 2^{12} divided by 2, i.e. 2048.

Conclusion

In total, there are theoretically 2048 possible scales, i.e. 2048 ways to get from a root tone to an octave tone in 1 to 12 ascending steps.

1) In Chapter 4) (In chapter 833.7 (All Scales) we find these scales under the respective scale numbers.

All Scales) or on the website All Scales [23] there is an overview of all 2048 theoretically possible scales within a system with 12 tones according to the definition mentioned above.

3.1.1 Modes

By definition, every scale repeats itself after every octave. If you start the scale from a note other than the root note, you get the so-called modes of a scale.

The Dorian scale for example starts from the 2nd note of the Ionian major scale. For example D Dorian starts with the D in the C major scale and continues through E, F, G, A, B, C until it reaches D again:

(C-) **D-E-F-G-A-H-C-D** (-E-F-G-A-H-C).

The Dorian minor scale is therefore a mode of the Ionian major scale. It is also said that Dorian is the second degree of the Ionian scale.

The determination of which scale is the actual scale and which is a mode is of course arbitrary. The Ionian scale is for example also the 7th mode of the Dorian scale. C major for example starts from the 7th note of the D Dorian scale.

To determine how many scales there are in total if you don't count the modes, you can use the website All Scales [23] mentioned above by setting the filter in the column *without modes* to *yes*.

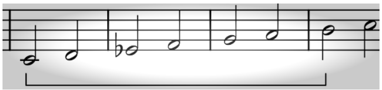
Conclusion

In a system with 12 tones, there are a total of 351 structurally different scales, if you do not count the modes and only consider scales that go from a fundamental tone to an octave tone in 1 to 12 ascending steps within an octave.

2) This is still a manageable number of different scales. In chapter 4) (In chapter 833.7 (All Scales) we find these scales under the respective scale numbers.

All Scales) all 2048 scales are divided into 351 groups in the table.

3.2 Seven-step scales



The seven-step scales, i.e. the scales with seven tones, are the most important because western harmony theory is based on these scales. In addition, the focus is on those that have a maximum of a minor third, i.e. three semitones as the largest interval and no two consecutive semitones.

Conclusion

If we only consider scales (without modes) that meet the following requirements:

a) Containing seven ascending tones,

b) not an interval of a minor second twice in a row row (so a maximum of two ones in a row),

c) the largest interval is a minor third,

only the following 6 scales remain:

Scale name	Pattern	Scale number [5]	Number of tones	Largest interval	2 consec. semitones	Structure [4]
Major (Ionian)	101011010101	325	7	2	n	1-9-M3-11-5-6-maj7
Melodic Minor (MM1)	101101010101	323	7	2	n	1-9-m3-11-5-6-maj7
Harmonic minor (HM1)	101101011001	289	7	3	n	1-9-m3-11-5-b6-maj7
Harmonic major (HD1)	101011011001	285	7	3	n	1-9-M3-11-5-b6-maj7
Hungarian major [1]	100110110110	290	7	3	n	1-#9-M3-#11-5-13-7
Lydian#23 [2]	100101101101	262	7	3	n	1-#9-#M3-#11-#5-6-maj7

Table 36 - The 6 possible seven-step scales, which have a minor third as the largest interval and no two consecutive semitones

You can find these scales on the website All Scales [23] mentioned above by setting the filter in the column *without modes* to *yes*, the number of tones to *7*, *two consecutive semitones* to *no* and the *largest interval* to *3*.

There is also a scale listed here that is very common in Arabic and Oriental countries and contains two consecutive semitones and two minor thirds:

Scale name	Pattern	Scale number [5)]	Number of tones	Largest interval	2 consec. semitones	Structure [4)]
Double harmonic minor (DHM1) [3)]	101100111001	288	7	3	j	1-9-m3-#11-5-b6-maj7

Table 37 - The double harmonic minor scale (DHM1) with two minor thirds and two semitones in a row

Note

1) The scale *Hungary major* is entirely included in the half-tone whole-tone scale, see chapter 11.2 (The half-tone whole-tone scale), and is therefore not discussed in a separate chapter. The half-tone whole-tone scale also contains the small 9th (b9).

2) The *Lydian#23* scale is because of its sounding minor and major third difficult to classify harmonically and is therefore not treated in a separate chapter. Since the second note is a minor third and the third is a fourth away from the fundamental, they must therefore be referred to as #9 and #M3.

3) The scale double harmonic minor (DHM1) is also called Hungarian minor, Rāga Madhava Manohari, Egyptian or politically incorrectly often called Gipsy minor.

   The scale on the fifth degree of the double harmonic minor scale (DHM5) with the structure 1-b9-M3-11-5-b6-maj7 is also known as the Arabic scale or, politically incorrectly, as Gypsy major.

4) The interval designation (1, 9, m3, 6 etc.) will be introduced in chapter 4.3 (Interval designations).

5) In chapter 833.7 (All Scales) we find these scales under the respective scale numbers.

> The naming of all chords and (even non-seven-step) scales, so to speak the entire theory of harmony, is based on definitions of the seven-step scales.

The most prominent seven-step scale is the Ionian major scale, often simply referred to as the major scale.

3.2.1 The Ionian major scale

The Ionian major scale is one of the two possible seven-step scales that have a major second as the largest interval and not two consecutive minor seconds. It has a total of 7 modes and, in addition to the root note, contains the major ninth (9) and major third (M3), the perfect eleventh (11) and perfect fifth (5), the major sixth (6) and major seventh (maj7 see chapter 5 (The Ionian major scale and its modes and chords).

Example: C Ionian

[24]

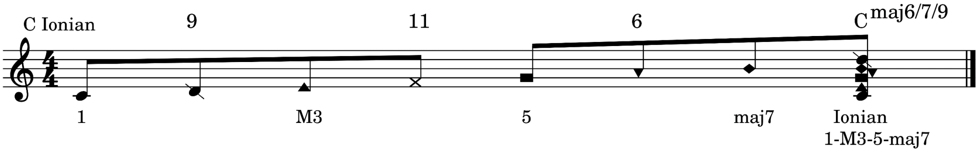


Figure 10 - The Ionian major scale in C

It has a total of seven modes,

Note

For better differentiation, this symbolism, i.e. the type of note heads depending on the respective interval, is used throughout this harmony theory:

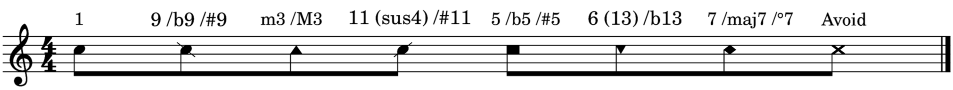


Figure 11 - The different types of noteheads used within this book

3.2.2 The melodic minor scale

The melodic minor scale (MM1) - also called melodic minor ascending (MMA) - is, along with the Ionian major scale, the other of the two possible seven-step scales that have a major second as the largest interval and not two consecutive minor seconds. It also has a total of 7 modes and, in addition to the root note, contains the major ninth (9) and minor third (m3), the perfect eleventh (11) and perfect fifth (5), the major sixth (6) and major seventh (maj7), see Chapter 7 (Melodic minor and its modes and chords).

Example: C melodic minor

[39]

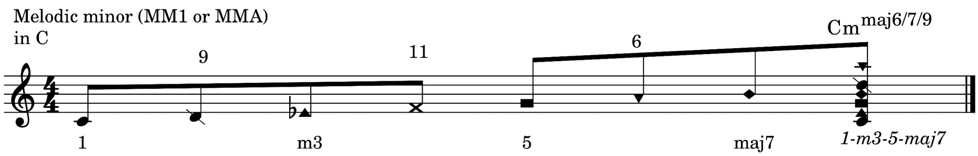


Figure 12 - The melodic minor scale in C

It also has a total of 7 modes, see Chapter 7 (Melodic minor and its modes and chords).

The (Ionian) major scale and melodic minor ascending (MM1 or MMA) are called diatonic scales [26] and the chords derived from them form a so-called diatonic system. They are the most important scales in almost all musical genres and serve as the basis for most harmonic analyzes of musical pieces.

Note

The fact that the Ionian major scale and the melodic minor scale are the only seven-step scales that have a major second as the largest interval and not two consecutive minor seconds can be seen on the website All Scales [23] by using the filter *without modes* set to *yes*, *two semitones in a row* to *no*, *largest interval* to *<=2* and *number of tones* to *7*.

3.2.3 The harmonic minor scale

The harmonic minor scale (HM1) is the first of the four possible seven-step scales, which have a major third as the largest interval and not two consecutive minor seconds. It also has a total of 7 modes and, in addition to the root note, contains the major ninth (9) and minor third (m3), the perfect eleventh (11) and perfect fifth (5), the minor sixth (b6) and major seventh (maj7), see chapter 8 (Harmonic minor and its modes and chords).

Example: C harmonic minor

[48]

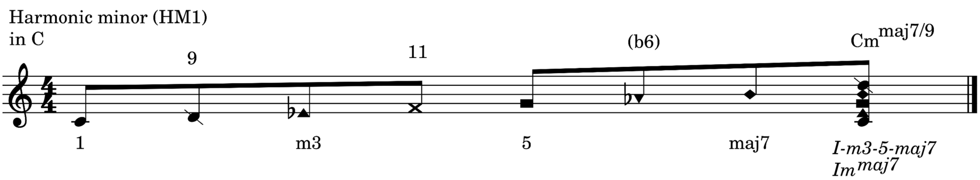


Figure 13 - the harmonic minor scale (HM1) in C

3.2.4 The harmonic major scale

The harmonic major scale (HD1) is, along with the harmonic minor scale (HM1), the second of the four possible seven-step scales, which have a major third as the largest interval and not two consecutive minor seconds. The harmonic major scale also has a total of 7 modes and, in addition to the root note, contains the major ninth (9) and major third (M3), the perfect eleventh (11) and perfect fifth (5), the minor sixth (b6) and major seventh (maj7), see Chapter 9 (Harmonic major and its modes and chords).

Example: C harmonic major

[48a]

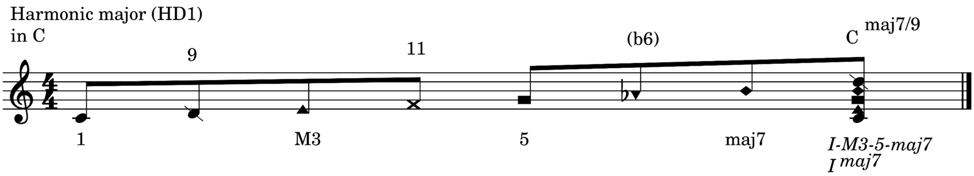


Figure 14 - *The harmonic major scale (HD1)*

3.2.5 The double harmonic minor scale (DHM1)

The double harmonic minor scale (DHM1) contains two consecutive semitones and two minor thirds. It also has a total of 7 modes and, in addition to the root note, contains the major ninth (9) and minor third (m3), the augmented eleventh (#11) and perfect fifth (5), the minor sixth (b6) and major seventh (maj7), see Chapter 10 (Double harmonic minor and its modes and chords).

Example: C double harmonic minor

[48b]

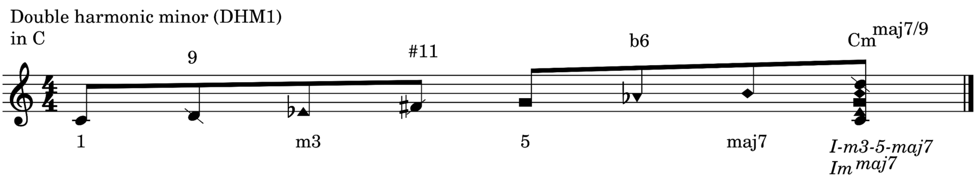


Figure 15 - The double harmonic minor scale (DHM1) in C

3.3 How to count

The following points are important and crucial for the correct and clear naming of the notes (and chords):

a) Each note (letter) may only appear once within the scale (exceptions will be discussed later).

b) The notes of all seven-step scales always follow the order C-D-E-F-G-A-B-C-D-E … For example, if the scale starts with E, it continues as follows: E-F-G-A-B-C-D-E-F-G-…

c) An accidental *#* raises and an accidental *b* lowers the tone by a semitone. They are set to match the interval.

You start with the root note and count 6 notes further, for example in F# Ionian (F# major):

Example	**F# Ionian**						
Start:	F#	G	A	B	C	D	E
Structure:							
No. of semitones:							
Result:							

Table 38 - Determination of the scale F# Ionian, Step 1: F#, G, A, B, C, D and E entered

Then you look at the structure of the scale and consider the corresponding number of semitones. The number of semitones is determined according to the interval designations (see above) and the structure of the scale, for example 1-9-M3-11-5-13-maj7 for the Ionian scale, see chapter 0 (The modes of the Ionian major scale are also called church modes [28]. They are presented below.

The Ionian major scale and its Major^7 chord). For F# Ionian, for example, the result is:

Example	**F# Ionian**						
Start:	F#	G	A	H	C	D	E
Structure:	1	9	M3	11	5	13	maj7
No. of semitones:	0	2	4	5	7	9	11
Result:							

Table 39 - Determination of the scale F# Ionian, Step 2: Structure 1-9-M3-11-5-13-maj7 and the corresponding number of semitones added

Then you calculate:

1. Tone F#.
2. Tone: G, but 2 semitones away from F#, so G#
3. Tone: A, but 4 semitones away from F#, so A#
4. Tone: B, but 5 semitones away from F#, so B is correct
5. Tone: C, but 7 semitones away from F#, so C#
6. Tone: D, but 9 semitones away from F#, so D#
7. Tone: E, but 11 semitones away from F#, so E#

Example	**F# Ionian**						
Start:	F#	G	A	B	C	D	E
Structure:	1	9	M3	11	5	13	maj7
No. of semitones:	0	2	4	5	7	9	11
Result:	F#	G#	A#	B	C#	D#	E#

Table 40 - Determination of the scale F# Ionian, Step 3: Accidentals set according to the number of semitones

Ready. F# Ionian consists of the notes F#, G#, A#, B, C#, D#, E#.

Note

The number of semitones is always counted from the first note, here from F#.

Further examples

Example	**C# melodic minor ascending (MMA) or MM1**						
Start:	C#	D	E	F	G	A	B
Structure:	1	9	m3	11	5	13	maj7
No. of semitones:	0	2	3	5	7	9	11
Result:	C#	D#	E	F#	G#	A#	B#

Table 41 - C# melodic minor ascending (MMA) or MM1

Example	**B# melodic minor ascending (MMA) or MM1**						
Start:	B#	C	D	E	F	G	A
Structure:	1	9	m3	11	5	13	maj7
No. of semitones:	0	2	3	5	7	9	11
Result:	B#	C##	D#	E#	F##	G##	A##

Table 42- B# melodic minor ascending (MMA) or MM1

Example	**Db Dorian**						
Start:	Db	E	F	G	A	H	C
Structure:	1	9	m3	11	5	13	7
No. of semitones:	0	2	3	5	7	9	10
Result:	Db	Eb	Fb	Gb	Ab	Bb	C

Table 43 - Db Dorian

Example	E harmonic minor 5th degree (HM5)						
Start:	E	F	G	A	B	C	D
Structure:	1	b9	M3	11	5	b13	7
No. of semitones:	0	1	4	5	7	8	10
Result:	E	F	G#	A	B	C	D

Table 44 - E harmonic minor 5th degree (HM5)

Exceptions:

The altered scale (MM7), see Chapter 7.7 (The melodic minor scale on the 7th degree (MM7, altered) and its altered dominant seventh chord), contains two ninths (b9 and #9) and no fifth, which must be taken into account accordingly:

Example	C altered (MM7)						
Start:	C	D	D	E	F	A	B
Structure:	1	b9	#9	M3	#11	b13	7
No. of semitones:	0	1	3	4	6	8	10
Result:	C	Db	D#	E	F#	Ab	Bb

Table 45 - C altered (MM7)

Example	G# altered (MM7)						
Start:	G#	A	A	B	C	E	F
Structure:	1	b9	#9	M3	#11	b13	7
No. of semitones:	0	1	3	4	6	8	10
Result:	G#	A	A##	B#	C##	E	F#

Table 46 - G# altered (MM7)

Example	E altered (MM7)						
Start:	E	F	F	G	A	C	D
Structure:	1	b9	#9	M3	#11	b13	7
No. of semitones:	0	1	3	4	6	8	10
Result:	E	F	F##	G#	A#	C	D

Table 47 - E altered (MM7)

3.4 The two (diatonic) scales with 6 or 8 tones

If we only consider the scales (without modes) that meet the following requirements:

b) not an interval of a minor second twice in a row (i.e. a maximum of two ones in a row),

c) the largest interval is a major second (i.e. no two or more zeros in a row),

but if we dispense with the condition a) that there must be seven notes, two more important scales result:

Scale name	**Pattern**	**Scale number** [2)]	**Number of tones**	**Largest interval**	**2 consec. semitones**	**Structure** [1)]
Diminished scale (WTHT)	110110110110	341	8	2	n	1-9-m3-11-b5-b13-b7-b15
Whole tone scale (WT)	101010101010	321	6	2	n	1-9-M3-#11-b13-7

Table 48 - The two (diatonic) scales with 6 or 8 tones

The diminished or whole-tone half-tone scale (WTHT) has only two modes due to its symmetry, namely the whole-tone half-tone scale (WTHT) itself and the half-tone whole-tone scale (HTWT) on the second degree.

The diminished or whole-tone half-tone scale (WTHT) and the whole-tone scale (WT) can be found alongside the Ionian major scale and the melodic minor scale on the website All Scales [23] mentioned above by setting the filter in the column *without modes* to *yes*, *two consecutive semitones* to *no* and the *largest interval* to <=2.

The diminished or whole-tone half-tone scale (WTHT) and the whole-tone scale (WT) are also often referred to as diatonic scales in the literature.

Notes

1) The designations of the intervals (1, 9, m3, 11 etc.) will be introduced in chapter 4.3 (Interval designations).

2) In chapter 833.7 (All Scales) we find these scales under the respective scale numbers.

3.4.1 The diminished or whole-tone half-tone scale (WTHT)

The diminished or whole-tone half-tone scale (WTHT) with the combination 1-0-1-1-0-1-1-0-1-1-0-1and the half-tone whole-tone scale (HTWT) with the combination 1-1-0-1-1-0-1-1-0-1-1-0 as the only mode consist of 8 tones each, see chapter 11 (The diminished scale and its diminished seventh chords).

Due to the symmetry of the scale, there are only two modes, WTHT and HTWT.

[59]

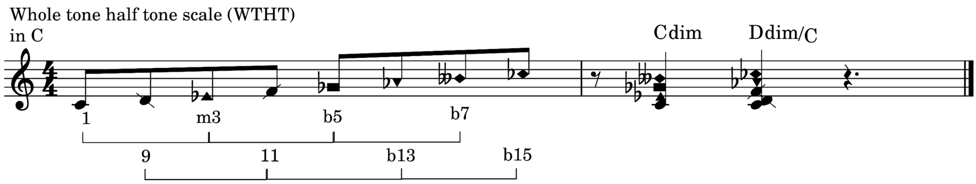


Figure 16 - The whole-tone half-tone (WTHT) scale in C - also known as diminished scale

The whole-tone half-tone scale (WTHT) is also referred to as diminished scale.

Since the whole-tone half-tone scale (WTHT) contains 8 instead of 7 tones, a function would have to occur twice. Here that would be the minor and major seventh. This can be avoided by calling the major seventh b15.

[58]

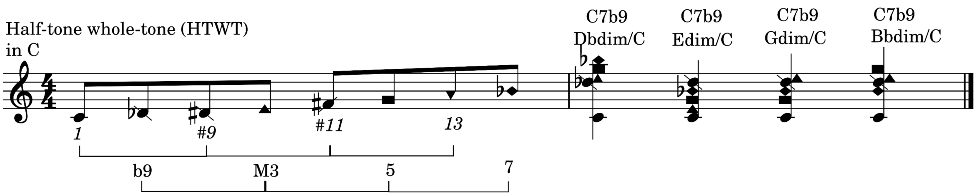


Figure 17 - The half-tone whole-tone scale (HTWT) in C

Since the half-tone whole-tone scale (HTWT) also has 8 tones instead of 7, one function must appear twice. In this case you use the ninth (9). HTWT contains the two ninths b9 and the #9.

3.4.2 The whole-tone scale (WT)

The whole-tone scale with the combination 1-0-1-0-1-0-1-0-1-0-1-0 consists of 6 tones and, because of its symmetry, no modes, see chapter 12 (The whole-tone scale and its augmented triads).

[61a]

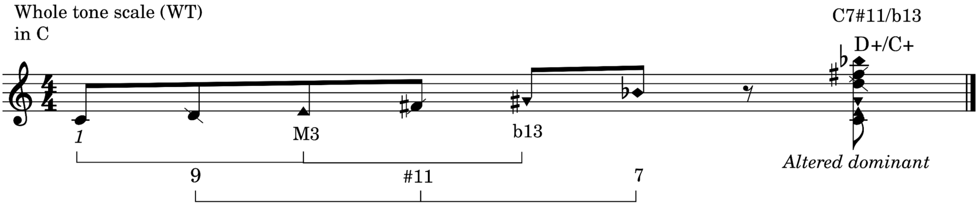


Figure 18 - The whole-tone scale in C

The whole tone scale (WT) only has six tones instead of seven, so a function is missing. In this case you leave out the fifth (5). The whole tone scale (WT) does not have a fifth and, due to its symmetry, has no modes.

3.5 The minor pentatonic and blues scales

It is generally difficult to examine the blues scientifically.

There are a total of seven scales that have the term blues in their name.

You can find them on the All Scales [23] website if you enter the term *blues* in the filter field in the *Scale name* column.

Scale name	Pattern	Scale number 2)	Number of tones	Largest interval	2 consec. semitones	Structure 1)
Minor pentatonic MP1	100101010010	241	5	3	n	1-m3-11-5-7
Blues scale	100101110010	242	6	3	j	1-m3-11-#11-5-7
Major blues scale	100111110010	245	7	3	j	1-m3-M3-11-#11-5-7
Modified Blues	101101110010	252	7	3	j	1-9-m3-11-#11-5-7
Blues Heptatonic II	100101110110	267	7	3	j	1-m3-11-#11-5-6-7
Blues Enneatonic II	101111110110	339	9	2	j	1-9-m3-M3-11-#11-5-6-7
Blues Scale II	101101110110	332	8	2	j	1-9-m3-11-#11-5-6-7

Table 49 - The scales with the term *blues* in their name

Notes

1) The designations of the intervals (1, 9, m3, 11 etc.) will be introduced in chapter 4.3 (Interval designations).

2) In chapter 833.7 (All Scales) we find these scales under the respective scale numbers

As part of this theory of harmony, the blues will be constructed from the minor pentatonic scale MP1 with the combination 100101010010. By adding the so-called blue note (#11) the blues scale with the combination 100101110010 is created:

[64]

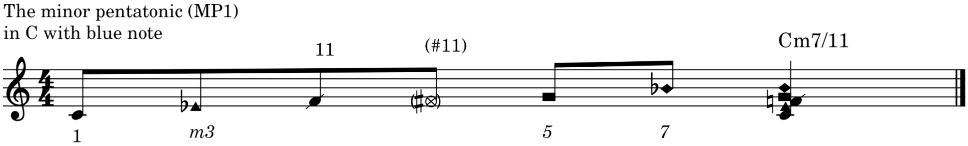


Figure 19 - The minor pentatonic (MP1) in C

The blues scale consists of the minor pentatonic (MP1) with the five tones 1-m3-11-5-7 and the blue note (#11). It is explained in more detail in chapter 13 (From the minor pentatonic scale to the blues).

3.6 The chromatic scale

The chromatic scale with the combination 111111111111 consists of 12 semitone steps.

[38]

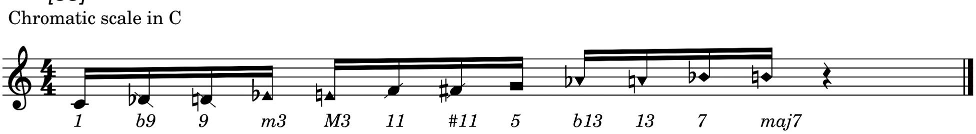


Figure 20 - The chromatic scale in C

Due to its symmetry, the chromatic scale has no modes and is not suitable for building a tonal system. It behaves the same from every starting note and is examined in more detail in the chapter 6 (The chromatic scale).

Scale name	Pattern	Scale number 2)	Number of tones	Largest interval	2 consec.	Structure 1)
Chromatische Tonleiter	111111111111	351	12	1	j	1-b9-9-m3-M3-11-#11-5-b13-13-7-maj7

Table 50 - The chromatic scale

Note

3) The designations of the intervals (1, 9, m3, 11 etc.) will be introduced in chapter 4.3 (Interval designations).

4) In chapter 833.7 (All Scales) we find these scales under the respective scale numbers.

3.7 All Scales

As we have shown in chapter 3.1 (Definition of scales and modes), there are a total of 2048 possible scales, i.e. 2048 different ways to go from a fundamental note to reach the octave note in one to twelve ascending steps within an octave. They are listed on the website All Scales [23], and there is also a filter option:

					Clear	Clear	Clear
Nr.	Muster	Tonleiter-Nr.	Tonleiter-Name	Anzahl Töne	Größtes Intervall	Zwei Halbtöne in Folge	Ohne Modi
1	100000000000	1.1	Unison	1	12	nein	ja
2	100000000001	2.1	Major Seventh Ditone	2	11	nein	ja
3	110000000000	2.2	Minor Second Ditone	2	11	nein	nein
4	100000000010	3.1	Warao Ditonic	2	10	nein	ja

Figure 21 - Website All Scales [23] with an overview of all 2048 theoretically possible scales within an octave

The following table also lists all scales.

The names are taken from the website of Ian Ring´s Scale Finder [73].

The scales that only start from a different starting note but otherwise correspond to the same scale, i.e. the modes, are grouped together. The 2048 scales are divided into 351 groups.

The so-called church modes Ionian, Dorian, Phrygian, Lydian, Mixolydian, Aeolian and Locrian, for example, are in a group because they are all based on the Ionian scale and just start from a different note.

Scale name	Pattern	Scale no.	No. of tones	Largest interval	2 semitones in a row
Ionian	101011010101	325.1	7	2	n
Dorian	101101010110	325.2			
Phrygian	110101011010	325.3			
Lydian	101010110101	325.4			
Mixolydian	101011010110	325.5			
Aeolian	101101011010	325.6			
Locrian	110101101010	325.7			

Table 51 - The Ionian scale and its modes, the so-called church modes

Particularly interesting for the construction of a tonal system are the scales that do not have two consecutive semitones and have at least 5 tones and have a minor third (3 semitones) as the largest interval. They are marked accordingly and will be examined in more detail within this theory of harmony.

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
1.1	100000000000	Unison	1	12	n
2.1	100000000001	Major Seventh Ditone	2	11	n
2.2	110000000000	Minor Second Ditone	2	11	n
3.1	100000000010	Warao Ditonic	2	10	n
3.2	101000000000	Vietnamese Ditonic	2	10	n
4.1	100000000011	Tritonic Chromatic Descending	3	10	j
4.2	110000000001	Tritonic Chromatic 2	3	10	j
4.3	111000000000	Tritonic Chromatic	3	10	j
5.1	100000000100	Major Sixth Ditone	2	9	n
5.2	100100000000	Minor Third Ditone	2	9	n
6.1	100000000101	PODian	3	9	n
6.2	101100000000	DIJian	3	9	n
6.3	110000000010	GEQian	3	9	n
7.1	100000000110	JIJian	3	9	n
7.2	101000000001	POWian	3	9	n
7.3	110100000000	Octatonic Trichord	3	9	n
8.1	100000000111	Tetratonic Chromatic Descending	4	9	j
8.2	110000000011	Tetratonic Chromatic 3	4	9	j
8.3	111000000001	Tetratonic Chromatic 2	4	9	j
8.4	111100000000	Tetratonic Chromatic	4	9	j
9.1	100000001000	Minor Sixth Ditone	2	8	n
9.2	100010000000	Major Third Ditone	2	8	n
10.1	100000001001	OLLian	3	8	n
10.2	100110000000	ACKian	3	8	n
10.3	110000000100	DEPian	3	8	n
11.1	100000001010	HUQian	3	8	n
11.2	101000000010	AMPian	3	8	n
11.3	101010000000	Wholetone Trichord	3	8	n
12.1	100000001011	UYOian	4	8	j
12.2	101110000000	ADUian	4	8	j
12.3	110000000101	POFian	4	8	j
12.4	111000000010	GISian	4	8	j
13.1	100000001100	ENBian	3	8	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
206.7	111100011101	Dygyllic	8	4	j
206.8	111110001110	Phralyllic	8	4	j
207.1	100011110010	Pynimic	6	4	j
207.2	100101000111	Podimic	6	4	j
207.3	101000111100	Ionothimic	6	4	j
207.4	110010100011	Ladimic	6	4	j
207.5	111001010001	Ranimic	6	4	j
207.6	111100101000	Zanimic	6	4	j
208.1	100011110011	Aeolacrian	7	4	j
208.2	100111000111	Thocrian	7	4	j
208.3	110001111001	Danian	7	4	j
208.4	110011100011	Koptian	7	4	j
208.5	111000111100	Mela Salaga	7	4	j
208.6	111001110001	Dyrian	7	4	j
208.7	111100111000	Zythian	7	4	j
209.1	100011110100	Kytrimic	6	4	j
209.2	100100011110	Aeolycrimic	6	4	j
209.3	101001000111	Gylimic	6	4	j
209.4	110100100011	Ryrimic	6	4	j
209.5	111010010001	Dyptimic	6	4	j
209.6	111101001000	Golimic	6	4	j
210.1	100011110101	Zogian	7	4	j
210.2	101011000111	Raga Rageshri	7	4	j
210.3	101100011110	Mocrian	7	4	j
210.4	110001111010	Zynian	7	4	j
210.5	110101100011	Daptian	7	4	j
210.6	111010110001	Lycrian	7	4	j
210.7	111101011000	Epyrian	7	4	j
211.1	100011110110	Saptian	7	4	j
211.2	101000111101	Thynian	7	4	j
211.3	101101000111	Boptian	7	4	j
211.4	110100011110	Stogian	7	4	j
211.5	110110100011	Rogian	7	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
13.2	100100000001	MOPian	3	8	n
13.3	110010000000	Hexatonic Trichord	3	8	n
14.1	100000001101	RUHian	4	8	n
14.2	101100000001	MORian	4	8	n
14.3	110000000110	JIKian	4	8	n
14.4	110110000000	ADOian	4	8	n
15.1	100000001110	LAJian	4	8	j
15.2	101000000011	TEKian	4	8	j
15.3	110100000001	MOQian	4	8	j
15.4	111010000000	APHian	4	8	j
16.1	100000001111	Pentatonic Chromatic Descending	5	8	j
16.2	110000000111	Pentatonic Chromatic 4	5	8	j
16.3	111000000011	Pentatonic Chromatic 3	5	8	j
16.4	111100000001	Pentatonic Chromatic 2	5	8	j
16.5	111110000000	Pentatonic Chromatic	5	8	j
17.1	100000010000	Niagari	2	7	n
17.2	100001000000	Honchoshi	2	7	n
18.1	100000010001	Major Seventh Omit 3	3	7	n
18.2	100011000000	AGUian	3	7	n
18.3	110000001000	GIJian	3	7	n
19.1	100000010010	CHOian	3	7	n
19.2	100101000000	Vietnamese Tritonic	3	7	n
19.3	101000000100	ALUian	3	7	n
20.1	100000010011	URTian	4	7	j
20.2	100111000000	AHOian	4	7	j
20.3	110000001001	OCOian	4	7	j
20.4	111000000100	DEYian	4	7	j
21.1	100000010100	Lahuzu 3 Tone Type 1	3	7	n
21.2	100100000010	Ute Tritonic	3	7	n
21.3	101001000000	Akha 3 Tone	3	7	n
22.1	100000010101	Lahuzu 5tone Type 2	4	7	n
22.2	101011000000	ABSian	4	7	n
22.3	101100000010	Warao Tetratonic	4	7	n
22.4	110000001010	HURian	4	7	n
23.1	100000010110	KEJian	4	7	n
23.2	101000000101	POGian	4	7	n
23.3	101101000000	APRian	4	7	n
23.4	110100000010	GIVian	4	7	n
24.1	100000010111	XIBian	5	7	j
24.2	101111000000	AJUian	5	7	j
24.3	110000001011	VABian	5	7	j
24.4	111000000101	PUHian	5	7	j
24.5	111100000010	GIXian	5	7	j
25.1	100000011000	CIVian	3	7	n
25.2	100010000001	MOTian	3	7	n
25.3	110001000000	Major Seventh Trichord	3	7	n
26.1	100000011001	PACian	4	7	n
26.2	100110000001	MOYian	4	7	n
26.3	110000001100	ESOian	4	7	n
26.4	110011000000	ARFian	4	7	n
27.1	100000011010	IMSian	4	7	n
27.2	101000000110	JILian	4	7	n
27.3	101010000001	MOWian	4	7	n
27.4	110101000000	ALFian	4	7	n
28.1	100000011011	VOBian	5	7	j
28.2	101110000001	MOBian	5	7	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
211.6	111011010001	Macrian	7	4	j
211.7	111101101000	Aerodian	7	4	j
212.1	100011110111	Pynyllic	8	4	j
212.2	101111000111	Zycryllic	8	4	j
212.3	110001111011	Pylyllic	8	4	j
212.4	110111100011	Raryllic	8	4	j
212.5	111000111101	Laptyllic	8	4	j
212.6	111011110001	Kogyllic	8	4	j
212.7	111100011110	Mycryllic	8	4	j
212.8	111101111000	Bocryllic	8	4	j
213.1	100011111001	Thycrian	7	4	j
213.2	100110001111	Starian	7	4	j
213.3	110001111100	Phrathian	7	4	j
213.4	110011000111	Katygian	7	4	j
213.5	111001100011	Eponian	7	4	j
213.6	111100110001	Dylian	7	4	j
213.7	111110011000	Aeoladian	7	4	j
214.1	100011111010	Stanian	7	4	j
214.2	101000111110	Dydian	7	4	j
214.3	101010001111	Phroptian	7	4	j
214.4	110101000111	Kalian	7	4	j
214.5	111010100011	Stocrian	7	4	j
214.6	111101010001	Konian	7	4	j
214.7	111110101000	Epanian	7	4	j
215.1	100011111011	Aeoladyllic	8	4	j
215.2	101110001111	Bygyllic	8	4	j
215.3	110001111101	Ionayllic	8	4	j
215.4	110111000111	Kydyllic	8	4	j
215.5	111000111110	Phryptyllic	8	4	j
215.6	111011100011	Bynyllic	8	4	j
215.7	111101110001	Lodyllic	8	4	j
215.8	111110111000	Kocryllic	8	4	j
216.1	100011111100	Katyptian	7	4	j
216.2	100100011111	Kythian	7	4	j
216.3	110010001111	Aeolarian	7	4	j
216.4	111001000111	Aerocrian	7	4	j
216.5	111100100011	Pacrian	7	4	j
216.6	111110010001	Mygian	7	4	j
216.7	111111001000	Epodian	7	4	j
217.1	100011111101	Phroryllic	8	4	j
217.2	101100011111	Phrycryllic	8	4	j
217.3	110001111110	Palyllic	8	4	j
217.4	110110001111	Storyllic	8	4	j
217.5	111011000111	Paptyllic	8	4	j
217.6	111101100011	Mixonyllic	8	4	j
217.7	111110110001	Poptyllic	8	4	j
217.8	111111011000	Thyphyllic	8	4	j
218.1	100011111110	Stolyllic	8	4	j
218.2	101000111111	Ionyllic	8	4	j
218.3	110100011111	Dynyllic	8	4	j
218.4	111010001111	Eparyllic	8	4	j
218.5	111101000111	Gydyllic	8	4	j
218.6	111110100011	Thynyllic	8	4	j
218.7	111111010001	Dacryllic	8	4	j
218.8	111111101000	Logyllic	8	4	j
219.1	100011111111	Nonatonic Chromatic Descending	9	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
28.3	110000001101	RUJian	5	7	j
28.4	110111000000	AHUian	5	7	j
28.5	111000000110	JOMian	5	7	j
29.1	100000011100	FOPian	4	7	j
29.2	100100000011	TEMian	4	7	j
29.3	110010000001	MOVian	4	7	j
29.4	111001000000	AFUian	4	7	j
30.1	100000011101	SIHian	5	7	j
30.2	101100000011	TEPian	5	7	j
30.3	110000001110	LAKian	5	7	j
30.4	110110000001	MOZian	5	7	j
30.5	111011000000	ASPian	5	7	j
31.1	100000011110	LUKian	5	7	j
31.2	101000000111	WIDian	5	7	j
31.3	110100000011	REHian	5	7	j
31.4	111010000001	MOXian	5	7	j
31.5	111101000000	AGOian	5	7	j
32.1	100000011111	Hexatonic Chromatic Descending	6	7	j
32.2	110000001111	Hexatonic Chromatic 5	6	7	j
32.3	111000000111	WIFian	6	7	j
32.4	111100000011	Hexatonic Chromatic 3	6	7	j
32.5	111110000001	Hexatonic Chromatic 4	6	7	j
32.6	111111000000	Hexatonic Chromatic	6	7	j
33.1	100000100000	Tritone	2	6	n
34.1	100000100001	MUXian	3	6	n
34.2	100001100000	ATHian	3	6	n
34.3	110000010000	ATOian	3	6	n
35.1	100000100010	GOCian	3	6	n
35.2	100010100000	Karen 3 Tone Type 6	3	6	n
35.3	101000001000	BOZian	3	6	n
36.1	100000100011	TOVian	4	6	j
36.2	100011100000	ARUian	4	6	j
36.3	110000010001	NELian	4	6	j
36.4	111000001000	UDWian	4	6	j
37.1	100000100100	ILLian	3	6	n
37.2	100100000100	ASTian	3	6	n
37.3	100100100000	Diminished Triad	3	6	n
38.1	100000100101	ODWian	4	6	n
38.2	100101100000	EDWian	4	6	n
38.3	101100000100	IDWian	4	6	n
38.4	110000010010	ADWian	4	6	n
39.1	100000100110	JUWian	4	6	n
39.2	100110100000	AGGian	4	6	n
39.3	101000001001	OCUian	4	6	n
39.4	110100000100	DEBian	4	6	n
40.1	100000100111	WUPian	5	6	j
40.2	100111100000	ASOian	5	6	j
40.3	110000010011	ETRian	5	6	j
40.4	111000001001	Raga Kumarapriya	5	6	j
40.5	111100000100	DEDian	5	6	j
41.1	100000101000	CAHian	3	6	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
219.2	110001111111	Nonatonic Chromatic 8	9	4	j
219.3	111000111111	Nonatonic Chromatic 7	9	4	j
219.4	111100011111	Nonatonic Chromatic 6	9	4	j
219.5	111110001111	Nonatonic Chromatic 5	9	4	j
219.6	111111000111	Nonatonic Chromatic 4	9	4	j
219.7	111111100011	Nonatonic Chromatic 3	9	4	j
219.8	111111110001	Nonatonic Chromatic 2	9	4	j
219.9	111111111000	Chromatic Nonamode	9	4	j
220.1	100100100100	Diminished Seventh	4	3	n
221.1	100100100101	Bartók Beta Chord	5	3	n
221.2	100100101100	Phrothitonic	5	3	n
221.3	100101100100	Katycritonic	5	3	n
221.4	101100100100	Ionalitonic	5	3	n
221.5	110010010010	Raga Manaranjani I	5	3	n
222.1	100100100110	Thyritonic	5	3	n
222.2	100100110100	Thoptitonic	5	3	n
222.3	100110100100	Bycritonic	5	3	n
222.4	101001001001	Raga Priyadharshini	5	3	n
222.5	110100100100	Pathitonic	5	3	n
223.1	100100100111	Epynimic	6	3	j
223.2	100100111100	Ionogimic	6	3	j
223.3	100111100100	Kydimic	6	3	j
223.4	110010010011	Ionaphimic	6	3	j
223.5	111001001001	Tharimic	6	3	j
223.6	111100100100	Gaptimic	6	3	j
224.1	100100101001	Bartók Gamma Chord	5	3	n
224.2	100101001100	Dogitonic	5	3	n
224.3	100110010010	Garitonic	5	3	n
224.4	101001100100	Phralitonic	5	3	n
224.5	110010010100	Raga Rasika Ranjani	5	3	n
225.1	100100101010	Raga Harikauns	5	3	n
225.2	100101010100	Minor Added Sixth Pentatonic	5	3	n
225.3	101001001010	Chaio	5	3	n
225.4	101010010010	Dominant Pentatonic	5	3	n
225.5	101010100100	Kung	5	3	n
226.1	100100101011	Palimic	6	3	j
226.2	100101011100	Stothimic	6	3	j
226.3	101011100100	Aeronimic	6	3	j
226.4	101110010010	Katagimic	6	3	j
226.5	110010010101	Banimic	6	3	j
226.6	111001001010	Phronimic	6	3	j
227.1	100100101101	Thoptimic	6	3	n
227.2	100101101100	Bagimic	6	3	n
227.3	101100100101	Raga Ranjani	6	3	n
227.4	101101100100	Pyramid Hexatonic	6	3	n
227.5	110010010110	Raga Malayamarutam	6	3	n
227.6	110110010010	Sonimic	6	3	n
228.1	100100101110	Thagimic	6	3	j
228.2	100101110100	Kolimic	6	3	j
228.3	101001001011	Katolimic	6	3	j
228.4	101110100100	Dycrimic	6	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
41.2	100010000010	HITian	3	6	n
41.3	101000100000	DEZian	3	6	n
42.1	100000101001	OFFian	4	6	n
42.2	100110000010	GIDian	4	6	n
42.3	101001100000	All-Interval Tetrachord 3	4	6	n
42.4	110000010100	DUXian	4	6	n
43.1	100000101010	ISKian	4	6	n
43.2	101000001010	HUSian	4	6	n
43.3	101010000010	GIBian	4	6	n
43.4	101010100000	SEGian	4	6	n
44.1	100000101011	VENian	5	6	j
44.2	101011100000	ANBian	5	6	j
44.3	101110000010	GIGian	5	6	j
44.4	110000010101	RAHian	5	6	j
44.5	111000001010	HUTian	5	6	j
45.1	100000101100	FEBian	4	6	n
45.2	100100000101	PUJian	4	6	n
45.3	101100100000	ALVian	4	6	n
45.4	110010000010	GIZian	4	6	n
46.1	100000101101	SATian	5	6	n
46.2	101100000101	PULian	5	6	n
46.3	101101100000	AMSian	5	6	n
46.4	110000010110	KEKian	5	6	n
46.5	110110000010	GIFian	5	6	n
47.1	100000101110	LIWian	5	6	j
47.2	101000001011	VACian	5	6	j
47.3	101110100000	ANUian	5	6	j
47.4	110100000101	PUKian	5	6	j
47.5	111010000010	GICian	5	6	j
48.1	100000101111	YUSian	6	6	j
48.2	101111100000	ATWian	6	6	j
48.3	110000010111	XICian	6	6	j
48.4	111000001011	VADian	6	6	j
48.5	111100000101	PUMian	6	6	j
48.6	111110000010	GIHian	6	6	j
49.1	100000110000	Raga Ongkari	3	6	n
49.2	100001000001	MODian	3	6	n
49.3	110000100000	Viennese Trichord	3	6	n
50.1	100000110001	NOXian	4	6	n
50.2	100011000001	MUNian	4	6	n
50.3	110000011000	CIWian	4	6	n
50.4	110001100000	IPRian	4	6	n
51.1	100000110010	HICian	4	6	n
51.2	100101000001	MUJian	4	6	n
51.3	101000001100	ESUian	4	6	n
51.4	110010100000	All-Interval Tetrachord 1	4	6	n
52.1	100000110011	URRian	5	6	j
52.2	100111000001	RIGian	5	6	j
52.3	110000011001	Raga Deshgaur	5	6	j
52.4	110011100000	ASHian	5	6	j
52.5	111000001100	Raga Putrika	5	6	j
53.1	100000110100	EDRian	4	6	n
53.2	100100000110	JONian	4	6	n
53.3	101001000001	MOGian	4	6	n
53.4	110100100000	ILOian	4	6	n
54.1	100000110101	RITian	5	6	n
54.2	101011000001	MUQian	5	6	n
54.3	101100000110	JOQian	5	6	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
228.5	110100100101	Gocrimic	6	3	j
228.6	111010010010	Epycrimic	6	3	j
229.1	100100101111	Bonian	7	3	j
229.2	100101111100	Badian	7	3	j
229.3	101111100100	Debussy's Heptatonic	7	3	j
229.4	110010010111	Aeryrian	7	3	j
229.5	111001001011	Moptian	7	3	j
229.6	111100100101	Dothian	7	3	j
229.7	111110010010	Sadian	7	3	j
230.1	100100110010	Raga Samudhra Priya	5	3	n
230.2	100101001001	Gothitonic	5	3	n
230.3	100110010100	Raga Mohanangi	5	3	n
230.4	101001001100	Rothitonic	5	3	n
230.5	110010100100	Sogitonic	5	3	n
231.1	100100110011	Raga Jivantini	6	3	j
231.2	100110011100	Bogimic	6	3	j
231.3	100111001001	Docrimic	6	3	j
231.4	110010011001	Raga Bauli	6	3	j
231.5	110011100100	Mogimic	6	3	j
231.6	111001001100	Raga Suddha Mukhari	6	3	j
232.1	100100110101	Dagimic	6	3	n
232.2	100110101100	Aeolydimic	6	3	n
232.3	101011001001	Raga Sarasanana	6	3	n
232.4	101100100110	Thylimic	6	3	n
232.5	110010011010	Lolimic	6	3	n
232.6	110101100100	Double-Phrygian Hexatonic	6	3	n
233.1	100100110110	Raga Madhukauns	6	3	n
233.2	100110110100	Stygimic	6	3	n
233.3	101001001101	Baptimic	6	3	n
233.4	101101001001	Raga Ghantana	6	3	n
233.5	110100100110	Dacrimic	6	3	n
233.6	110110100100	Aeolygimic	6	3	n
234.1	100100110111	Epagian	7	3	j
234.2	100110111100	Mela Sucaritra	7	3	j
234.3	101111001001	Sythian	7	3	j
234.4	110010011011	Kylian	7	3	j
234.5	110111100100	Epolian	7	3	j
234.6	111001001101	Epocrian	7	3	j
234.7	111100100110	Sydian	7	3	j
235.1	100100111001	Mydimic	6	3	j
235.2	100110010011	Ionalimic	6	3	j
235.3	100111001100	Thyptimic	6	3	j
235.4	110010011100	Raga Kalagada	6	3	j
235.5	110011001001	Raga Lalita	6	3	j
235.6	111001100100	Schoenberg Hexachord	6	3	j
236.1	100100111010	Zagimic	6	3	j
236.2	100111010100	Lagimic	6	3	j
236.3	101001001110	Pathimic	6	3	j
236.4	101010010011	Bycrimic	6	3	j
236.5	110101001001	Raga Viyogavarali	6	3	j
236.6	111010100100	Thyrimic	6	3	j
237.1	100100111011	Stalian	7	3	j
237.2	100111011100	Mela Yagapriya	7	3	j
237.3	101110010011	Aeolaptian	7	3	j
237.4	110010011101	Bygian	7	3	j
237.5	110111001001	Kataptian	7	3	j
237.6	111001001110	Pothian	7	3	j
237.7	111011100100	Zygian	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
54.4	110000011010	IROian	5	6	n
54.5	110101100000	ANSian	5	6	n
55.1	100000110110	KOWian	5	6	n
55.2	101000001101	RUKian	5	6	n
55.3	101101000001	MULian	5	6	n
55.4	110100000110	JOPian	5	6	n
55.5	110110100000	ANOian	5	6	n
56.1	100000110111	YARian	6	6	j
56.2	101111000001	MUVian	6	6	j
56.3	110000011011	VOCian	6	6	j
56.4	110111100000	ASUian	6	6	j
56.5	111000001101	RULian	6	6	j
56.6	111100000110	JORian	6	6	j
57.1	100000111000	CUJian	4	6	j
57.2	100010000011	TIRian	4	6	j
57.3	110001000001	MOFian	4	6	j
57.4	111000100000	ALOian	4	6	j
58.1	100000111001	PEQian	5	6	j
58.2	100110000011	TIWian	5	6	j
58.3	110000011100	FOQian	5	6	j
58.4	110011000001	Raga Megharanji	5	6	j
58.5	111001100000	APUian	5	6	j
59.1	100000111010	JAVian	5	6	j
59.2	101000001110	LALian	5	6	j
59.3	101010000011	BUQian	5	6	j
59.4	110101000001	MUKian	5	6	j
59.5	111010100000	ASRian	5	6	j
60.1	100000111011	WANian	6	6	j
60.2	101110000011	TIYian	6	6	j
60.3	110000011101	SIJian	6	6	j
60.4	110111000001	MUTian	6	6	j
60.5	111000001110	LAMian	6	6	j
60.6	111011100000	SMOian	6	6	j
61.1	100000111100	GABian	5	6	j
61.2	100100000111	WIGian	5	6	j
61.3	110010000011	TISian	5	6	j
61.4	111001000001	MUHian	5	6	j
61.5	111100100000	APPian	5	6	j
62.1	100000111101	SUVian	6	6	j
62.2	101100000111	WIJian	6	6	j
62.3	110000011110	LULian	6	6	j
62.4	110110000011	TIXian	6	6	j
62.5	111011000001	MURian	6	6	j
62.6	111101100000	AROian	6	6	j
63.1	100000111110	MEWian	6	6	j
63.2	101000001111	YIHian	6	6	j
63.3	110100000111	WIHian	6	6	j
63.4	111010000011	TIVian	6	6	j
63.5	111101000001	MUMian	6	6	j
63.6	111110100000	ARKian	6	6	j
64.1	100000111111	Heptatonic Chromatic Descending	7	6	j
64.2	110000011111	Heptatonic Chromatic 6	7	6	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
238.1	100100111101	Gacrian	7	3	j
238.2	100111101100	Borian	7	3	j
238.3	101100100111	Mixodorian	7	3	j
238.4	110010011110	Dathian	7	3	j
238.5	110110010011	Aeolocrian	7	3	j
238.6	111011001001	Gadian	7	3	j
238.7	111101100100	Sycrian	7	3	j
239.1	100100111110	Katoptian	7	3	j
239.2	100111110100	Ponian	7	3	j
239.3	101001001111	Thanian	7	3	j
239.4	110100100111	Polian	7	3	j
239.5	111010010011	Thyphian	7	3	j
239.6	111101001001	Gynian	7	3	j
239.7	111110100100	Kadian	7	3	j
240.1	100100111111	Zaryllic	8	3	j
240.2	100111111100	Dythyllic	8	3	j
240.3	110010011111	Loryllic	8	3	j
240.4	111001001111	Pathyllic	8	3	j
240.5	111100100111	Sonyllic	8	3	j
240.6	111110010011	Kataptyllic	8	3	j
240.7	111111001001	Laryllic	8	3	j
240.8	111111100100	Ionaryllic	8	3	j
241.1	100101001010	Blues Minor MP4	5	3	n
241.2	100101010010	Minor Pentatonic MP1	5	3	n
241.3	101001010010	Suspended Pentatonic MP3	5	3	n
241.4	101001010100	Scottish Pentatonic MP5	5	3	n
241.5	101010010100	Major Pentatonic MP2	5	3	n
242.1	100101001011	Mixolimic	6	3	j
242.2	100101110010	Blues Scale (Minor pentatonic plus blue note)	6	3	j
242.3	101001011100	Dadimic	6	3	j
242.4	101110010100	Gycrimic	6	3	j
242.5	110010100101	Raga Hamsanandi	6	3	j
242.6	111001010010	Pyrimic	6	3	j
243.1	100101001101	Stythimic	6	3	n
243.2	100110110010	Pygimic	6	3	n
243.3	101001101100	Kothimic	6	3	n
243.4	101100101001	Takemitsu Linea Mode 1	6	3	n
243.5	110010100110	Prometheus Neapolitan	6	3	n
243.6	110110010100	Rodimic	6	3	n
244.1	100101001110	Ionacrimic	6	3	j
244.2	100111010010	Raga Bhanumanjari	6	3	j
244.3	101001010011	Raga Brindabani Sarang	6	3	j
244.4	101001110100	Gathimic	6	3	j
244.5	110100101001	Raga Gurjari Todi	6	3	j
244.6	111010010100	Phrynimic	6	3	j
245.1	100101001111	Morian	7	3	j
245.2	100111110010	Heptatonic Blues (Major Blues scale)	7	3	j
245.3	101001111100	Rycrian	7	3	j
245.4	110010100111	Kaptian	7	3	j
245.5	111001010011	Mela Tanarupi	7	3	j
245.6	111100101001	Katorian	7	3	j
245.7	111110010100	Stycrian	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
64.3	111000001111	Heptatonic Chromatic 5	7	6	j
64.4	111100000111	Heptatonic Chromatic 4	7	6	j
64.5	111110000011	Heptatonic Chromatic 3	7	6	j
64.6	111111000001	Heptatonic Chromatic 2	7	6	j
64.7	111111100000	Heptatonic Chromatic	7	6	j
65.1	100001000010	Sansagari	3	5	n
65.2	100001010000	Suspended Fourth Triad	3	5	n
65.3	101000010000	Suspended Second Triad	3	5	n
66.1	100001000011	TIBian	4	5	j
66.2	100001110000	BIBian	4	5	j
66.3	110000100001	MUYian	4	5	j
66.4	111000010000	ATTian	4	5	j
67.1	100001000100	Karen 3 Tone Type 4	3	5	n
67.2	100010010000	Major Triad	3	5	n
67.3	100100001000	BOXian	3	5	n
68.1	100001000101	PUXian	4	5	n
68.2	100010110000	All-Interval Tetrachord 4	4	5	n
68.3	101100001000	BOCian	4	5	n
68.4	110000100010	PEDian	4	5	n
69.1	100001000110	JOCian	4	5	n
69.2	100011010000	BEXian	4	5	n
69.3	101000010001	NEMian	4	5	n
69.4	110100001000	BOBian	4	5	n
70.1	100001000111	WOVian	5	5	j
70.2	100011110000	BILian	5	5	j
70.3	110000100011	TOWian	5	5	j
70.4	111000010001	NENian	5	5	j
70.5	111100001000	BODian	5	5	j
71.1	100001001000	Karen 3 Tone Type 3	3	5	n
71.2	100010000100	Raga Bilwadala	3	5	n
71.3	100100010000	Minor Triad	3	5	n
72.1	100001001001	OGOian	4	5	n
72.2	100100110000	BEMian	4	5	n
72.3	100110000100	ATUian	4	5	n
72.4	110000100100	GIYian	4	5	n
73.1	100001001010	Akha 4 Tone Type 2	4	5	n
73.2	100101010000	Vietnamese Tetratonic	4	5	n
73.3	101000010010	ALKian	4	5	n
73.4	101010000100	DEHian	4	5	n
74.1	100001001011	VATian	5	5	j
74.2	100101110000	BIGian	5	5	j
74.3	101110000100	DEMian	5	5	j
74.4	110000100101	QERian	5	5	j
74.5	111000010010	HASian	5	5	j
75.1	100001001100	FAHian	4	5	n
75.2	100100001001	OSRian	4	5	n
75.3	100110010000	BAJian	4	5	n
75.4	110010000100	DEGian	4	5	n
76.1	100001001101	RUBian	5	5	n
76.2	100110110000	BIWian	5	5	n
76.3	101100001001	ODOian	5	5	n
246.1	100101010011	Dalimic	6	3	j
246.2	100111001010	Epogimic	6	3	j
246.3	101001110010	Zolimic	6	3	j
246.4	101010011100	Dygimic	6	3	j
246.5	110010101001	Paptimic	6	3	j
246.6	111001010100	Lanimic	6	3	j
247.1	100101010101	Aeragimic	6	3	n
247.2	101010101100	Epothimic	6	3	n
247.3	101010110010	Salimic	6	3	n
247.4	101011001010	Lyptimic	6	3	n
247.5	101100101010	Takemitsu Linea Mode 2	6	3	n
247.6	110010101010	Gygimic	6	3	n
248.1	100101010110	Raga Manohari	6	3	n
248.2	101001010101	Raga Nagagandhari	6	3	n
248.3	101010110100	Raga Yamuna Kalyani	6	3	n
248.4	101011010010	Raga Siva Kambhoji	6	3	n
248.5	101101001010	Phradimic	6	3	n
248.6	110100101010	Aeolorimic	6	3	n
249.1	100101010111	Phraptian	7	3	j
249.2	101010111100	Mela Kantamani	7	3	j
249.3	101011110010	Katythian	7	3	j
249.4	101111001010	Madian	7	3	j
249.5	110010101011	Enigmatic	7	3	j
249.6	111001010101	Mela Manavati	7	3	j
249.7	111100101010	Aerygian	7	3	j
250.1	100101011001	Raga Takka	6	3	n
250.2	100110010101	Porimic	6	3	n
250.3	101011001100	Aeranimic	6	3	n
250.4	101100110010	Raga Simharava	6	3	n
250.5	110010101100	Raga Hejjajji	6	3	n
250.6	110011001010	Raga Vasantabhairavi	6	3	n
251.1	100101011010	Raga Gopikavasantam	6	3	n
251.2	101001010110	Mixolydian Hexatonic	6	3	n
251.3	101010010101	Raga Kumud	6	3	n
251.4	101011010100	Arezzo Major Diatonic Hexachord	6	3	n
251.5	101101010010	Minor Hexatonic	6	3	n
251.6	110101001010	Ritsu	6	3	n
252.1	100101011011	Phrolian	7	3	j
252.2	101011011100	Mela Mararanjani	7	3	j
252.3	101101110010	Modified Blues	7	3	j
252.4	101110010101	Epygian	7	3	j
252.5	110010101101	Kagian	7	3	j
252.6	110111001010	Kycrian	7	3	j
252.7	111001010110	Mela Vanaspati	7	3	j
253.1	100101011101	Epacrian	7	3	j
253.2	101011101100	Sathian	7	3	j
253.3	101100101011	Stynian	7	3	j
253.4	101110110010	Lathian	7	3	j
253.5	110010101110	Persichetti Scale	7	3	j
253.6	110110010101	Kynian	7	3	j
253.7	111011001010	Elephant Scale	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
76.4	110000100110	JUXian	5	5	n
76.5	110110000100	DELian	5	5	n
77.1	100001001110	LECian	5	5	j
77.2	100111010000	BECian	5	5	j
77.3	101000010011	UTWian	5	5	j
77.4	110100001001	ORKian	5	5	j
77.5	111010000100	DEJian	5	5	j
78.1	100001001111	YOYian	6	5	j
78.2	100111110000	BOQian	6	5	j
78.3	110000100111	WUQian	6	5	j
78.4	111000010011	UCOian	6	5	j
78.5	111100001001	ODUian	6	5	j
78.6	111110000100	DENian	6	5	j
79.1	100001010001	NIDian	4	5	n
79.2	100011000010	GOSian	4	5	n
79.3	101000110000	BEKian	4	5	n
79.4	110000101000	CAJian	4	5	n
80.1	100001010010	Genus Primum Inverse	4	5	n
80.2	100101000010	Karen 4 Tone Type 1	4	5	n
80.3	101000010100	DUYian	4	5	n
80.4	101001010000	Genus Primum	4	5	n
81.1	100001010011	UNBian	5	5	j
81.2	100111000010	GOXian	5	5	j
81.3	101001110000	BIDian	5	5	j
81.4	110000101001	OMOian	5	5	j
81.5	111000010100	DUZian	5	5	j
82.1	100001010100	Lahuzu 4 Tone Type 1	4	5	n
82.2	100100001010	HUVian	4	5	n
82.3	101001000010	Karen 4 Tone Type 4	4	5	n
82.4	101010010000	Eskimo Tetratonic	4	5	n
83.1	100001010101	Raga Puruhutika	5	5	n
83.2	101010110000	BITian	5	5	n
83.3	101011000010	GOVian	5	5	n
83.4	101100001010	HUXian	5	5	n
83.5	110000101010	IGOian	5	5	n
84.1	100001010110	Raga Kuntvarali	5	5	n
84.2	101000010101	Lahuzu 5 Tone Type 3	5	5	n
84.3	101011010000	Raga Budhamanohari	5	5	n
84.4	101101000010	GOQian	5	5	n
84.5	110100001010	HUWian	5	5	n
85.1	100001010111	XUVian	6	5	j
85.2	101011110000	Raga Dipak	6	5	j
85.3	101111000010	GOZian	6	5	j
85.4	110000101011	VEPian	6	5	j
85.5	111000010101	RAKian	6	5	j
85.6	111100001010	HUYian	6	5	j
86.1	100001011000	COPian	4	5	n
86.2	100010000101	PUNian	4	5	n
86.3	101100010000	BABian	4	5	n
86.4	110001000010	GIKian	4	5	n
87.1	100001011001	Raga Devaranjani	5	5	n
87.2	100110000101	OTLian	5	5	n
87.3	101100110000	BEPian	5	5	n
87.4	110000101100	FECian	5	5	n
87.5	110011000010	GOTian	5	5	n
88.1	100001011010	JABian	5	5	n
88.2	101000010110	Raga Matha Kokila	5	5	n
88.3	101010000101	Raga Neroshta	5	5	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
254.1	100101011110	Soptian	7	3	j
254.2	101001010111	Raga Sorati	7	3	j
254.3	101011110100	Ionyptian	7	3	j
254.4	101111010010	Gyrian	7	3	j
254.5	110100101011	Bylian	7	3	j
254.6	111010010101	Stolian	7	3	j
254.7	111101001010	Zalian	7	3	j
255.1	100101011111	Phranyllic	8	3	j
255.2	101011111100	Stydyllic	8	3	j
255.3	101111110010	Zadyllic	8	3	j
255.4	110010101111	Stoptyllic	8	3	j
255.5	111001010111	Aerathyllic	8	3	j
255.6	111100101011	Katocryllic	8	3	j
255.7	111110010101	Zocryllic	8	3	j
255.8	111111001010	Zalyllic	8	3	j
256.1	100101100101	Messiaen Mode 2 Truncation 1	6	3	n
256.2	101100101100	Raga Neelangi	6	3	n
256.3	110010110010	Tritone Scale	6	3	n
257.1	100101100110	Bocrimic	6	3	n
257.2	100110100101	Aeolythimic	6	3	n
257.3	101001011001	Raga Bhinna Pancama	6	3	n
257.4	101100110100	Raga Vijayanagari	6	3	n
257.5	110011010010	Pagimic	6	3	n
257.6	110100101100	Molimic	6	3	n
258.1	100101100111	Katocrian	7	3	j
258.2	100111100101	Aerycrian	7	3	j
258.3	101100111100	Mela Syamalangi	7	3	j
258.4	110010110011	Mela Visvambhari	7	3	j
258.5	110011110010	Katynian	7	3	j
258.6	111001011001	Mela Ganamurti	7	3	j
258.7	111100101100	Ganian	7	3	j
259.1	100101101001	Zacrimic	6	3	n
259.2	100110010110	Lorimic	6	3	n
259.3	101001100101	Stydimic	6	3	n
259.4	101101001100	Larimic	6	3	n
259.5	110010110100	Ionadimic	6	3	n
259.6	110100110010	Thacrimic	6	3	n
260.1	100101101010	Phracrimic	6	3	n
260.2	101001011010	Raga Navamanohari	6	3	n
260.3	101010010110	Zeracrimic	6	3	n
260.4	101010100101	Raga Mruganandana	6	3	n
260.5	101101010100	Raga Suddha Bangala	6	3	n
260.6	110101010010	Raga Gandharavam	6	3	n
261.1	100101101011	Thonian	7	3	j
261.2	101011100101	Thodian	7	3	j
261.3	101101011100	Mela Jhankaradhvani	7	3	j
261.4	101110010110	Dogian	7	3	j
261.5	110010110101	Marva That	7	3	j
261.6	110101110010	Stadian	7	3	j
261.7	111001011010	Mela Ratnangi	7	3	j
262.1	100101101101	Pogian	7	3	n
262.2	101100101101	Lylian	7	3	n
262.3	101101100101	Jeths' Mode	7	3	n
262.4	101101101100	Moravian Pistalkova	7	3	n
262.5	110010110110	Mela Ramapriya	7	3	n
262.6	110110010110	Kathian	7	3	n
262.7	110110110010	Epylian	7	3	n
263.1	100101101110	Ionopian	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
88.4	101101010000	Raga Purnalalita	5	5	n
88.5	110101000010	GOPian	5	5	n
89.1	100001011011	VUVian	6	5	j
89.2	101101110000	BIJian	6	5	j
89.3	101110000101	PUVian	6	5	j
89.4	110000101101	SAVian	6	5	j
89.5	110111000010	GOYian	6	5	j
89.6	111000010110	KEMian	6	5	j
90.1	100001011100	FUJian	5	5	j
90.2	100100001011	VAFian	5	5	j
90.3	101110010000	BALian	5	5	j
90.4	110010000101	PUPian	5	5	j
90.5	111001000010	GOMian	5	5	j
91.1	100001011101	SOBian	6	5	j
91.2	101100001011	VAHian	6	5	j
91.3	101110110000	BIYian	6	5	j
91.4	110000101110	LIXian	6	5	j
91.5	110110000101	PUTian	6	5	j
91.6	111011000010	GOWian	6	5	j
92.1	100001011110	MACian	6	5	j
92.2	101000010111	XIDian	6	5	j
92.3	101111010000	BEFian	6	5	j
92.4	110100001011	SMUian	6	5	j
92.5	111010000101	PURian	6	5	j
92.6	111101000010	GORian	6	5	j
93.1	100001011111	ZIYian	7	5	j
93.2	101111110000	BOSian	7	5	j
93.3	110000101111	YUTian	7	5	j
93.4	111000010111	XOFian	7	5	j
93.5	111100001011	VAJian	7	5	j
93.6	111110000101	PUWian	7	5	j
93.7	111111000010	GOBian	7	5	j
94.1	100001100001	Messiaen Mode 5 Truncation 2	4	5	n
94.2	110000110000	Messiaen Mode 5 Truncation 1	4	5	n
95.1	100001100010	GUWian	4	5	n
95.2	100010100001	Raga Nigamagamini	4	5	n
95.3	101000011000	CIXian	4	5	n
95.4	110001010000	BAPian	4	5	n
96.1	100001100011	TUPian	5	5	j
96.2	100011100001	NEZian	5	5	j
96.3	110000110001	NOYian	5	5	j
96.4	110001110000	BICian	5	5	j
96.5	111000011000	CIYian	5	5	j
97.1	100001100100	DOCian	4	5	n
97.2	100100001100	EMPian	4	5	n
97.3	100100100001	NABian	4	5	n
97.4	110010010000	BAFian	4	5	n
98.1	100001100101	QOKian	5	5	n
98.2	100101100001	NAVian	5	5	n
98.3	101100001100	ETOian	5	5	n
98.4	110000110010	HIDian	5	5	n
98.5	110010110000	BISian	5	5	n
99.1	100001100110	KAPian	5	5	n
99.2	100110100001	NALian	5	5	n
99.3	101000011001	PAFian	5	5	n
99.4	110011010000	BEYian	5	5	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
263.2	101001011011	Rathian	7	3	j
263.3	101101110100	Aeologian	7	3	j
263.4	101110100101	Sygian	7	3	j
263.5	110100101101	Phrogian	7	3	j
263.6	110111010010	Ceiling Scale	7	3	j
263.7	111010010110	Phralian	7	3	j
264.1	100101101111	Lydyllic	8	3	j
264.2	101101111100	Radyllic	8	3	j
264.3	101111100101	Ionoryllic	8	3	j
264.4	110010110111	Epothyllic	8	3	j
264.5	110111110010	Stagyllic	8	3	j
264.6	111001011011	Banyllic	8	3	j
264.7	111100101101	Aeragyllic	8	3	j
264.8	111110010110	Phrodyllic	8	3	j
265.1	100101110011	Chromatic Hypophrygian	7	3	j
265.2	100111001011	Chromatic Phrygian	7	3	j
265.3	101110011100	Chromatic Hypodorian	7	3	j
265.4	110010111001	Chromatic Hypolydian	7	3	j
265.5	110011100101	Chromatic Lydian	7	3	j
265.6	111001011100	Chromatic Dorian	7	3	j
265.7	111001110010	Chromatic Mixolydian	7	3	j
266.1	100101110101	Eporian	7	3	j
266.2	101011001011	Katanian	7	3	j
266.3	101100101110	Katyrian	7	3	j
266.4	101110101100	Rylian	7	3	j
266.5	110010111010	Namanarayani	7	3	j
266.6	110101100101	Byrian	7	3	j
266.7	111010110010	Epaptian	7	3	j
267.1	100101110110	Blues Heptatonic II	7	3	j
267.2	101001011101	Ionolian	7	3	j
267.3	101101001011	Lodian	7	3	j
267.4	101110110100	Donian	7	3	j
267.5	110100101110	Solian	7	3	j
267.6	110110100101	Panian	7	3	j
267.7	111011010010	Aeoloptian	7	3	j
268.1	100101110111	Zoryllic	8	3	j
268.2	101110111100	Phrolyllic	8	3	j
268.3	101111001011	Socryllic	8	3	j
268.4	110010111011	Aeoryllic	8	3	j
268.5	110111100101	Thodyllic	8	3	j
268.6	111001011101	Zythyllic	8	3	j
268.7	111011110010	Kolyllic	8	3	j
268.8	111100101110	Aeolyllic	8	3	j
269.1	100101111001	Laptian	7	3	j
269.2	100110010111	Phrocrian	7	3	j
269.3	101111001100	Lygian	7	3	j
269.4	110010111100	Mela Dhavalambari	7	3	j
269.5	110011001011	Verdi's Scala Enigmatica Descending	7	3	j
269.6	111001100101	Lalian	7	3	j
269.7	111100110010	Logian	7	3	j
270.1	100101111010	Stathian	7	3	j
270.2	101001011110	Pyrian	7	3	j
270.3	101010010111	Gycrian	7	3	j
270.4	101111010100	Mixonyphian	7	3	j
270.5	110101001011	Aeolyphian	7	3	j
270.6	111010100101	Dadian	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
99.5	110100001100	ETRian	5	5	n
100.1	100001100111	XAHian	6	5	j
100.2	100111100001	NEFian	6	5	j
100.3	110000110011	URFian	6	5	j
100.4	110011110000	BOMian	6	5	j
100.5	111000011001	PAGian	6	5	j
100.6	111100001100	ETUian	6	5	j
101.1	100001101000	CEBian	4	5	n
101.2	100010000110	JOSian	4	5	n
101.3	101000100001	Raga Sumukam	4	5	n
101.4	110100010000	All-Interval Tetrachord 2	4	5	n
102.1	100001101001	OROian	5	5	n
102.2	100110000110	JOXian	5	5	n
102.3	101001100001	NASian	5	5	n
102.4	110000110100	EHOian	5	5	n
102.5	110100110000	MiaoYao 5 Tone Type 3	5	5	n
103.1	100001101010	INSian	5	5	n
103.2	101000011010	IRUian	5	5	n
103.3	101010000110	JOVian	5	5	n
103.4	101010100001	Raga Kumurdaki	5	5	n
103.5	110101010000	PRUian	5	5	n
104.1	100001101011	VIHian	6	5	j
104.2	101011100001	NECian	6	5	j
104.3	101110000110	JOZian	6	5	j
104.4	110000110101	RIVian	6	5	j
104.5	110101110000	BIHian	6	5	j
104.6	111000011010	IMPian	6	5	j
105.1	100001101100	JAHian	5	5	n
105.2	100100001101	RUMian	5	5	n
105.3	101100100001	NADian	5	5	n
105.4	110010000110	JOTian	5	5	n
105.5	110110010000	BAKian	5	5	n
106.1	100001101101	SENian	6	5	n
106.2	101100001101	RUPian	6	5	n
106.3	101101100001	NEXian	6	5	n
106.4	110000110110	KOXian	6	5	n
106.5	110110000110	JOYian	6	5	n
106.6	110110110000	Istrian	6	5	n
107.1	100001101110	LOQian	6	5	j
107.2	101000011011	VODian	6	5	j
107.3	101110100001	NANian	6	5	j
107.4	110100001101	RUNian	6	5	j
107.5	110111010000	BEDian	6	5	j
107.6	111010000110	JOWian	6	5	j
108.1	100001101111	ZALian	7	5	j
108.2	101111100001	NEHian	7	5	j
108.3	110000110111	YASian	7	5	j
108.4	110111110000	BORian	7	5	j
108.5	111000011011	VOFian	7	5	j
108.6	111100001101	RUQian	7	5	j
108.7	111110000110	JOBian	7	5	j
109.1	100001110001	NURian	5	5	j
109.2	100011000011	TILian	5	5	j
109.3	110000111000	Raga Saugandhini	5	5	j
109.4	110001100001	NARian	5	5	j
109.5	111000110000	Raga Nabhomani	5	5	j
110.1	100001110010	HOWian	5	5	j
110.2	100101000011	TIGian	5	5	j
110.3	101000011100	BOFian	5	5	j
110.4	110010100001	NAHian	5	5	j
110.5	111001010000	BARian	5	5	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
270.7	111101010010	Magian	7	3	j
271.1	100101111011	Pothyllic	8	3	j
271.2	101110010111	Zydyllic	8	3	j
271.3	101111011100	Phronyllic	8	3	j
271.4	110010111101	Rythyllic	8	3	j
271.5	110111001011	Aeryptyllic	8	3	j
271.6	111001011110	Katolyllic	8	3	j
271.7	111011100101	Rathyllic	8	3	j
271.8	111101110010	Stynyllic	8	3	j
272.1	100101111101	Aeronyllic	8	3	j
272.2	101100101111	Epaphyllic	8	3	j
272.3	101111101100	Pycryllic	8	3	j
272.4	110010111110	Lolyllic	8	3	j
272.5	110110010111	Ioninyllic	8	3	j
272.6	111011001011	Daptyllic	8	3	j
272.7	111101100101	Lylyllic	8	3	j
272.8	111110110010	Mygyllic	8	3	j
273.1	100101111110	Mixolydyllic	8	3	j
273.2	101001011111	Phradyllic	8	3	j
273.3	101111110100	Mixonyphyllic	8	3	j
273.4	110100101111	Gogyllic	8	3	j
273.5	111010010111	Ionagyllic	8	3	j
273.6	111101001011	Kygyllic	8	3	j
273.7	111110100101	Thocryllic	8	3	j
273.8	111111010010	Aeolanyllic	8	3	j
274.1	100101111111	Sathygic	9	3	j
274.2	101111111100	Ladygic	9	3	j
274.3	110010111111	Ionilygic	9	3	j
274.4	111001011111	Doptygic	9	3	j
274.5	111100101111	Lynygic	9	3	j
274.6	111110010111	Thadygic	9	3	j
274.7	111111001011	Aeolynygic	9	3	j
274.8	111111100101	Thacrygic	9	3	j
274.9	111111110010	Sarygic	9	3	j
275.1	100110011001	Augmented	6	3	n
275.2	110011001100	Augmented Inverse	6	3	n
276.1	100110011010	Dynimic	6	3	n
276.2	100110101001	Zathimic	6	3	n
276.3	101001100110	Syptimic	6	3	n
276.4	101010011001	Raga Latika	6	3	n
276.5	110011010100	Raga Kalavati	6	3	n
276.6	110101001100	Radimic	6	3	n
277.1	100110011011	Katathian	7	3	j
277.2	100110111001	Mela Dhatuvardhani	7	3	j
277.3	101110011001	Sagian	7	3	j
277.4	110011001101	Major Romani	7	3	j
277.5	110011011100	Mela Gayakapriya	7	3	j
277.6	110111001100	Mixolocrian	7	3	j
277.7	111001100110	Aeolothian	7	3	j
278.1	100110011101	Tholian	7	3	j
278.2	100111011001	Mela Gangeyabhusani	7	3	j
278.3	101100110011	Mela Nitimati	7	3	j
278.4	110011001110	Ionygian	7	3	j
278.5	110011101100	Ralian	7	3	j
278.6	110110011001	Ionocrian	7	3	j
278.7	111011001100	Stodian	7	3	j
279.1	100110011110	Zarian	7	3	j
279.2	100111101001	Rorian	7	3	j
279.3	101001100111	Kodian	7	3	j
279.4	110011110100	Phrythian	7	3	j
279.5	110100110011	Mela Divyamani	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
111.1	100001110011	ULLian	6	5	j
111.2	100111000011	TOQian	6	5	j
111.3	110000111001	PIRian	6	5	j
111.4	110011100001	NEBian	6	5	j
111.5	111000011100	FOSian	6	5	j
111.6	111001110000	BIFian	6	5	j
112.1	100001110100	TRUian	5	5	j
112.2	100100001110	LANian	5	5	j
112.3	101001000011	TIDian	5	5	j
112.4	110100100001	NACian	5	5	j
112.5	111010010000	BAHian	5	5	j
113.1	100001110101	RONian	6	5	j
113.2	101011000011	TONian	6	5	j
113.3	101100001110	LAQian	6	5	j
113.4	110000111010	UFFian	6	5	j
113.5	110101100001	NEWian	6	5	j
113.6	111010110000	BIVian	6	5	j
114.1	100001110110	KUQian	6	5	j
114.2	101000011101	SIKian	6	5	j
114.3	101101000011	TIJian	6	5	j
114.4	110100001110	LAPian	6	5	j
114.5	110110100001	NAMian	6	5	j
114.6	111011010000	BEBian	6	5	j
115.1	100001110111	YELian	7	5	j
115.2	101111000011	TOSian	7	5	j
115.3	110000111011	WAPian	7	5	j
115.4	110111100001	NEGian	7	5	j
115.5	111000011101	SILian	7	5	j
115.6	111011110000	BOPian	7	5	j
115.7	111100001110	LARian	7	5	j
116.1	100001111000	DABian	5	5	j
116.2	100010000111	WILian	5	5	j
116.3	110001000011	TICian	5	5	j
116.4	111000100001	MUBian	5	5	j
116.5	111100010000	BACian	5	5	j
117.1	100001111001	PIKian	6	5	j
117.2	100110000111	WOQian	6	5	j
117.3	110000111100	GACian	6	5	j
117.4	110011000011	TOMian	6	5	j
117.5	111001100001	NATian	6	5	j
117.6	111100110000	BEQian	6	5	j
118.1	100001111010	JEPian	6	5	j
118.2	101000011110	LUMian	6	5	j
118.3	101010000111	OLKian	6	5	j
118.4	110101000011	TIHian	6	5	j
118.5	111010100001	NAKian	6	5	j
118.6	111101010000	BEWian	6	5	j
119.1	100001111011	WEHian	7	5	j
119.2	101110000111	WOSian	7	5	j
119.3	110000111101	SUWian	7	5	j
119.4	110111000011	TORian	7	5	j
119.5	111000011110	LUNian	7	5	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
279.6	111010011001	Bothian	7	3	j
279.7	111101001100	Bolian	7	3	j
280.1	100110011111	Ioniptyllic	8	3	j
280.2	100111111001	Aeolaptyllic	8	3	j
280.3	110011001111	Ryryllic	8	3	j
280.4	110011111100	Kycryllic	8	3	j
280.5	111001100111	Zonyllic	8	3	j
280.6	111100110011	Pythyllic	8	3	j
280.7	111110011001	Ionathyllic	8	3	j
280.8	111111001100	Rodyllic	8	3	j
281.1	100110100110	Hungarian Major No5	6	3	n
281.2	101001101001	T4 First Rotation	6	3	n
281.3	110100110100	T4 Prime Mode	6	3	n
282.1	100110100111	Ranian	7	3	j
282.2	100111100110	Ionothian	7	3	j
282.3	101001111001	Podian	7	3	j
282.4	110011010011	Mela Hatakambari	7	3	j
282.5	110100111100	Mela Gavambodhi	7	3	j
282.6	111001101001	Zylian	7	3	j
282.7	111100110100	Kanian	7	3	j
283.1	100110101010	Boptimic	6	3	n
283.2	101001101010	Padimic	6	3	n
283.3	101010011010	Bythimic	6	3	n
283.4	101010100110	Scriabin's Prometheus	6	3	n
283.5	101010101001	Eskimo Hexatonic 2	6	3	n
283.6	110101010100	Stogimic	6	3	n
284.1	100110101011	Golian	7	3	j
284.2	101010111001	Harmonic Lydian	7	3	j
284.3	101011100110	Minor Romani Inverse	7	3	j
284.4	101110011010	Sabach ascending	7	3	j
284.5	110011010101	Mela Suryakanta	7	3	j
284.6	110101011100	Mela Senavati	7	3	j
284.7	111001101010	Pynian	7	3	j
285.1	101011011001	Harmonic Major	7	3	n
285.2	101101100110	Dorian Flat 5 (Harmonic Major 2)	7	3	n
285.3	110110011010	Phrygian Flat 4 (Harmonic Major 3)	7	3	n
285.4	101100110101	Lydian Flat 3 (Harmonic Major 4)	7	3	n
285.5	110011010110	Harmonic Minor Inverse (Harmonic Major 5)	7	3	n
285.6	100110101101	Lydian Augmented Sharp 2 (Harmonic Major 6)	7	3	n
285.7	110101101100	Locrian Double-flat 7 (Harmonic Major 7)	7	3	n
286.1	100110101110	Korian	7	3	j
286.2	101001101011	Marian	7	3	j
286.3	101011101001	Malian	7	3	j
286.4	101110100110	Synian	7	3	j
286.5	110100110101	Mela Suvarnangi	7	3	j
286.6	110101110100	Lynian	7	3	j
286.7	111010011010	Phragian	7	3	j
287.1	100110101111	Aeolothyllic	8	3	j
287.2	101011111001	Rydyllic	8	3	j
287.3	101111100110	Gonyllic	8	3	j
287.4	110011010111	Modyllic	8	3	j
287.5	110101111100	Ionyryllic	8	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
119.6	111011100001	NEDian	7	5	j
119.7	111101110000	BIKian	7	5	j
120.1	100001111100	GAVian	6	5	j
120.2	100100001111	YIKian	6	5	j
120.3	110010000111	WOMian	6	5	j
120.4	111001000011	TIFian	6	5	j
120.5	111100100001	NAFian	6	5	j
120.6	111110010000	BAMian	6	5	j
121.1	100001111101	TANian	7	5	j
121.2	101100001111	YOMian	7	5	j
121.3	110000111110	MEXian	7	5	j
121.4	110110000111	WORian	7	5	j
121.5	111011000011	TOPian	7	5	j
121.6	111101100001	NEYian	7	5	j
121.7	111110110000	BIZian	7	5	j
122.1	100001111110	MEQian	7	5	j
122.2	101000011111	ZEHian	7	5	j
122.3	110100001111	YILian	7	5	j
122.4	111010000111	WOPian	7	5	j
122.5	111101000011	TIKian	7	5	j
122.6	111110100001	NAPian	7	5	j
122.7	111111010000	BEGian	7	5	j
123.1	100001111111	Octatonic Chromatic Descending	8	5	j
123.2	110000111111	Octatonic Chromatic 7	8	5	j
123.3	111000011111	Octatonic Chromatic 6	8	5	j
123.4	111100001111	Octatonic Chromatic 5	8	5	j
123.5	111110000111	Octatonic Chromatic 4	8	5	j
123.6	111111000011	Octatonic Chromatic 3	8	5	j
123.7	111111100001	Octatonic Chromatic 2	8	5	j
123.8	111111110000	Chromatic Octamode	8	5	j
124.1	100010001000	Augmented Triad	3	4	n
125.1	100010001001	Zyphic	4	4	n
125.2	100010011000	Epogic	4	4	n
125.3	100110001000	Lanic	4	4	n
125.4	110001000100	Pyrric	4	4	n
126.1	100010001010	Aeolic	4	4	n
126.2	100010101000	Kmhmu 4 Tone Type 2	4	4	n
126.3	101000100010	Lydic	4	4	n
126.4	101010001000	Mixolyric	4	4	n
127.1	100010001011	Zylitonic	5	4	j
127.2	100010111000	Zoditonic	5	4	j
127.3	101110001000	Zaritonic	5	4	j
127.4	110001000101	Rolitonic	5	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
287.6	111001101011	Zyptyllic	8	3	j
287.7	111100110101	Katydyllic	8	3	j
287.8	111110011010	Rolyllic	8	3	j
288.1	101100111001	Double Harmonic Minor	7	3	j
288.2	110011100110	Asian	7	3	j
288.3	100111001101	Ionian Augmented Sharp 2	7	3	j
288.4	111001101100	Hungarian Romani Minor 4th Mode	7	3	j
288.5	110011011001	Double Harmonic	7	3	j
288.6	100110110011	Lydian Sharp 2 Sharp 6	7	3	j
288.7	110110011100	Ultraphrygian	7	3	j
289.1	101101011001	Harmonic Minor HM1	7	3	n
289.2	110101100110	Locrian Natural 6 (Harmonic Minor HM2)	7	3	n
289.3	101011001101	Major Augmented (Harmonic Minor HM3)	7	3	n
289.4	101100110110	Lydian Diminished (Harmonic Minor HM4)	7	3	n
289.5	110011011010	Phrygian Dominant (Harmonic Minor HM5)	7	3	n
289.6	100110110101	Aeolian Harmonic (Harmonic Minor HM6)	7	3	n
289.7	110110101100	Ultralocrian (Harmonic Minor HM7)	7	3	n
290.1	100110110110	Hungarian Major	7	3	n
290.2	101001101101	Nohkan Flute Scale	7	3	n
290.3	101101001101	Hungarian Major 5th Mode	7	3	n
290.4	101101101001	Harmonic Minor Flat 5	7	3	n
290.5	110100110110	Mela Sadvidhamargini	7	3	n
290.6	110110100110	Hungarian Major 4th Mode	7	3	n
290.7	110110110100	Alternating Heptamode	7	3	n
291.1	100110110111	Maptyllic	8	3	j
291.2	101101111001	Algerian	8	3	j
291.3	101111001101	Phrylyllic	8	3	j
291.4	110011011011	Ponyllic	8	3	j
291.5	110110111100	Aeraptyllic	8	3	j
291.6	110111100110	Magyllic	8	3	j
291.7	111001101101	Molyllic	8	3	j
291.8	111100110110	Epigyllic	8	3	j
292.1	100110111010	Mela Jyotisvarupini	7	3	j
292.2	101001101110	Ionylian	7	3	j
292.3	101010011011	Kyptian	7	3	j
292.4	101110101001	Stagian	7	3	j
292.5	110101001101	Phrycrian	7	3	j
292.6	110111010100	Aerothian	7	3	j
292.7	111010100110	Lothian	7	3	j
293.1	100110111011	Thyptyllic	8	3	j
293.2	101110011011	Sabach	8	3	j
293.3	101110111001	Aeolaryllic	8	3	j
293.4	110011011101	Raga Saurashtra	8	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
127.5	111000100010	Phrythitonic	5	4	j
128.1	100010001100	Aeoloric	4	4	n
128.2	100011001000	Gonic	4	4	n
128.3	100100010001	Dygic	4	4	n
128.4	110010001000	Dalic	4	4	n
129.1	100010001101	Dolitonic	5	4	n
129.2	100011011000	Raga Zilaf	5	4	n
129.3	101100010001	Zagitonic	5	4	n
129.4	110001000110	Lagitonic	5	4	n
129.5	110110001000	Aerylitonic	5	4	n
130.1	100010001110	Ranitonic	5	4	j
130.2	100011101000	Laditonic	5	4	j
130.3	101000100011	Kanitonic	5	4	j
130.4	110100010001	Ionothitonic	5	4	j
130.5	111010001000	Poditonic	5	4	j
131.1	100010001111	Ponimic	6	4	j
131.2	100011111000	Kadimic	6	4	j
131.3	110001000111	Thanimic	6	4	j
131.4	111000100011	Polimic	6	4	j
131.5	111100010001	Thydimic	6	4	j
131.6	111110001000	Gynimic	6	4	j
132.1	100010010001	Major Seventh	4	4	n
132.2	100011000100	Phratic	4	4	n
132.3	100100011000	Lothic	4	4	n
132.4	110001001000	Raga Lavangi	4	4	n
133.1	100010010010	Raga Mahathi	4	4	n
133.2	100100101000	Lonic	4	4	n
133.3	100101000100	Phradic	4	4	n
133.4	101000100100	Bolic	4	4	n
134.1	100010010011	Molitonic	5	4	j
134.2	100100111000	Staptitonic	5	4	j
134.3	100111000100	Mothitonic	5	4	j
134.4	110001001001	Raga Kshanika	5	4	j
134.5	111000100100	Aeritonic	5	4	j
135.1	100010010100	Lahuzu 4 Tone Type 3	4	4	n
135.2	100100010010	Bi Yu	4	4	n
135.3	100101001000	Karen 4 Tone Type 3	4	4	n
135.4	101001000100	Lahuzu 4 Tone Type 4	4	4	n
136.1	100010010101	Raga Mamata	5	4	n
136.2	100101011000	Raga Kokil Pancham	5	4	n
136.3	101011000100	Aeolyphritonic	5	4	n
136.4	101100010010	Gycritonic	5	4	n
136.5	110001001010	Pyritonic	5	4	n
137.1	100010010110	Raga Valaji	5	4	n
137.2	100101101000	Bocritonic	5	4	n
137.3	101000100101	Raga Shubravarni	5	4	n
137.4	101101000100	Raga Abhogi	5	4	n
137.5	110100010010	Raga Rukmangi	5	4	n
138.1	100010010111	Starimic	6	4	j
138.2	100101111000	Phrathimic	6	4	j
138.3	101111000100	Saptimic	6	4	j
138.4	110001001011	Rogimic	6	4	j
138.5	111000100101	Macrimic	6	4	j
138.6	111100010010	Aerodimic	6	4	j
139.1	100010011001	Zacritonic	5	4	n
139.2	100110001001	Styditonic	5	4	n
139.3	100110011000	Laritonic	5	4	n
139.4	110001001100	Loritonic	5	4	n
139.5	110011000100	Thacritonic	5	4	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
293.5	110111001101	Ganyllic	8	3	j
293.6	110111011100	Ionogyllic	8	3	j
293.7	111001101110	Salyllic	8	3	j
293.8	111011100110	Katygyllic	8	3	j
294.1	100110111101	Doptyllic	8	3	j
294.2	101100110111	Eporyllic	8	3	j
294.3	101111011001	Manyllic	8	3	j
294.4	110011011110	Aerynyllic	8	3	j
294.5	110110011011	Mugham Shüshtär	8	3	j
294.6	110111101100	Ionilyllic	8	3	j
294.7	111011001101	Stanyllic	8	3	j
294.8	111101100110	Polyllic	8	3	j
295.1	100110111110	Stacryllic	8	3	j
295.2	101001101111	Stathyllic	8	3	j
295.3	101111101001	Kadyllic	8	3	j
295.4	110100110111	Kagyllic	8	3	j
295.5	110111110100	Doryllic	8	3	j
295.6	111010011011	Rothyllic	8	3	j
295.7	111101001101	Aerogyllic	8	3	j
295.8	111110100110	Rynyllic	8	3	j
296.1	100110111111	Phrygic	9	3	j
296.2	101111111001	Dothygic	9	3	j
296.3	110011011111	Lonygic	9	3	j
296.4	110111111100	Aeranygic	9	3	j
296.5	111001101111	Zynygic	9	3	j
296.6	111100110111	Stodygic	9	3	j
296.7	111110011011	Byptygic	9	3	j
296.8	111111001101	Stadygic	9	3	j
296.9	111111100110	Lydygic	9	3	j
297.1	100111001110	Chromatic Hypodorian Inverse	7	3	j
297.2	100111010011	Mela Calanata	7	3	j
297.3	101001110011	Chromatic Mixolydian Inverse	7	3	j
297.4	110011101001	Raga Lalita	7	3	j
297.5	110100111001	Todi That	7	3	j
297.6	111001110100	Chromatic Hypophrygian Inverse	7	3	j
297.7	111010011100	Chromatic Phrygian Inverse	7	3	j
298.1	100111001111	Locryllic	8	3	j
298.2	100111110011	Ionycryllic	8	3	j
298.3	110011100111	Aeolylyllic	8	3	j
298.4	110011111001	Raga Ramkali	8	3	j
298.5	111001110011	Soptyllic	8	3	j
298.6	111001111100	Bylyllic	8	3	j
298.7	111100111001	Epyryllic	8	3	j
298.8	111110011100	Koptyllic	8	3	j
299.1	100111010101	Mela Sulini	7	3	j
299.2	101010110011	Mela Citrambari	7	3	j
299.3	101011001110	Lagian	7	3	j
299.4	101100111010	Minor Romani	7	3	j
299.5	110011101010	Locrian Dominant	7	3	j
299.6	110101011001	Neapolitan Minor	7	3	j
299.7	111010101100	Porian	7	3	j
300.1	100111010110	Mela Vagadhisvari	7	3	j
300.2	101001110101	Zolian	7	3	j
300.3	101011010011	Mela Naganandini	7	3	j
300.4	101101001110	Dalian	7	3	j
300.5	110100111010	Mela Bhavapriya	7	3	j
300.6	110101101001	Aeolorian	7	3	j
300.7	111010110100	Phradian	7	3	j
301.1	100111010111	Aeracryllic	8	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
140.1	100010011010	Ryphitonic	5	4	n
140.2	100110101000	Gylitonic	5	4	n
140.3	101000100110	Zanitonic	5	4	n
140.4	101010001001	Pynitonic	5	4	n
140.5	110101000100	Aeolycritonic	5	4	n
141.1	100010011011	Lathimic	6	4	j
141.2	100110111000	Aeralimic	6	4	j
141.3	101110001001	Stynimic	6	4	j
141.4	110001001101	Katoptimic	6	4	j
141.5	110111000100	Kynimic	6	4	j
141.6	111000100110	Epytimic	6	4	j
142.1	100010011100	Aeolyritonic	5	4	j
142.2	100100010011	Aeraphitonic	5	4	j
142.3	100111001000	Goritonic	5	4	j
142.4	110010001001	Doptitonic	5	4	j
142.5	111001000100	Aeoloditonic	5	4	j
143.1	100010011101	Bygimic	6	4	j
143.2	100111011000	Thycrimic	6	4	j
143.3	101100010011	Eponimic	6	4	j
143.4	110001001110	Katygimic	6	4	j
143.5	110110001001	Dylimic	6	4	j
143.6	111011000100	Aeoladimic	6	4	j
144.1	100010011110	Galimic	6	4	j
144.2	100111101000	Kathimic	6	4	j
144.3	101000100111	Sathimic	6	4	j
144.4	110100010011	Epacrimic	6	4	j
144.5	111010001001	Epalimic	6	4	j
144.6	111101000100	Lylimic	6	4	j
145.1	100010011111	Thadian	7	4	j
145.2	100111111000	Sanian	7	4	j
145.3	110001001111	Aeryptian	7	4	j
145.4	111000100111	Mathian	7	4	j
145.5	111100010011	Katydian	7	4	j
145.6	111110001001	Epydian	7	4	j
145.7	111111000100	Ionydian	7	4	j
146.1	100010100010	Messiaen Truncated Mode 6 Inverse	4	4	n
146.2	101000101000	Messiaen Truncated Mode 6	4	4	n
147.1	100010100011	Zathitonic	5	4	j
147.2	100011100010	Stonitonic	5	4	j
147.3	101000111000	Raditonic	5	4	j
147.4	110001010001	Raga Gauri	5	4	j
147.5	111000101000	Syptitonic	5	4	j
148.1	100010100100	Saric	4	4	n
148.2	100100010100	Byptic	4	4	n
148.3	100100100010	Aeraphic	4	4	n
148.4	101001001000	Raga Haripriya	4	4	n
149.1	100010100101	Raga Hindol	5	4	n
149.2	100101100010	Raga Jayakauns	5	4	n
149.3	101001011000	Han-kumoi	5	4	n
149.4	101100010100	Dorian Pentatonic	5	4	n
149.5	110001010010	Kokin-joshi	5	4	n
150.1	100010100110	Phronitonic	5	4	n
150.2	100110100010	Locrian Pentatonic 2	5	4	n
150.3	101000101001	Dyptitonic	5	4	n
150.4	101001101000	Banitonic	5	4	n
150.5	110100010100	Golitonic	5	4	n
151.1	100010100111	Stalimic	6	4	j
151.2	100111100010	Zygimic	6	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
301.2	101011110011	Lanyllic	8	3	j
301.3	101111001110	Phrynyllic	8	3	j
301.4	110011101011	Verdi's Scala Enigmatica	8	3	j
301.5	110101111001	Half-Diminished Bebop	8	3	j
301.6	111001110101	Ionyptyllic	8	3	j
301.7	111010111100	Epygyllic	8	3	j
301.8	111100111010	Lycryllic	8	3	j
302.1	100111011010	Mela Ragavardhani	7	3	j
302.2	101001110110	Lonian	7	3	j
302.3	101010011101	Darian	7	3	j
302.4	101101010011	Mela Varunapriya	7	3	j
302.5	110101001110	Byptian	7	3	j
302.6	110110101001	Zoptian	7	3	j
302.7	111011010100	Sarian	7	3	j
303.1	100111011011	Dydyllic	8	3	j
303.2	101101110011	Bycryllic	8	3	j
303.3	101110011101	Panyllic	8	3	j
303.4	110011101101	Zathyllic	8	3	j
303.5	110110111001	Mirage Scale	8	3	j
303.6	110111001110	Zacryllic	8	3	j
303.7	111001110110	Dyryllic	8	3	j
303.8	111011011100	Thogyllic	8	3	j
304.1	100111011101	Lonyllic	8	3	j
304.2	101100111011	Thadyllic	8	3	j
304.3	101110110011	Saryllic	8	3	j
304.4	110011101110	Lynyllic	8	3	j
304.5	110110011101	Aeolynyllic	8	3	j
304.6	110111011001	Layllic	8	3	j
304.7	111011001110	Thacryllic	8	3	j
304.8	111011101100	Sathyllic	8	3	j
305.1	100111011110	Dagyllic	8	3	j
305.2	101001110111	Aeologyllic	8	3	j
305.3	101111010011	Dodyllic	8	3	j
305.4	110100111011	Neveseri	8	3	j
305.5	110111101001	Katoryllic	8	3	j
305.6	111010011101	Madyllic	8	3	j
305.7	111011110100	Katalyllic	8	3	j
305.8	111101001110	Zogyllic	8	3	j
306.1	100111011111	Kalygic	9	3	j
306.2	101111110011	Epygic	9	3	j
306.3	110011101111	Galygic	9	3	j
306.4	110111111001	Bythygic	9	3	j
306.5	111001110111	Mylygic	9	3	j
306.6	111011111100	Ionodygic	9	3	j
306.7	111100111011	Aeroptygic	9	3	j
306.8	111110011101	Gaptygic	9	3	j
306.9	111111001110	Marygic	9	3	j
307.1	100111100111	Messiaen Mode 4 Rotation 2	8	3	j
307.2	110011110011	Tcherepnin Octatonic Mode 1	8	3	j
307.3	111001111001	Messiaen Mode 4	8	3	j
307.4	111100111100	Messiaen Mode 4 Rotation 3	8	3	j
308.1	100111101010	Pagian	7	3	j
308.2	101001111010	Ragian	7	3	j
308.3	101010011110	Aeranian	7	3	j
308.4	101010100111	Mothian	7	3	j
308.5	110101010011	Mela Rupavati	7	3	j
308.6	111010101001	Molian	7	3	j
308.7	111101010100	Aeolythian	7	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
151.3	101001111000	Stoptimic	6	4	j
151.4	110001010011	Pothimic	6	4	j
151.5	111000101001	Aeolaptimic	6	4	j
151.6	111100010100	Kataptimic	6	4	j
152.1	100010101001	Karen 5tone Type 2	5	4	n
152.2	100110001010	Dynitonic	5	4	n
152.3	101001100010	Ionaritonic	5	4	n
152.4	101010011000	Raga Bhupeshwari	5	4	n
152.5	110001010100	Altered Pentatonic	5	4	n
153.1	100010101010	Ngapauk auk Pyan	5	4	n
153.2	101000101010	Tholitonic	5	4	n
153.3	101010001010	Koditonic	5	4	n
153.4	101010100010	Kataditonic	5	4	n
153.5	101010101000	Bothitonic	5	4	n
154.1	100010101011	Katanimic	6	4	j
154.2	101010111000	Katyrimic	6	4	j
154.3	101011100010	Rynimic	6	4	j
154.4	101110001010	Pogimic	6	4	j
154.5	110001010101	Raga Jivantika	6	4	j
154.6	111000101010	Aeraptimic	6	4	j
155.1	100010101100	Aerynitonic	5	4	n
155.2	100100010101	Katagitonic	5	4	n
155.3	101011001000	Palitonic	5	4	n
155.4	101100100010	Stothitonic	5	4	n
155.5	110010001010	Aerophitonic	5	4	n
156.1	100010101101	Rycrimic	6	4	n
156.2	101011011000	Ronimic	6	4	n
156.3	101100010101	Hawaiian	6	4	n
156.4	101101100010	Stycrimic	6	4	n
156.5	110001010110	Raga Rasavali	6	4	n
156.6	110110001010	Katorimic	6	4	n
157.1	100010101110	Dathimic	6	4	j
157.2	101000101011	Sydimic	6	4	j
157.3	101011101000	Epagimic	6	4	j
157.4	101110100010	Raptimic	6	4	j
157.5	110100010101	Sythimic	6	4	j
157.6	111010001010	Epolimic	6	4	j
158.1	100010101111	Pythian	7	4	j
158.2	101011111000	Katylian	7	4	j
158.3	101111100010	Bydian	7	4	j
158.4	110001010111	Myrian	7	4	j
158.5	111000101011	Zonian	7	4	j
158.6	111100010101	Galian	7	4	j
158.7	111110001010	Bynian	7	4	j
159.1	100010110001	Lydian Pentatonic	5	4	n
159.2	100011000101	Raga Bhinna Shadja	5	4	n
159.3	101100011000	Aeolian Pentatonic	5	4	n
159.4	110001011000	Hon-kumoi-joshi	5	4	n
159.5	110001100010	Iwato	5	4	n
160.1	100010110010	Ionoditonic	5	4	n
160.2	100101000101	Marga Hindolam	5	4	n
160.3	101000101100	Epaditonic	5	4	n
160.4	101100101000	Bogitonic	5	4	n
160.5	110010100010	Mogitonic	5	4	n
161.1	100010110011	Raga Vijayavasanta	6	4	j
161.2	100111000101	Pylimic	6	4	j
161.3	101100111000	Raga Syamalam	6	4	j
161.4	110001011001	Raga Padi	6	4	j
161.5	110011100010	Aerygimic	6	4	j
161.6	111000101100	Ionathimic	6	4	j
162.1	100010110100	Raga Dhavalashri	5	4	n
162.2	100100010110	Thocritonic	5	4	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
309.1	100111101011	Bacryllic	8	3	j
309.2	101011100111	Bagyllic	8	3	j
309.3	101110011110	Mathyllic	8	3	j
309.4	110011110101	Raga Bhatiyar	8	3	j
309.5	110101110011	Boptyllic	8	3	j
309.6	111001111010	Styptyllic	8	3	j
309.7	111010111001	Dathyllic	8	3	j
309.8	111101011100	Aerygyllic	8	3	j
310.1	100111101101	Aeolathyllic	8	3	j
310.2	101100111101	Gyptyllic	8	3	j
310.3	101101100111	Epaptyllic	8	3	j
310.4	110011110110	Aerythyllic	8	3	j
310.5	110110011110	Ionoyllic	8	3	j
310.6	110110110011	Kodyllic	8	3	j
310.7	111011011001	Phroptyllic	8	3	j
310.8	111101101100	Aeolocryllic	8	3	j
311.1	100111101110	Zagyllic	8	3	j
311.2	101001111011	Thycryllic	8	3	j
311.3	101110100111	Katylyllic	8	3	j
311.4	110100111101	Mydyllic	8	3	j
311.5	110111010011	Loptyllic	8	3	j
311.6	111010011110	Malyllic	8	3	j
311.7	111011101001	Thorcryllic	8	3	j
311.8	111101110100	Epacryllic	8	3	j
312.1	100111101111	Mixolydygic	9	3	j
312.2	101111100111	Locrygic	9	3	j
312.3	110011110111	Dorygic	9	3	j
312.4	110111110011	Phrygygic	9	3	j
312.5	111001111011	Aerathygic	9	3	j
312.6	111011111001	Zoptygic	9	3	j
312.7	111100111101	Aeracrygic	9	3	j
312.8	111101111100	Ionycrygic	9	3	j
312.9	111110011110	Gonygic	9	3	j
313.1	100111110101	Gythyllic	8	3	j
313.2	101011001111	Phrocryllic	8	3	j
313.3	101100111110	Raga Cintamani	8	3	j
313.4	110011111010	Zothyllic	8	3	j
313.5	110101100111	Badyllic	8	3	j
313.6	111010110011	Phrathyllic	8	3	j
313.7	111101011001	Harmonic and Neapolitan Minor Mixed	8	3	j
313.8	111110101100	Pyryllic	8	3	j
314.1	100111110110	Tharyllic	8	3	j
314.2	101001111101	Raptyllic	8	3	j
314.3	101101001111	Styryllic	8	3	j
314.4	110100111110	Sideways Scale	8	3	j
314.5	110110100111	Monyllic	8	3	j
314.6	111011010011	Daryllic	8	3	j
314.7	111101101001	Lothyllic	8	3	j
314.8	111110110100	Sylyllic	8	3	j
315.1	100111110111	Dycrygic	9	3	j
315.2	101111001111	Bycrygic	9	3	j
315.3	110011111011	Dyrygic	9	3	j
315.4	110111100111	Rynygic	9	3	j
315.5	111001111101	Panygic	9	3	j
315.6	111011110011	Tholygic	9	3	j
315.7	111100111110	Zacrygic	9	3	j
315.8	111101111001	Dydygic	9	3	j
315.9	111110111100	Aeolygic	9	3	j
316.1	100111111010	Kataryllic	8	3	j
316.2	101001111110	Katycryllic	8	3	j
316.3	101010011111	Sythyllic	8	3	j
316.4	110101001111	Kyryllic	8	3	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
162.3	101001000101	Raga Rasranjani	5	4	n
162.4	101101001000	Raga Audav Tukhari	5	4	n
162.5	110100100010	Dyritonic	5	4	n
163.1	100010110101	Dyrimic	6	4	n
163.2	101011000101	Raga Hamsa Vinodini	6	4	n
163.3	101100010110	Raga Manavi	6	4	n
163.4	101101011000	Koptimic	6	4	n
163.5	110001011010	Raga Phenadyuti	6	4	n
163.6	110101100010	Honchoshi Plagal Form	6	4	n
164.1	100010110110	Raga Vutari	6	4	n
164.2	101000101101	Byrimic	6	4	n
164.3	101101000101	Rylimic	6	4	n
164.4	101101101000	Marimic	6	4	n
164.5	110100010110	Raga Salagavarali	6	4	n
164.6	110110100010	Superlocrian Hexamirror	6	4	n
165.1	100010110111	Aeopian	7	4	j
165.2	101101111000	Rygian	7	4	j
165.3	101111000101	Ionogian	7	4	j
165.4	110001011011	Tharian	7	4	j
165.5	110111100010	Epynian	7	4	j
165.6	111000101101	Gaptian	7	4	j
165.7	111100010110	Kydian	7	4	j
166.1	100010111001	Aerycrimic	6	4	j
166.2	100110001011	Phraptimic	6	4	j
166.3	101110011000	Ganimic	6	4	j
166.4	110001011100	Raga Kalakanthi	6	4	j
166.5	110011000101	Raga Vasanta	6	4	j
166.6	111001100010	Eparimic	6	4	j
167.1	100010111010	Raga Jyoti	6	4	j
167.2	101000101110	Phrygimic	6	4	j
167.3	101010001011	Aeolocrimic	6	4	j
167.4	101110101000	Borimic	6	4	j
167.5	110101000101	Gadimic	6	4	j
167.6	111010100010	Sycrimic	6	4	j
168.1	100010111011	Katogian	7	4	j
168.2	101110001011	Phrodian	7	4	j
168.3	101110111000	Stacrian	7	4	j
168.4	110001011101	Gyptian	7	4	j
168.5	110111000101	Ionyrian	7	4	j
168.6	111000101110	Pycrian	7	4	j
168.7	111011100010	Styrian	7	4	j
169.1	100010111100	Kocrimic	6	4	j
169.2	100100010111	Phragimic	6	4	j
169.3	101111001000	Korimic	6	4	j
169.4	110010001011	Synimic	6	4	j
169.5	111001000101	Malimic	6	4	j
169.6	111100100010	Lynimic	6	4	j
170.1	100010111101	Epycrian	7	4	j
170.2	101100010111	Kyrian	7	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
316.5	111010100111	Aeonyllic	8	3	j
316.6	111101010011	Aeolonyllic	8	3	j
316.7	111110101001	Zanyllic	8	3	j
316.8	111111010100	Aerocryllic	8	3	j
317.1	100111111011	Loptygic	9	3	j
317.2	101110011111	Dogygic	9	3	j
317.3	110011111101	Madygic	9	3	j
317.4	110111001111	Katorygic	9	3	j
317.5	111001111110	Zodygic	9	3	j
317.6	111011100111	Katalygic	9	3	j
317.7	111101110011	Mixodygic	9	3	j
317.8	111110111001	Phradygic	9	3	j
317.9	111111011100	Katylygic	9	3	j
318.1	100111111101	Zothygic	9	3	j
318.2	101100111111	Gyptygic	9	3	j
318.3	110011111110	Aerythygic	9	3	j
318.4	110110011111	Ionygic	9	3	j
318.5	111011001111	Eparygic	9	3	j
318.6	111101100111	Kodygic	9	3	j
318.7	111110110011	Phroptygic	9	3	j
318.8	111111011001	Aeolocrygic	9	3	j
318.9	111111101100	Aeolathygic	9	3	j
319.1	100111111110	Aeolacrygic	9	3	j
319.2	101001111111	Starygic	9	3	j
319.3	110100111111	Phrocrygic	9	3	j
319.4	111010011111	Badygic	9	3	j
319.5	111101001111	Phrathygic	9	3	j
319.6	111110100111	Rycrygic	9	3	j
319.7	111111010011	Pyrygic	9	3	j
319.8	111111101001	Gythygic	9	3	j
319.9	111111110100	Raptygic	9	3	j
320.1	100111111111	Decatonic Chromatic Descending	10	3	j
320.10	111111111100	Chromatic Decamode	10	3	j
320.2	110011111111	Decatonic Chromatic 9	10	3	j
320.3	111001111111	Decatonic Chromatic 8	10	3	j
320.4	111100111111	Decatonic Chromatic 7	10	3	j
320.5	111110011111	Decatonic Chromatic 6	10	3	j
320.6	111111001111	Decatonic Chromatic 5	10	3	j
320.7	111111100111	Decatonic Chromatic 4	10	3	j
320.8	111111110011	Decatonic Chromatic 3	10	3	j
320.9	111111111001	Decatonic Chromatic 2	10	3	j
321.1	101010101010	Whole Tone	6	2	n
322.1	101010101011	Leading Whole-tone	7	2	j
322.2	101010101110	Aeroptian	7	2	j
322.3	101010111010	Lydian Minor	7	2	j
322.4	101011101010	Major Locrian	7	2	j
322.5	101110101010	Storian	7	2	j
322.6	110101010101	Neapolitan Major	7	2	j
322.7	111010101010	Leading Whole-Tone Inverse	7	2	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
170.3	101111011000	Gocrian	7	4	j
170.4	110001011110	Sonian	7	4	j
170.5	110110001011	Bagian	7	4	j
170.6	111011000101	Thoptian	7	4	j
170.7	111101100010	Katolian	7	4	j
171.1	100010111110	Gydian	7	4	j
171.2	101000101111	Rydian	7	4	j
171.3	101111101000	Kogian	7	4	j
171.4	110100010111	Myptian	7	4	j
171.5	111010001011	Crater Scale	7	4	j
171.6	111101000101	Aerolian	7	4	j
171.7	111110100010	Rarian	7	4	j
172.1	100010111111	Stycryllic	8	4	j
172.2	101111111000	Ionothyllic	8	4	j
172.3	110001011111	Sadyllic	8	4	j
172.4	111000101111	Katyryllic	8	4	j
172.5	111100010111	Tholyllic	8	4	j
172.6	111110001011	Bonyllic	8	4	j
172.7	111111000101	Aerylyllic	8	4	j
172.8	111111100010	Mythyllic	8	4	j
173.1	100011000110	Raga Khamaji Durga	5	4	n
173.2	100011010001	Ionian Pentatonic	5	4	n
173.3	101000110001	Raga Vaijayanti	5	4	n
173.4	110001101000	African Pentatonic 4	5	4	n
173.5	110100011000	Phrygian Pentatonic	5	4	n
174.1	100011000111	Daptimic	6	4	j
174.2	100011110001	Mocrimic	6	4	j
174.3	110001100011	Zythimic	6	4	j
174.4	110001111000	Kygimic	6	4	j
174.5	111000110001	Raga Vijayasri	6	4	j
174.6	111100011000	Zynimic	6	4	j
175.1	100011001001	Raga Girija	5	4	n
175.2	100100110001	Raga Multani	5	4	n
175.3	100110001100	Mocritonic	5	4	n
175.4	110001100100	Anchihoye	5	4	n
175.5	110010011000	Raga Reva	5	4	n
176.1	100011001010	Epygitonic	5	4	n
176.2	100101010001	Kagitonic	5	4	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
323.4	101101010101	Melodic Minor Ascending (Melodic Minor MM1)	7	2	n
323.6	110101010110	Dorian Flat 2 (Melodic Minor MM2)	7	2	n
323.1	101010101101	Lydian Augmented (Melodic Minor MM3)	7	2	n
323.2	101010110110	Acoustic (Melodic Minor MM4)	7	2	n
323.3	101011011010	Major-Minor (Melodic Minor MM5)	7	2	n
323.5	101101101010	Minor Locrian (Melodic Minor MM6)	7	2	n
323.7	110110101010	Superlocrian (Melodic Minor MM7)	7	2	n
324.1	101010101111	Thyryllic	8	2	j
324.2	101010111110	Gygyllic	8	2	j
324.3	101011111010	Sodyllic	8	2	j
324.4	101111101010	Goryllic	8	2	j
324.5	110101010111	Phryryllic	8	2	j
324.6	111010101011	Ionaptyllic	8	2	j
324.7	111101010101	Gynyllic	8	2	j
324.8	111110101010	Bothyllic	8	2	j
325.1	101011010101	Major (Ionian)	7	2	n
325.2	101101010110	Dorian (Ionian 2nd degree)	7	2	n
325.3	110101011010	Phrygian	7	2	n
325.4	101010110101	Lydian (Ionian 4th degree)	7	2	n
325.5	101011010110	Mixolydian (Ionian 5th degree)	7	2	n
325.6	101101011010	Aeolian (Ionian 6th degree)	7	2	n
325.7	110101101010	Locrian (Ionian 7th degree)	7	2	n
326.1	101010110111	Spanish Octamode 8th Rotation	8	2	j
326.2	101011011110	Spanish Octamode 6th Rotation	8	2	j
326.3	101101111010	Spanish Octamode 4th Rotation	8	2	j
326.4	101111010101	Spanish Octamode 1st Rotation	8	2	j
326.5	110101011011	Hamel	8	2	j
326.6	110111101010	Espla's Scale	8	2	j
326.7	111010101101	Spanish Octamode 10th Rotation	8	2	j
326.8	111101010110	Adonai Malakh	8	2	j
327.1	101010111011	Racryllic	8	2	j
327.2	101011101110	Epicryllic	8	2	j
327.3	101110101011	Aerothyllic	8	2	j
327.4	101110111010	Stygyllic	8	2	j
327.5	110101011101	Neapolitan Major and Minor Mixed	8	2	j
327.6	110111010101	Stythyllic	8	2	j
327.7	111010101110	Mixoryllic	8	2	j
327.8	111011101010	Syryllic	8	2	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
176.3	101000110010	Epyritonic	5	4	n
176.4	101010001100	Zogitonic	5	4	n
176.5	110010101000	Zaptitonic	5	4	n
177.1	100011001011	Phralimic	6	4	j
177.2	100101110001	Rathimic	6	4	j
177.3	101110001100	Katocrimic	6	4	j
177.4	110001100101	Katynimic	6	4	j
177.5	110010111000	Raga Dhavalangam	6	4	j
177.6	111000110010	Phryptimic	6	4	j
178.1	100011001100	Zothitonic	5	4	n
178.2	100100011001	Kyritonic	5	4	n
178.3	100110010001	Ionagitonic	5	4	n
178.4	110010001100	Aeolapritonic	5	4	n
178.5	110011001000	Raga Megharanjani	5	4	n
179.1	100011001101	Solimic	6	4	n
179.2	100110110001	Raga Rasamanjari	6	4	n
179.3	101100011001	Zadimic	6	4	n
179.4	110001100110	Sygimic	6	4	n
179.5	110011011000	Raga Purna Pancama	6	4	n
179.6	110110001100	Aeologimic	6	4	n
180.1	100011001110	Thogimic	6	4	j
180.2	100111010001	Donimic	6	4	j
180.3	101000110011	Raga Malarani	6	4	j
180.4	110011101000	Rythimic	6	4	j
180.5	110100011001	Panimic	6	4	j
180.6	111010001100	Aeoloptimic	6	4	j
181.1	100011001111	Parian	7	4	j
181.2	100111110001	Thylian	7	4	j
181.3	110001100111	Dycrian	7	4	j
181.4	110011111000	Ionaptian	7	4	j
181.5	111000110011	Mela Raghupriya	7	4	j
181.6	111100011001	Thagian	7	4	j
181.7	111110001100	Lolian	7	4	j
182.1	100011010010	Mixolydian Pentatonic	5	4	n
182.2	100101000110	Raga Chandrakauns	5	4	n
182.3	101000110100	Raga Shri Kalyan	5	4	n
182.4	101001010001	Raga Desh	5	4	n
182.5	110100101000	Raga Chhaya Todi	5	4	n
183.1	100011010011	Raga Tilang	6	4	j
183.2	100111000110	Zogimic	6	4	j
183.3	101001110001	Kagimic	6	4	j
183.4	110001101001	Lycrimic	6	4	j
183.5	110100111000	Zaptimic	6	4	j
183.6	111000110100	Raga Chandrajyoti	6	4	j
184.1	100011010100	Raga Nagasvaravali	5	4	n
184.2	100100011010	Raga Shailaja	5	4	n
184.3	101001000110	Raga Guhamanohari	5	4	n
184.4	101010010001	Raga Hamsadhvani	5	4	n
184.5	110101001000	Raga Chitthakarshini	5	4	n
185.1	100011010101	Raga Hari Nata	6	4	n
185.2	101010110001	Raga Caturangini	6	4	n
185.3	101011000110	Raga Rageshri	6	4	n
185.4	101100011010	Raga Trimurti	6	4	n
185.5	110001101010	Kycrimic	6	4	n
185.6	110101011000	Raga Suddha Simantini	6	4	n
186.1	100011010110	Raga Khamas	6	4	n
186.2	101000110101	Raga Nishadi	6	4	n

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
328.1	101010111101	Ionocryllic	8	2	j
328.2	101011110110	Lydian/Mixolydian Mixed	8	2	j
328.3	101101010111	Raga Mian Ki Malhar	8	2	j
328.4	101111011010	Epiryllic	8	2	j
328.5	110101011110	Epocryllic	8	2	j
328.6	110110101011	Magen Abot 1	8	2	j
328.7	111011010101	Staptyllic	8	2	j
328.8	111101101010	Aeradyllic	8	2	j
329.1	101010111111	Kyrygic	9	2	j
329.2	101011111110	Sythygic	9	2	j
329.3	101111111010	Katycrygic	9	2	j
329.4	110101011111	Styrygic	9	2	j
329.5	111010101111	Monygic	9	2	j
329.6	111101010111	Darygic	9	2	j
329.7	111110101011	Lothygic	9	2	j
329.8	111111010101	Sylygic	9	2	j
329.9	111111101010	Tharygic	9	2	j
330.1	101011010111	Dominant Bebop	8	2	j
330.2	101011110101	Ichikotsuchô	8	2	j
330.3	101101011110	Raga Mukhari	8	2	j
330.4	101111010110	Minor Bebop	8	2	j
330.5	110101101011	Prokofiev	8	2	j
330.6	110101111010	Phrygian/Locrian Mixed	8	2	j
330.7	111010110101	Quartal Octamode 10th Rotation	8	2	j
330.8	111101011010	Quartal Octamode	8	2	j
331.1	101011011011	Stogyllic	8	2	j
331.2	101101101110	Ionidyllic	8	2	j
331.3	101101110101	Stalyllic	8	2	j
331.4	101110101101	Mocryllic	8	2	j
331.5	110101101101	Baryllic	8	2	j
331.6	110110111010	Bebop Locrian	8	2	j
331.7	110111010110	JG Octatonic	8	2	j
331.8	111010110110	Aeolyryllic	8	2	j
332.1	101011011101	Major Bebop	8	2	j
332.2	101101011011	Gregorian Nr.4	8	2	j
332.3	101101110110	Blues Scale II	8	2	j
332.4	101110110101	Gycryllic	8	2	j
332.5	110101101110	Moptyllic	8	2	j
332.6	110110101101	Magen Abot 2	8	2	j
332.7	110111011010	Spanish Phrygian	8	2	j
332.8	111011010110	Lyryllic	8	2	j
333.1	101011011111	Raga Pahadi	9	2	j
333.2	101101111110	Kiourdi	9	2	j
333.3	101111110101	Zolygic	9	2	j
333.4	110101101111	Ryptygic	9	2	j
333.5	110111111010	Styptygic	9	2	j
333.6	111010110111	Aeralygic	9	2	j
333.7	111101011011	Zyphygic	9	2	j
333.8	111110101101	Katygic	9	2	j
333.9	111111010110	Sydygic	9	2	j
334.1	101011101011	Messiaen Mode 6	8	2	j
334.2	101110101110	Messiaen Mode 6 Rotation 1	8	2	j
334.3	110101110101	Van der Horst Octatonic	8	2	j
334.4	111010111010	Messiaen Mode 6 Rotation 2	8	2	j
335.1	101011101101	Dalyllic	8	2	j
335.2	101101011101	Bebop Minor	8	2	j
335.3	101101101011	Gathyllic	8	2	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
186.3	101011010001	Raga Nalinakanti	6	4	n
186.4	101101000110	Raga Bagesri	6	4	n
186.5	110100011010	Raga Kashyapi	6	4	n
186.6	110101101000	Soptimic	6	4	n
187.1	100011010111	Raga Madhuri	7	4	j
187.2	101011110001	Gorian	7	4	j
187.3	101111000110	Aeolodian	7	4	j
187.4	110001101011	Zacrian	7	4	j
187.5	110101111000	Aeolyrian	7	4	j
187.6	111000110101	Mela Pavani	7	4	j
187.7	111100011010	Doptian	7	4	j
188.1	100011011001	Raga Paraju	6	4	n
188.2	100110001101	African Pentatonic 3	6	4	n
188.3	101100110001	Raga Amarasenapriya	6	4	n
188.4	110001101100	Phrocrimic	6	4	n
188.5	110011000110	Raga Rudra Pancama	6	4	n
188.6	110110011000	Lygimic	6	4	n
189.1	100011011010	Raga Kamalamanohari	6	4	n
189.2	101000110110	Raga Sarasvati	6	4	n
189.3	101010001101	Aelothimic	6	4	n
189.4	101101010001	Raga Sindhura Kafi	6	4	n
189.5	110101000110	Sagimic	6	4	n
189.6	110110101000	Barimic	6	4	n
190.1	100011011011	Stygian	7	4	j
190.2	101101110001	Aerogian	7	4	j
190.3	101110001101	Baptian	7	4	j
190.4	110001101101	Aeolydian	7	4	j
190.5	110110111000	Aeolygian	7	4	j
190.6	110111000110	Dacrian	7	4	j
190.7	111000110110	Mela Navanitam	7	4	j
191.1	100011011100	Raga Saravati	6	4	j
191.2	100100011011	Katathimic	6	4	j
191.3	101110010001	Ionocrimic	6	4	j
191.4	110010001101	Ionygimic	6	4	j
191.5	110111001000	Stodimic	6	4	j
191.6	111001000110	Zycrimic	6	4	j
192.1	100011011101	Stythian	7	4	j
192.2	101100011011	Monian	7	4	j
192.3	101110110001	Pygian	7	4	j
192.4	110001101110	Thalian	7	4	j
192.5	110110001101	Sorian	7	4	j
192.6	110111011000	Kothian	7	4	j
192.7	111011000110	Rodian	7	4	j
193.1	100011011110	Zorian	7	4	j
193.2	101000110111	Gyphian	7	4	j
193.3	101111010001	Epothian	7	4	j
193.4	110100011011	Sudhvidhamagini	7	4	j
193.5	110111101000	Aeragian	7	4	j
193.6	111010001101	Lyptian	7	4	j
193.7	111101000110	Salian	7	4	j
194.1	100011011111	Dolyllic	8	4	j
194.2	101111110001	Bydyllic	8	4	j
194.3	110001101111	Dogyllic	8	4	j
194.4	110111111000	Moryllic	8	4	j
194.5	111000110111	Phrygyllic	8	4	j
194.6	111100011011	Gyryllic	8	4	j
194.7	111110001101	Phracryllic	8	4	j
194.8	111111000110	Pocryllic	8	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
335.4	101110110110	Ionyphyllic	8	2	j
335.5	110101110110	Stylyllic	8	2	j
335.6	110110101110	Mixopyryllic	8	2	j
335.7	110110110101	Shostakovich	8	2	j
335.8	111011011010	Zaptyllic	8	2	j
336.1	101011101111	Porygic	9	2	j
336.2	101110111110	Mocrygic	9	2	j
336.3	101111101011	Katarygic	9	2	j
336.4	110101110111	Aeolanygic	9	2	j
336.5	110111110101	Barygic	9	2	j
336.6	111010111011	Aeolonygic	9	2	j
336.7	111011111010	Aeolyrygic	9	2	j
336.8	111101011101	Zanygic	9	2	j
336.9	111110101110	Aerocrygic	9	2	j
337.1	101011110111	Taishikicho	9	2	j
337.2	101111010111	Raga Malgunji	9	2	j
337.3	101111011110	Houseini	9	2	j
337.4	110101111011	Ionoptygic	9	2	j
337.5	110111101011	Garygic	9	2	j
337.6	111010111101	Epithygic	9	2	j
337.7	111011110101	Zylygic	9	2	j
337.8	111101011110	Diatonic Dorian Mixed	9	2	j
337.9	111101111010	Locrian/Aeolian Mixed	9	2	j
338.1	101011111011	Kaptygic	9	2	j
338.2	101110101111	Ionidygic	9	2	j
338.3	101111101110	Sacrygic	9	2	j
338.4	110101111101	Stalygic	9	2	j
338.5	110111010111	Stophygic	9	2	j
338.6	111010111110	Stonygic	9	2	j
338.7	111011101011	Kynygic	9	2	j
338.8	111101110101	Epilygic	9	2	j
338.9	111110111010	Padygic	9	2	j
339.1	101011111101	Apinygic	9	2	j
339.2	101101011111	Raga Pilu	9	2	j
339.3	101111110110	Blues Enneatonic II	9	2	j
339.4	110101111110	Boptygic	9	2	j
339.5	110110101111	Aerygic	9	2	j
339.6	111011010111	Chromatic Bebop	9	2	j
339.7	111101101011	Lythygic	9	2	j
339.8	111110110101	Gothygic	9	2	j
339.9	111111011010	Radygic	9	2	j
340.1	101011111111	Sydyllian	10	2	j
340.10	111111111010	Mixodyllian	10	2	j
340.2	101111111110	Katogyllian	10	2	j
340.3	110101111111	Katyllian	10	2	j
340.4	111010111111	Dagyllian	10	2	j
340.5	111101011111	Phradyllian	10	2	j
340.6	111110101111	Kataphyllian	10	2	j
340.7	111111010111	Loptyllian	10	2	j
340.8	111111101011	Ryptyllian	10	2	j
340.9	111111110101	Aeradyllian	10	2	j
341.1	101101101101	Diminished (Whole step half step)	8	2	n
341.2	110110110110	Octatonic (Half step whole step)	8	2	n
342.1	101101101111	Koptygic	9	2	j
342.2	101101111101	Zycrygic	9	2	j
342.3	101111101101	Laptygic	9	2	j
342.4	110110110111	Epidygic	9	2	j
342.5	110110111110	Raphygic	9	2	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
195.1	100011100011	Messiaen Mode 5 Rotation 1	6	4	j
195.2	110001110001	Messiaen Mode 5	6	4	j
195.3	111000111000	Messiaen Mode 5 Rotation 2	6	4	j
196.1	100011100100	Ionyptitonic	5	4	j
196.2	100100011100	Bylitonic	5	4	j
196.3	100100100011	Stolitonic	5	4	j
196.4	110010010001	Zalitonic	5	4	j
196.5	111001001000	Gyritonic	5	4	j
197.1	100011100101	Mythimic	6	4	j
197.2	100101100011	Rothimic	6	4	j
197.3	101100011100	Katarimic	6	4	j
197.4	110001110010	Sylimic	6	4	j
197.5	110010110001	Raga Mandari	6	4	j
197.6	111001011000	Sogimic	6	4	j
198.1	100011100110	Bolimic	6	4	j
198.2	100110100011	Kodimic	6	4	j
198.3	101000111001	Ralimic	6	4	j
198.4	110011010001	Raga Gaula	6	4	j
198.5	110100011100	Tholimic	6	4	j
198.6	111001101000	Bothimic	6	4	j
199.1	100011100111	Ionarian	7	4	j
199.2	100111100011	Zathian	7	4	j
199.3	110001110011	Syptian	7	4	j
199.4	110011110001	Zydian	7	4	j
199.5	111000111001	Mela Jhalavarali	7	4	j
199.6	111001111000	Dynian	7	4	j
199.7	111100011100	Radian	7	4	j
200.1	100011101001	Kanimic	6	4	j
200.2	100110001110	Phrythimic	6	4	j
200.3	101001100011	Zarimic	6	4	j
200.4	110001110100	Rorimic	6	4	j
200.5	110100110001	Zodimic	6	4	j
200.6	111010011000	All-Trichord Hexachord	6	4	j
201.1	100011101010	Mycrimic	6	4	j
201.2	101000111010	Raga Jaganmohanam	6	4	j
201.3	101010001110	Katothimic	6	4	j
201.4	101010100011	Zyptimic	6	4	j
201.5	110101010001	Phrydimic	6	4	j
201.6	111010101000	Ionorimic	6	4	j
202.1	100011101011	Thacrian	7	4	j
202.2	101011100011	Aeolonian	7	4	j
202.3	101110001110	Aeradian	7	4	j
202.4	110001110101	Zyrian	7	4	j
202.5	110101110001	Aeolyptian	7	4	j
202.6	111000111010	Mela Jalarnava	7	4	j
202.7	111010111000	Dodian	7	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
342.6	110111110110	Mycrygic	9	2	j
342.7	111011011011	Epolygic	9	2	j
342.8	111101101101	Rodygic	9	2	j
342.9	111110110110	Pylygic	9	2	j
343.1	101101110111	Diminishing Nonamode 8th Rotation	9	2	j
343.2	101110111101	Nine Tone Scale	9	2	j
343.3	101111011011	Diminishing Nonamode 1st Rotation	9	2	j
343.4	110110111011	Diminishing Nonamode 9th Rotation	9	2	j
343.5	110111011110	Diminishing Nonamode 6th Rotation	9	2	j
343.6	110111101101	Diminishing Nonamode 2nd Rotation	9	2	j
343.7	111011011101	Diminishing Nonamode	9	2	j
343.8	111011110110	Youlan	9	2	j
343.9	111101101110	Diminishing Nonamode Basic	9	2	j
344.1	101101111011	Aeolorygic	9	2	j
344.2	101110110111	Moptygic	9	2	j
344.3	101111011101	Gycrygic	9	2	j
344.4	110110111101	Gocrygic	9	2	j
344.5	110111011011	Moorish Phrygian	9	2	j
344.6	110111101110	Thydygic	9	2	j
344.7	111011011110	Ionocrygic	9	2	j
344.8	111011101101	Modygic	9	2	j
344.9	111101110110	Lyrygic	9	2	j
345.1	101101111111	Gothyllian	10	2	j
345.10	111111110110	Aerygyllian	10	2	j
345.2	101111111101	Bacryllian	10	2	j
345.3	110110111111	Zolyllian	10	2	j
345.4	110111111110	Lythyllian	10	2	j
345.5	111011011111	Styptyllian	10	2	j
345.6	111101101111	Mathyllian	10	2	j
345.7	111110110111	Bagyllian	10	2	j
345.8	111111011011	Raga Sindhi-Bhairavi	10	2	j
345.9	111111101101	Dathyllian	10	2	j
346.1	101110111011	Messiaen Mode 3	9	2	j
346.2	110111011101	Messiaen Mode 3 Rotation 2	9	2	j
346.3	111011101110	Messiaen Mode 3 Rotation 1	9	2	j
347.1	101110111111	Staptyllian	10	2	j
347.10	111111101110	Rocryllian	10	2	j
347.2	101111111011	Epocryllian	10	2	j
347.3	110111011111	Ragyllian	10	2	j
347.4	110111111101	Goptyllian	10	2	j
347.5	111011101111	Katagyllian	10	2	j
347.6	111011111110	Danyllian	10	2	j
347.7	111101110111	Epinyllian	10	2	j
347.8	111110111011	Sagyllian	10	2	j
347.9	111111011101	Zyryllian	10	2	j
348.1	101111011111	Major/Minor Mixed	10	2	j

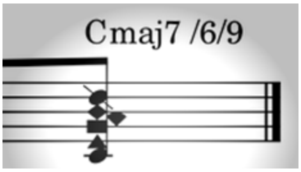
No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
203.1	100011101100	Aerothimic	6	4	j
203.2	100100011101	Ionylimic	6	4	j
203.3	101100100011	Phrycrimic	6	4	j
203.4	110010001110	Kyptimic	6	4	j
203.5	110110010001	Dorimic	6	4	j
203.6	111011001000	Stagimic	6	4	j
204.1	100011101101	Aeolathian	7	4	j
204.2	101100011101	Thygian	7	4	j
204.3	101101100011	Rolian	7	4	j
204.4	110001110110	Katalian	7	4	j
204.5	110110001110	Pydian	7	4	j
204.6	110110110001	Padian	7	4	j
204.7	111011011000	Bythian	7	4	j
205.1	100011101110	Katacrian	7	4	j
205.2	101000111011	Zocrian	7	4	j
205.3	101110100011	Mylian	7	4	j
205.4	110100011101	Thorian	7	4	j
205.5	110111010001	Bathian	7	4	j
205.6	111010001110	Godian	7	4	j
205.7	111011101000	Sodian	7	4	j
206.1	100011101111	Thagyllic	8	4	j
206.2	101111100011	Gylyllic	8	4	j
206.3	110001110111	Epogyllic	8	4	j
206.4	110111110001	Phraptyllic	8	4	j
206.5	111000111011	Ronyllic	8	4	j
206.6	111011111000	Thoptyllic	8	4	j

No.	Pattern	Name	No. of tones	Largest interval	2 semitones in a row
348.10	111111011110	Soryllian	10	2	j
348.2	101111110111	Minor Pentatonic With Leading Tones	10	2	j
348.3	110111101111	Aeoryllian	10	2	j
348.4	110111111011	Zyphyllian	10	2	j
348.5	111011110111	Ionyllian	10	2	j
348.6	111011111101	Solyllian	10	2	j
348.7	111101111011	Epityllian	10	2	j
348.8	111101111110	Gadyllian	10	2	j
348.9	111110111101	Godyllian	10	2	j
349.1	101111101111	Messiaen Mode 7 Rotation 3	10	2	j
349.2	110111110111	Messiaen Mode 7 Rotation 2	10	2	j
349.3	111011111011	Messiaen Mode 7 Rotation 1	10	2	j
349.4	111101111101	Messiaen Mode 7	10	2	j
349.5	111110111110	Messiaen Mode 7 Rotation 4	10	2	j
350.1	101111111111	Chromatic Undecamode 11	11	2	j
350.10	111111111101	Chromatic Undecamode 2	11	2	j
350.11	111111111110	Chromatic Undecamode	11	2	j
350.2	110111111111	Chromatic Undecamode 10	11	2	j
350.3	111011111111	Chromatic Undecamode 9	11	2	j
350.4	111101111111	Chromatic Undecamode 8	11	2	j
350.5	111110111111	Chromatic Undecamode 7	11	2	j
350.6	111111011111	Chromatic Undecamode 6	11	2	j
350.7	111111101111	Chromatic Undecamode 5	11	2	j
350.8	111111110111	Chromatic Undecamode 4	11	2	j
350.9	111111111011	Chromatic Undecamode 3	11	2	j
351.1	111111111111	Chromatic	12	1	j

Table 52 - All 2048 possible scales, summarized in 351 groups (scales and their modes)

4 Chords

4.1 Definition and structure



4.1.1 Definition chord

A chord is a subset of notes of a scale that are played simultaneously, i.e. arranged vertically.

4.1.2 Structure

In principle, the structure of the chords based on the scale works in the same way for all (seven-note) scales. We will look at this using the seven-note Ionian major scale, see chapter 5.1 (The Ionian major scale and its Major^7 chord):

[24]

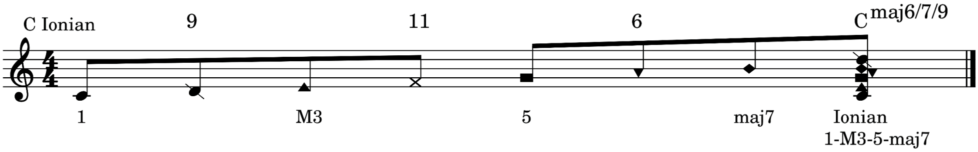


Figure 22 - The derivation of the major 7 chord from the Ionian scale, here in C

The root chord (here C^{maj7}) is formed from the 1st (root), 3rd (here M3), 5th and 7th (here maj7) notes:

[116]

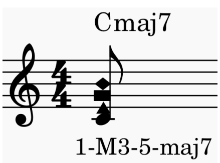


Figure 23 - The C^{maj7}chord

Note

The designations of the intervals (1, 9, M3, 11, maj7 etc.) will be introduced in chapter 4.3 (Interval designations).

The 2nd (here the 9th), 4th (here the 11th) and 6th tones are the optional tones, the so-called tensions, that can be added as required. Unfortunately, they are not labeled consistently.

The 2nd note is always designated as the 9, i.e. the scale is extended by an octave and the 2nd note is taken there, i.e. the 9th note counted from the 1st note. The scale has 7 notes, i.e. the 8th corresponds to the 1st, the 9th to the 2nd and so on.

The 4th note is designated as the 11 or sus4 (from suspended fourth). 11 because the scale is again extended by an octave and the 4th note, i.e. the 11th note from the 1st note, is used. The sus4 is only used for the dominant seventh chord, otherwise the 11 is used.

The 6th note is designated as 13 or 6. The 6 is used for the tonic types Ionian, Lydian and melodic minor (MM1 or MMA), otherwise the 13. 13 because the scale is again extended by an octave and the 6th tone there, i.e. the 13th note from the 1st note, is used.

For better differentiation, this symbolism, i.e. the type of note heads depending on the respective interval, is used throughout this harmony theory:

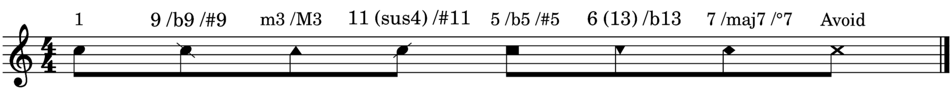


Figure 24 - The different types of noteheads used within this book

Important

Even if tensions are referred to as 9, 11 or 13, for example, this does not necessarily mean that they have to be a ninth, eleventh or thirteenth away from the root note in the chord.

For example, the major 9 can be two semitones above or the 13 can be three semitones below the root note.

[117]

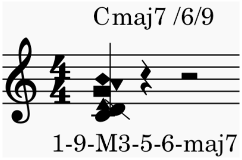


Figure 25 - The C^{maj7} chord with the 6th and 9th as tensions

Note

> Tensions merely expand the character of a scale or chord, they are not intended to change it. This principle is important; it helps determine whether a note in the scale is to be avoided or not.

4.1.3 Example dominant seventh chord

The dominant seventh chord (here G^7), for example, is formed from the Mixolydian scale, see Chapter 5.5 (The Mixolydian major scale and its dominant seventh chord). This is explained here using the example of G Mixolydian:

[32]

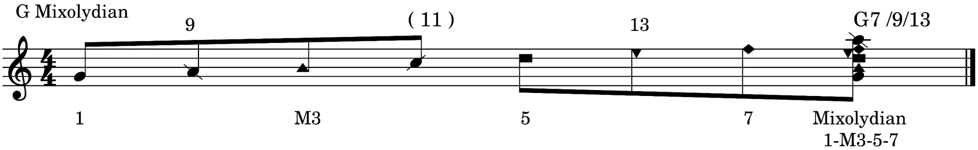


Figure 26 - The derivation of the dominant seventh chord from the Mixolydian scale, here in G

The basic chord is again formed from the 1st (root note), 3rd (here M3), 5th and 7th tone:

[104]

Figure 27 - G^7 - The dominant seventh chord in G

The tensions here are the 2nd (the 9th) and the 6th tone (the 13th):

[105]

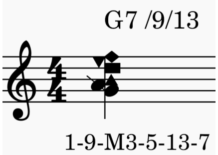


Figure 28 - The dominant seventh chord in G with the 9th and 13th as tensions

In this case, the 4th tone (sus4) is not a tension, but is used as an alternative to the major 3rd (M3). The chord is then called G^{7sus4} with the tensions 9 and 13:

[107]

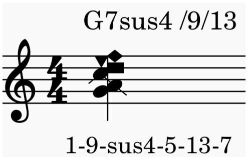


Figure 29 - The sus4 chord in G, i.e. the dominant seventh chord with the sus4 (perfect fourth) instead of the M3 (major 3rd)

> The major 3rd M3 and the sus4 are mutually exclusive. In $G^{7/9/13}$ the sus4 is considered a note to be avoided, in $G^{7sus4\,/9/13}$ the major 3rd M3 is considered a note to be avoided.

4.1.4 Example minor seventh chord

For example, a minor seventh chord (here Dm^7) is formed from the Dorian scale, see Chapter 5.2 (The Dorian scale and its minor seventh chord). This is explained here using the example of D Dorian:

[29]

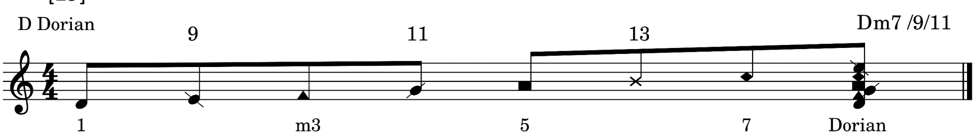


Figure 30 - The derivation of the (Dorian) minor seventh chord from the Dorian scale with the 9th and 13th as tensions, here in D

The basic chord is again formed from the 1st (root note), 3rd (minor 3rd m3), 5th and 7th note:

[118]

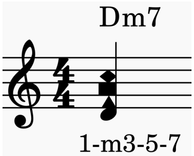


Figure 31 - The Dm⁷ chord

The tensions are here the 2nd (here the 9th) and the 4th (the 11th) tone:

[108]

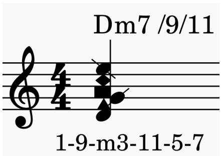


Figure 32 - The Dm⁷ chord with the 9th and 11th as tensions

The 6th tone, the 13th, is not used as a tension. It is considered an avoid note, see note 6 in chapter 4.3 (Interval designations).

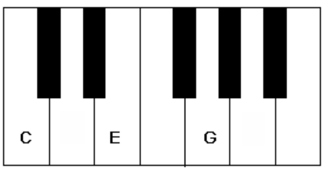
4.2 Chord types

We distinguish between the following chord types, which result from the 3-note chords (triads) and their four-note extensions introduced in chapter 2.2 (Three-note chords within an octave):

	Chord type (Triad)	**Chord type extension (Four-note chord)**	**Pattern**	**Example chord**
Major	Major triad		1-M3-5	C
		Major^{7}	1-M3-5-maj7	C^{maj7}
		Dominant seventh	1-M3-5-7	C^{7}
	Augmented triad		1-M3-#5 or 1-M3-b13	C^{+} or C^{aug}
		Major$^{7\#5}$	1-M3-#5-maj7	C$^{maj7\#5}$
		Dominant seventh/b13	1-M3-b13-7	C^{7b13}
	Major^{b5} triad [4]		1-M3-b5	C$^{(b5)}$
		Dominant seventh/b5	1-M3-b5-7	C$^{7/b5}$
Minor	Minor triad		1-m3-5	Cm
		Minor seventh	1-m3-5-7	Cm^{7}
		Minor-Major^{7}	1-m3-5-maj7	Cm^{maj7}
	Diminished triad		1-m3- b5	C°
		Half diminished four-note chord	1-m3-b5-7	C^{m7b5}
		Diminished four-note chord	1-m3-b5-b7	C^{dim}
	Sus4 triad		1-sus4-5	C^{sus4}, Cm^{11}
		7sus4	1-sus4-5-7	C^{7sus4} Cm$^{7/11}$

Table 53 - chord types

4.2.1 Major chords



Based on the definition that we form the basic chord from the 1st, 3rd, 5th and 7th notes of a scale, there are basically only two possible keys: major and minor. Major chords have a major third (M3), minor chords have a minor third (m3).

The dyad 1-M3 can be expanded by a perfect fifth (5) to the major triad 1-M3-5, or by an augmented fifth (#5) to the augmented triad 1-M3-#5, or by a diminished fifth (b5) to the triad 1-M3-b5. The triads can then be expanded by including a minor seventh (7) or major seventh (maj7).

Major					
Chord type (Triad) (Pattern)	**Chord type extension (four-note chord) (Pattern)**	**Example chord**	**Corresponding scales** [2]	**Tensions** [2]	**Avoid notes** [2]
Major triad (1-M3-5)		C	Ionian Lydian Mixolydian HM5 HM6 MM4 MM5 HTWT HD1 HD6 DHM5 DHM6	9, 6, maj7 9, #11, 6, maj7 9, 13, 7 b9, b13, 7 #11, 6 9, #11, 13, 7 9, 11, b13, 7 b9, #9, 13, 7 9 #11, 6 -- #11	11 -- (4) (4) #9 -- -- -- 11, (b6) #9 b9, 11, b13 #9, #13
	$Major^{7}$ (1-M3-5-maj7)	C^{maj7}	Ionian Lydian HM6 HD1 HD6 DHM5 DHM6	9, 6 9, #11, 6 #11, 13, 9 #11, 6 -- #11	11 -- #9 11, (b6) #9 b9, 11, b13 #9, #13
	Dominant seventh (1-M3-5-7)	C^{7}	Mixolydian HM5 MM4 MM5 HTWT, HD3 HD5	9, 13 b9, b13 9, #11, 13 9, b13 b9, #9, #11, 13 b9, #9, b13 b9, 13	(4) (11) -- (11) -- -- (11)
Augmented triad [1] (1-M3-#5) resp. (1-M3-b13) [3]		C^{+} or C^{aug}	HM3 HM5 HM7 MM3 MM5 MM7 WT	9, maj7 b9, 7 b9, #9, #11 9, #11, maj7 9, 7 b9, #9, #11, 7 9, #11, 7	11, (13) (11), (5) (b7) (6) (11), (b13) -- --
	$Major^{7\#5}$ (1-M3-#5-maj7)	$C^{maj7\#5}$	HM3 MM3 DHM3	9 9, #11 --	11, (13) (6) #9, 11, (6)
	Dominant seventh/b13 (1-M3-b13-7)	C^{7b13}	HM5 HM7 MM5 MM7 WT	b9 b9, #9, #11 9 b9, #9, #11 9, #11	(11), (5) (b7) (11), (5) -- --
$Major^{b5}$ triad (1-M3-b5) [4]	Dominant seventh/b5 (1-M3-b5-7)	$C^{7/b5}$	DHM2	b9, 13	(11)

Table 54 - Chord types and extensions for Major

1) In addition to the major triad, the augmented triad also belongs to the major key family due to its major 3rd (M3).

2) Column 2 shows the scales from which the chord types are derived. They - just like the tensions and the avoid tones - are gradually introduced as part of this theory of harmony. Only from the scales can you ultimately derive the enharmonically correct chord names. They determine whether we are talking about a b5 or #11, #5 or b13, etc. in the chord.

3) The designation #5 is used for the Maj7#5 chord derived from the HM3 or MM3 scales. For the chords derived from the HM5, HM7, MM5, MM7 and GT scales, the designation b13 is more appropriate. Only the augmented triad itself should be referred to as C^{+} or C^{aug}.

4) A diminished fifth (b5) is usually notated as an augmented 11th (#11) in major scales and major chords. The only exception is the chord derived from the double harmonic minor scale on the 2nd degree (DHM2) with the structure 1-M3-b5-7. The structure 1-M3-b5-maj7 does not appear in the scales presented in more detail in this harmony theory.

4.2.2 Minor chords

In addition to the major key and its major chords with a major 3rd (M3), there is also the minor key, which is formed from the minor chords with a minor 3rd (m3).

The basic interval with a minor third (1-m3) can be expanded to a minor triad with a perfect fifth (1-m3-5) or to a diminished triad with a diminished fifth (1-m3-b5).

The minor triad can in turn be expanded by the minor 7th (7) to the minor seventh four-note chord with the structure 1-m3-5-7 or by the major 7th (maj7) to the minor-major7 four-note chord with the structure 1-m3-5-maj7.

The diminished triad with the designation °, for example C°, can be expanded by the diminished 7th (b7) to form the diminished four-note chord with the structure 1-m3-b5-b7, for example C^{dim}. The diminished 7th (b7) with its interval of 9 semitones is a sounding major 6th (6).

For the diminished triad (1-m3-b5) we use the ° symbol, e.g. C° and for the four-note chord (1-m3-b5-b7) we use the dim symbol, e.g. C^{dim}.

Minor					
Chord type (Triad) (Pattern)	**Chord type extension (Four-note chord) (Pattern)**	**Example chord**	**Corresponding scales** [2)]	**Tensions** [2)]	**Avoid notes** [2)]
Minor triad (1-m3-5)		Cm	Dorian	9, 11, 7	(13)
			Phrygian	11, 7	b9, b13
			Aeolian	9, 11, 7	b13
			HM1	9, 11, maj7	b13
			HM4	9, 7	#11, (13)
			HM6	#11, 13, maj7	#9
			MM1	9, 11, 6, maj7	
			MM2	11, 7	b9, (13)
			HTWT	b9, #9, #11, 13, 7	--
			Minor pentatonic	11, #11, 7	--
			HD4	9, #11, 6, maj7	--
			DHM1	9, #11, maj7	--
	Minor seventh (1-m3-5-7)	Cm^7	Dorian	9, 11	(13)
			Phrygian	11	b9, b13
			Aeolian	9, 11	b13
			HM4	9	(13)
			MM2	11	b9, (13)
			HTWT	b9, #9, #11	--
			Minor pentatonic	11, #11	--
	Minor-Major^7 (1-m3-5-maj7)	Cm^{maj7}	HM1	9, 11	b13
			MM1	9, 11, 6	--
			HD4,	9, #11, 6	--
			DHM1	9, #11, maj7	(b6)
Diminished triad [1)] (1-m3-b5)		C°	Locrian	11, b13, 7	b9
			HM2	b9, 13, 7	b9
			HM4	9, 7	(13)
			MM6	9, 11, b13, 7	--
			MM7	b9, #9, b13, 7	--
			HTWT	b9, #9, 13, 7	--
			WTHT	9, 11, b13, b7, b15	--
			Minor pentatonic	11, 7	--
			HD7	b9, 11, b13, b7	--
	Half-diminished (1-m3-b5-7)	Cm^{7b5}	Locrian	11, b13	b9
			HM2	b9, 13	b9
			HM4	9	(13)
			MM6	9, 11, b13	--
			MM7	b9, #9, b13	--
			HTWT	b9, #9, 13	--
			Minor pentatonic	11	--
			HD2	9, 11, 13	--
	Diminished four-note chord (1-m3-b5-b7) [3)]	C^{dim}	WTHT	9, 11, b13, b15	--
			HD7	b9, 11, b13	--

Table 55 - Chord types and extensions for minor

1) In addition to the minor triad, the diminished triad also belongs to the minor key family because of its minor 3rd (m3).

2) Column 4 shows the scales from which the chord types are derived. They are - just like the tensions and the avoid tones - gradually introduced as part of this book.

3) The combination 1-m3-b5-maj7 appears in the scales examined in more detail in this book only in the whole-tone half-tone scale, where the maj7 must be notated as b15, since it already contains the diminished seventh b7.

4.2.3 Chords with sus4 triad

The sus4 triad (1-sus4-5) is not an own mode. It is part of both minor and major chords.

Sus4					
Chord type (Triad) (Pattern)	**Chord type extension (Four-note chord) (Pattern)**	**Example chord**	**Corresponding scales**	**Tensions**	**Avoid notes**
Sus4 triad (1-sus4-5)		C^{sus4}	Mixolydian HM5 MM5 HD5	9, 13, 7 b9, 5, b13, 7 9, b13, 7 b9, 13	(M3) (M3) (M3) (M3)
		Cm^{11}	Dorian Phrygian Aeolian	9, m3, 7 m3, 7 9, m3, 7	(13) b9, b13 b13
	7sus4 four-note-chord (1-sus4-5-7)	C^{7sus4}	Mixolydian HM5 MM5	9, 13 b9, 5, b13 9, b13	(M3) (M3) (M3)
		$Cm^{7/11}$	Dorian Phrygian Aeolian	9, m3, m3 9, m3	(13) b9, b13 b13

Table 56 - Chord type and extensions for the sus4 chord type

4.3 Interval designations

The following table lists the commonly used interval names and interval shortcuts. The names are based on a seven-step system with the names: prime (or 1st), 9th, 3rd, 4th (or 11th), 5th, 6th (or 13th) and 7th.

No. of semi-tones	Interval name		Interval shortcut 1)				Interval name (+1 octave)		No. of semi-tones
0	Prime or 1st		1				octave		12
1	minor	2nd	b2			b9	minor	9th	13
2	major		2			9 2)	major		14
3	minor	3rd	m3	3)		#9	augmented		15
4	major		M3			10	major	10th	16
5	perfect	4th	sus4	4)		11	perfect	11th	17
6	diminished	5th	b5			#11	augmented		18
7	perfect		5	5)		12	perfect	12th	19
8	augmented		#5			b13	minor	13th	20
9	major	6th	6	6)	b7	13	major		21
10	minor	7th	7		7)	14	minor	14th	22
11	major		maj7			b15	diminished	15th	23

Table 57 - The interval names in chords and scales

The corresponding seven interval shortcuts are: 1, 9, m3/M3, sus4 or 11, 5, 6 or 13 and 7.

The terms for the gradations are minor, major, perfect, diminished and augmented, and the interval shortcuts are accordingly b, #, m, M, maj. Unfortunately, these gradations are not consistently named, you have to learn them.

The interval shortcuts are used both to designate individual functions within the scales and in the chord names.

Notes

1) The interval shortcuts are used both in the names of individual functions and in the chord names. The b and # signs are written after the seventh, e.g. Cm^{7b5} or $C^{7\#11}$ or $C^{7\#11/b13}$ or $C^{maj7\#11}$, so that it is clear that it is an interval designation and not an increase or decrease of the fundamental tone. Otherwise they would quickly be misinterpreted, e.g. $C^{\#11}$ would be misunderstood as $C^{\#}$ with a perfect 11th (11).

   The interval names in gray are not used for chords, i.e. when talking about a chord or within a scale, one speaks of the 9th and not the 2nd, the 3rd and not the 10th, and the 5th and not the 12th. This is confusing and in fact the names of the intervals larger than an octave, namely 9th, 11th and 13th, are also called this when used within the same octave.

2) The minor 9th (b9) is considered a tone to be avoided for all chord types except the dominants, since the dissonance to the fundamental is only “tolerated” for

dominants. The augmented 9th (#9) as a sounding minor 3rd (m3) does not fit a major chord and is therefore a tone to be avoided there.

3) When naming minor chords, only the small m is used instead of m3, e.g. Cm. For major chords, the name is left out completely, e.g. C means C major, i.e. with a major 3rd (M3). Minor chords are often written in lower case, e.g. cm or even just c. This is confusing and is therefore not used in the context of this theory of harmony. At the Berklee College of Music [1] the minus sign is used for minor, for example
C^{-7} for Cm^7.

4) The 4 is usually only used for a sus4 chord, i.e. a dominant seventh chord in which the major 3rd (M3) is replaced by the 4th (sus4). The sus4 is considered an avoid note in the dominant seventh chord because it sounds too dissonant with the major 3rd (M3). In the sus4 chord, on the other hand, the major 3rd (M3) sounds very dissonant and is therefore to be avoided. So either or: In the sus4 chord you avoid the major 3rd (M3) and in the dominant seventh chord you avoid the sus4. The perfect 11th (11) is a dissonant tone to be avoided with major and minor major chords or generally with tonic types, because the 4th tone forms a tritone with the major 7th (maj7), which sounds inappropriate in a tonic chord. The interval between the major 3rd (M3) and the perfect 11th (11) is also a minor 2nd or minor 9th, depending on the position, which also sound inappropriate in a tonic chord. However, it can be used as an option tone for minor chords, i.e. it is played in addition to the minor 3rd (m3), for example Cm^{11}.

5) The fifth (5) is only used in the chord name when it is diminished or augmented, for example in Cm^{7b5} or $C^{maj7\#5}$. With the perfect 5th (5), the 5 is omitted from the chord name, so C or Cm use the perfect 5th. For the major chords with an augmented 5th (5), see chapter 7.3 (The melodic minor scale on the 3rd degree (MM3) and its $major^{7\#5}$ chord) and chapter 8.4 (The harmonic minor scale on the 3rd degree (HM3) and its $major^{7\#5}$ chord), the major 13th (13) is a minor second above the augmented 5th (#5), therefore sounds dissonant and is to be avoided. Alternatively, you can avoid the augmented 5th (#5) and then use the major 13th (13) instead.

6) Major 13th (13) and major 6th (6) basically refer to the same chord tone. The major 6th (6) is used as a designation exclusively for the tonic types, i.e. $major^7$ and $minor\text{-}major^7$ chords. For all others, the major 13th (13) is used instead. C^{13}, for example, is a dominant seventh chord with a sounding major 6th as a tension, C^6 is a C^{maj} chord with a major 6th. To avoid confusion, you should use $C^{7/13}$ instead of C^{13} and C^{maj6} instead of C^6. In the Dorian minor chord, the major 13th changes the character to a tonic or dominant chord and is therefore to be avoided in II-V connections, as we will get to know in Chapter 14 (Cadences and Cadence variants). The major 13th (13) in the minor chord would anticipate the major 3rd (M3) of the following dominant seventh chord. For example, the major 13th in the

Am chord, i.e. the $F^{\#}$, corresponds to the major 3rd in the following D^7 chord. This means it no longer sounds like a II-V connection. In the minor major chord, the major 6th emphasizes the tonic character of the chord. The minor 6th (b6) is a semitone above the 5th (5) and is therefore an avoid note except in dominant chords. Either the 5th (5) or the minor 6th (b6), but not both, should be used at the same time. An exception is the half-diminished minor chord (m7b5), in which the minor 13th (b13) is far enough away from the diminished 5th (b5) so that it acts as an option note to underline the half-diminished character.

7) The diminished 7th (b7) is not used in chord names because it would be misinterpreted. The b7 only appears in diminished chords that use their own chord symbol, usually ° or dim, e.g. C° or C^{dim}, whereby in the context of this harmony we use the ° symbol for the diminished triad, e.g. C°, and the ^{dim} - symbol for the diminished four-note chord, e.g. C^{dim}. At the Berklee College of Music [1], the minor 7th (7) is designated b7, i.e. maj7 for the major and b7 for the minor 7th. This is problematic in two respects: Firstly, the b7 no longer corresponds to the chord designation, since, for example, in C^7 the minor 7th would be designated as b7 instead of 7. Secondly, in the whole-tone half-tone scale and its diminished chord, for example, there is a "real" b7, i.e. a diminished seventh, which leads to confusion. In his jazz harmony theory, Axel Jungbluth [2] also uses the b7 as a diminished seventh and designates the minor seventh as -7 instead of simply 7 as here. This is feasible, but it means that the parallelism to the chord designations is lost, since the minus sign is associated with a minor chord. So you have to be careful here and look closely at what is meant.

4.4 The circle of fifth

No harmony theory should be without a description of the circle of fifths. But why? What is so special about it? The answer is simple: nothing. As we will see in the chapter 14 (Cadences and Cadence variants), chord progressions in which the root note goes up in fourths or down in fifths have always been extremely popular.

Mathematically speaking, the fourth and fifth intervals with their 5 and 7 semitones are coprime to the octave with its 12 semitones. This means that if you go up or down in fourths or fifths, you only return to the starting note after 12 steps, so you go through all 12 tones (The least common multiple LCM of 12 and 5 is LCM(5, 12) = 5 x 12 or LCM(12, 7) = 7 x 12). This property is otherwise only found in minor second or major seventh, where you simply step (chromatically) up or down 12 semitones in a row (12 × 1 = 12). In thirds, however, the 3 or 4 semitones are not coprime to 12, i.e. after 4 steps of three semitones or 3 steps of four semitones you are back to the octave and thus back to the starting point (4 × 3 = 12 or 3 × 4 = 12). All other tones are not reached. In major seconds you reach the octave tone after six steps of two semitones, so you only reach half of the possible tones (6 × 2 = 12). In the tritone with its six semitone steps you are back to the octave tone by the 2nd tone (2 × 6 = 12). The sixths with their 8 and 9 semitones behave like the thirds, after 3 steps of eight or 4 steps of nine semitones you reach the octave tone again (3 × 8 = 2 × 12 or 4 × 9 = 3 × 12). Finally, the minor seventh with its 10 semitones behaves like the major second, i.e. after 6 minor sevenths you reach the octave tone again (6 × 10 = 5 × 12).

Explanation of the circle of fifth:

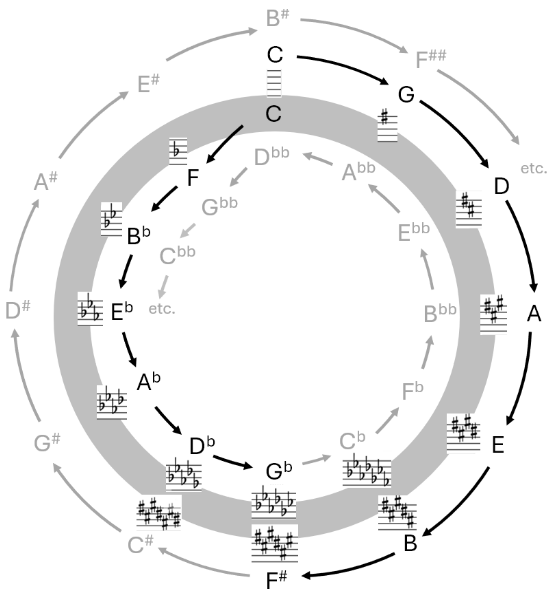


Figure 33 - The circle of fifths, which is actually a spiral

If you start at 12 o'clock from C and ascend clockwise in fifths, you arrive back at C after 12 steps via G, D, A, E, B, $F^{\#}$, $C^{\#}$, $G^{\#}$, $D^{\#}$, $A^{\#}$, $E^{\#}$, $B^{\#}$ (which is equal to C). In the counter-clockwise direction, you go down in fifth accordingly and arrive back at C after 12 steps via F, B^b, E^b, A^b, D^b, G^b, C^b, F^b, B^{bb}, E^{bb}, A^{bb}, D^{bb} (which is equal to C).

At the beginning of a piece of music, the key is often indicated in the form of the number of b or # signs, the so-called accidentals. The (Ionian) major scale is used. In C major (C, D, E, F, G, A, B, C) there are no accidentals, i.e. no b or # signs.

If you move to the right in the circle of fifth, the number of # accidentals increases by one. G major has one # accidental (G, A, B, C, D, E, $F^{\#}$), D major has two # accidental (D, E, $F^{\#}$, G, A, B, $C^{\#}$), A major has three and so on.

If you go down from C at 12 o'clock to the left in fifth, the number of b accidentals increases by one. F major has one b accidental (F, G, A, B^b, C, D, E), B^b has two (B^b, C, D, E^b, F, G, A), E^b has three and so on.

So that there aren't too many b and # accidentals, you make the so-called enharmonic transition from b- to the #-keys below at six o'clock at G^b or $F^{\#}$. You should memorize the 6b and 6# key signatures. There are numerous mottos about this. A common way to remember the 6# keys (G, D, A, E, B, $F^{\#}$) is: Go Down And End Battle, Father or Get Drunk And Eat Butter Flies. A suitable saying for the 6 b keys (F, B^b, E^b, A^b, D^b, G^b) is: Fat Big Elephants Always Drive Gocarts.

If you don't make an enharmonic transition and continue to move left and, you can see that the circle of fifths is actually a spiral of fifths that tends more and more towards the center to the left and more and more outwards to the right.

The parallel (aeolian) minor keys are also often listed in the circle of fifths:

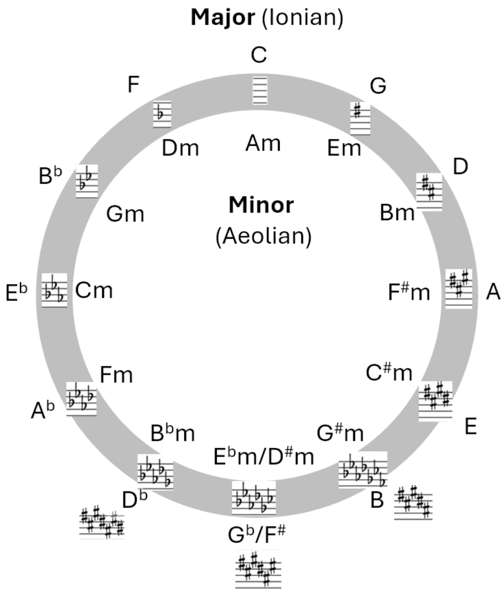


Figure 34 - the circle of fifth and the parallel minor (Aeolian) keys

4.5 Tonal systems, modality and sound clouds

Definition tonal system and sound cloud

Chords that are built from a scale and its modes together form a so-called tonal system [27], so they basically belong together. Alternatively, one also speaks of a sound cloud in which all chords and scales of a tonal system lie.

For example, in the Ionian major scale, see chapter 5 (The Ionian major scale and its modes and chords), the Ionian scale and its modes form Dorian, Phrygian, Lydian, Mixolydian, Aeolian and Locrian together with the associated chords Major7 (Ionian and Lydian), minor seventh (Dorian, Phrygian and Aeolian), dominant seventh (Mixolydian) and minor 7b5 (Locrian) a tonal system.

If you stay within a tonal system, you also speak of modality in jazz. In pop, rock and country music, in fact in all popular music styles, a song usually remains within one and the same tonal system, i.e. within the same sound cloud.

In the following chapters, the most important scales and the associated chords and sound clouds, i.e. the tonal systems, are presented.

5 The Ionian major scale and its modes and chords

The modes of the Ionian major scale are also called church modes [28]. They are presented below.

5.1 The Ionian major scale and its Major^{7} chord

[24]

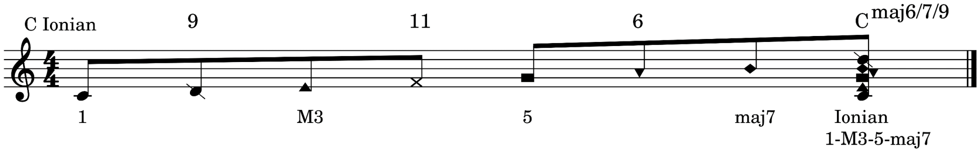


Figure 35 - The Ionian major scale in C and it Major^{7} chord

The Ionian scale [24] is also simply called the major scale. The 1st, 3rd, 5th and 7th notes form a Major7 chord with the structure 1-M3-5-maj7, here the C^{maj7}. The tensions are the major 9th and the major 6th.

The 4th tone, i.e. the perfect 11th - here the f - is considered a tone to be avoided in tonic chords, see note 4 in chapter 4.3 (Interval designations) because the 4th note forms a tritone with the major 7th, which sounds inappropriate in a tonic chord. The interval between the major 3rd (M3) and the 11th is also a minor 2nd or minor 9th, depending on the position, which also sound inappropriate in a tonic chord.

5.2 The Dorian scale and its minor seventh chord

[29]s

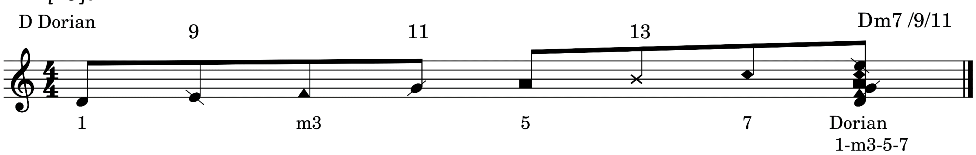


Figure 36 - The Dorian minor scale in D and its minor seventh chord

From the 2nd note onwards we get a minor scale, the so-called Dorian minor scale [29]. The 1st, 3rd, 5th and 7th notes form a minor seventh chord with the structure 1-m3-5-7, here the Dm^{7}. The tensions are the major 9th, perfect 11th and major 13th.

The 6th tone, i.e. the 13th - here the B - is, as shown in Chapter 14.2.1 (The 2-5-1), a tone to be avoided because it would anticipate the 3rd of the following dominant. See also note 6 in chapter 4.3 (Interval designations).

The Dorian minor scale forms the 2nd mode of the Ionian major scale.

5.3 The Phrygian minor scale and its minor seventh chord

[30]

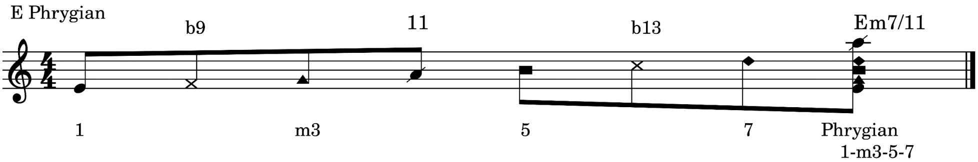


Figure 37 - The Phrygian minor scale in E and its minor seventh chord

From the 3rd note onwards we get a minor scale, the so-called Phrygian minor scale [30]. The 1st, 3rd, 5th and 7th notes form a minor seventh chord with the structure 1-m3-5-7, here the Em^7, with the perfect 11th is a tension.

The 2nd tone, i.e. the minor 9th (b9) - here the f - is considered a tone to be avoided because it sounds disharmonious to the fundamental tone. The minor 13th (b13) rubs against the perfect 5th and is therefore also considered a note to avoid. Alternatively, you can also do without the 5th. See also notes 2 and 6 in the chapter 4.3 (Interval designations).

The Phrygian minor scale forms the 3rd mode of the Ionian major scale.

5.4 The Lydian major scale and its Major^7 chord

[31]

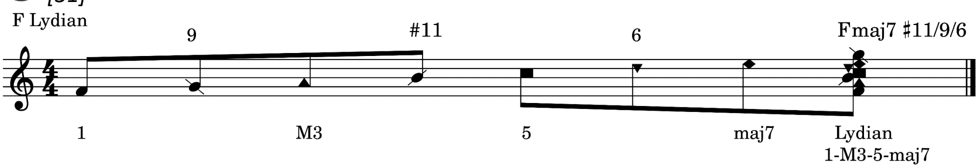


Figure 38 - The Lydian major scale in F and its major seventh chord

From the 4th note onwards we get a major scale, the so-called Lydian major scale [31]. The 1st, 3rd, 5th and 7th notes form a major^7 chord with the structure 1-M3-5-maj7, here the F^{maj7}. The tensions are the major 9th (9), the augmented 11th (#11) and the major 6th (6).

The Lydian major scale contains no avoid notes because the IV^{maj7} chord is typically at the end of a cadence and all tensions sound harmonious and appropriate.

When playing the augmented 11th (#11) instead of the perfect 5th, the tension between the #11 and the root note (tritone) shapes the special sound of this Maj7#11 chord. On the other hand, the #11 rubs against the 5, so you only use one, either the #11 or the 5, in the chord.

The Lydian major scale forms the 4th mode of the Ionian major scale.

5.5 The Mixolydian major scale and its dominant seventh chord

[32]

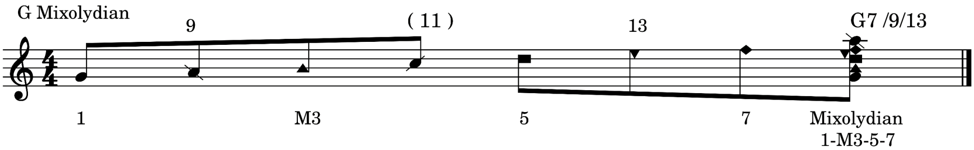


Figure 39 - The Mixolydian major scale in G and its dominant seventh chord

From the 5th note onwards we get a major scale, the so-called Mixolydian major scale [32]. The 1st, 3rd, 5th and 7th notes form a dominant seventh chord with the structure 1-M3-5-7, here the G^7. The tensions are the major 9th (9) and major 13th (13).

The Mixolydian major scale includes a dominant seventh chord or a sus4 chord. The sus4 (abbreviation for suspended fourth) is considered a tone to be avoided in the dominant seventh chord because it sounds dissonant to the major 3rd (M3). In the sus4 chord, the major 3rd (M3) is a note to avoid for the same reason. So M3 and sus4 are usually not played at the same time.

The Mixolydian major scale forms the 5th mode of the Ionian major scale.

5.6 The Aeolian minor scale and its minor seventh chord

[33]

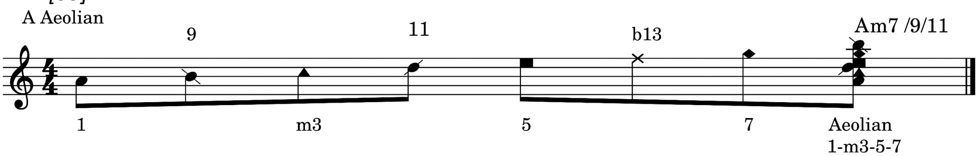


Figure 40 - The Aeolian minor scale in A and its minor seventh chord

From the 6th note onwards we get a minor scale, the so-called Aeolian minor scale [33]. The 1st, 3rd, 5th and 7th notes form a minor seventh chord with the structure 1-m3-5-7, here the Am^7. The tensions are the major 9th (9) and perfect 11th (11).

The 6th tone, i.e. the minor 13th (b13) - here the F - is considered a tone to be avoided because in the Aeolian minor chord sounds disharmonious to the perfect 5th (5), and, as shown in chapter 14.2.1 (The 2-5-1), would anticipate the 3rd of the following Dorian minor chord. See also note 6 in chapter 4.3 (Interval designations).

The Aeolian minor scale forms the 6th mode of the Ionian major scale.

5.7 The Locrian minor scale and its half-diminished minor seventh chord

[34]

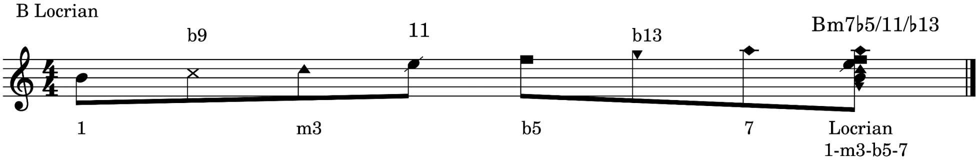


Figure 41 - The Locrian minor scale in B and its half-diminished minor seventh chord

From the 7th note onwards we get a minor scale, the so-called Locrian minor scale [34]. The 1st, 3rd, 5th and 7th notes form a half-diminished minor seventh chord with the structure 1-m3-b5-7, here the Bm^{7b5}. The tensions are the perfect 11th (11) and the minor 13th (b13). The minor 9th (b9) sounds disharmonious to the root note (1) in all chord types except the dominant seventh chords and is therefore considered an avoid note. See also note 2 in chapter 4.3 (Interval designations).

The Locrian minor scale forms the 7th mode of the Ionian major scale.

5.8 Conclusion

The seven-step Ionian major scale contains seven modes, i.e. seven scales, each starting from a different note of the scale. The scales and associated chords are the following:

[35]

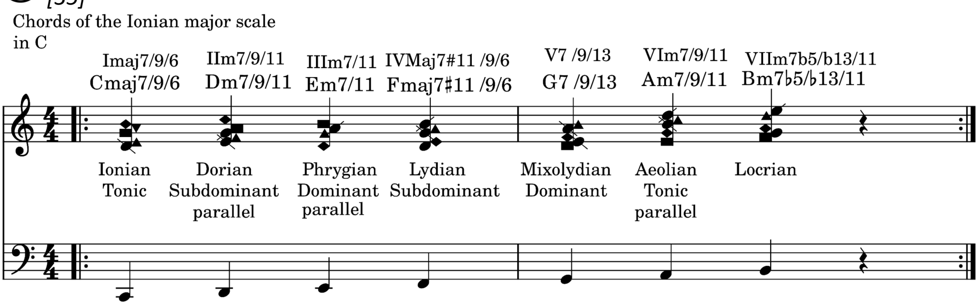


Figure 42 - The chords of the Ionian major scale and their modes

The chord on the 1st degree, here the C^{maj7}, is called the tonic [81], the one on the 5th degree, here the G^7, is called the dominant [83] and the one on the 4th degree, here the $F^{maj7\#11}$, as subdominant [82].

If you look at the parallel minor key on the 6th degree, here Am^7, as the tone center, tonic or I chord, the 4th becomes the 2nd degree and the 5th becomes the 3rd degree. Accordingly, the minor chord on the 6th degree is called the tonic parallel, the one on the 2nd degree is called the subdominant parallel and the one on the 3rd degree is called the dominant parallel.

Below is an overview of the functions, chords, important notes and notes to avoid, as well as the tensions for the so-called church modes derived from the major scale:

Scale designation	Function	Chord (Example)	Important notes	Avoid notes [1)]	Tensions
Ionian	Tonic	C^{maj7}	M3, maj7	11	9, 6
Dorian	Subdominant parallel	Cm^7	m3, 7	(13)	9, 11
Phrygian	Dominant parallel	Cm^7	m3, 7	b9, (b13)	11
Lydian	Subdominant	$C^{maj7\#11}$	M3, 5, maj7	--	9, #11, 6 [2)]
Mixolydian	Dominant	C^7	M3, 7	--	9, sus4, 13
Aeolian	Tonika parallel	Cm^7	m3, 7	(b13)	9, 11
Locrian		Cm^{7b5}	m3, b5, 7	b9	11, b13

Table 58 - The Church or Greek modes and their chords, tensions and avoid notes

1) In chapter 4.3 (Interval designations) the reasons why certain tones should be avoided are explained.

2) In contrast to the Ionian major scale, the Lydian major scale has an augmented 11th (#11). It shapes the Lydian character in the major chord, but rubs against the 5th. Therefore, in the Lydian $major^7$ chord you use either the 5 or the #11.

5.9 Church modes modality and sound clouds

In contrast to functional harmony, in which chords are brought into a II-V-I cadence sequence, for example, see Chapter 14 (Cadences and Cadence variants), modality refers to the creation of sound clouds in which the different chords (modes) of a scale are combined.

Note

In the context of modality and sound clouds, the so-called avoid notes are deliberately excluded.

5.9.1 The Ionian sound cloud

The Ionian sound cloud is obtained by underlaying the root note as a pedal point or pedal tone to the chords of the Ionian major scale. This is explained using the example of the Ionian major scale in E:

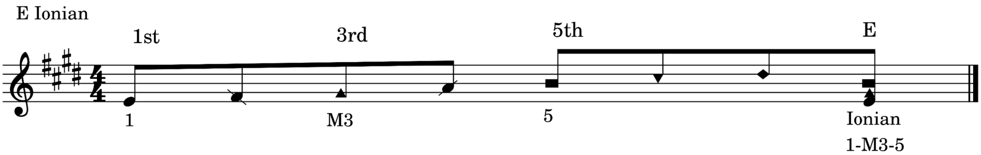


Figure 43 - The Ionian major scale in E

The chords of the Ionian major scale in E are underlaid with the root note - E - as a bass note:

[90]

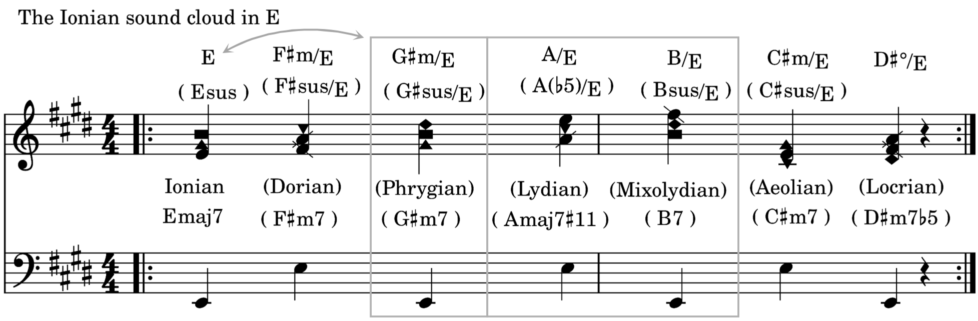


Figure 44 - The sound cloud of the Ionian major scale in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. For the Ionian sound cloud in E, for example, we take the triads E, $F^{\#}$m, $G^{\#}$m, A, B, $C^{\#}$m and $D^{\#\circ}$ from the chords E^{maj7} (Ionian), $F^{\#}m^{7}$ (Dorian), $G^{\#}m^{7}$ (Phrygian), A^{maj7} (Lydian), B^{7} (Mixolydian), $C^{\#}m^{7}$ (Aeolian) and $D^{\#}m^{7b5}$ (Locrian) and underlay them with the bass note E, where (Ionian) ... (Locrian) means that the respective chord is based on the corresponding scale.

The combination of the fourth (Lydian), fifth (Mixolydian) and third (Phrygian) degrees, here A/E, B/E (A major triad and B major triad over E in the bass) and G$^{\#}$m/E (G sharp minor triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: D$^{\#\circ}$ is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

In brackets below the actual chords are triads that also fit. The A$^{(b5)}$ triad should actually be A$^{(\#11)}$, since the Lydian scale includes the combination 1-M3-#11. However, we have referred to the corresponding triad 1-M3-b5 as major$^{(b5)}$, see Chapter 2.2 (Three-note chords within an octave), point f).

The Phrygian G$^{\#}$m/E forms the minor parallel to the Ionian E^{maj7} major seventh four-note chord.

5.9.2 The Dorian sound cloud

The Dorian sound cloud is obtained by adding the 2nd note as a pedal point to the chords of the Ionian major scale. E Dorian, for example, contains the notes of the Ionian D major scale:

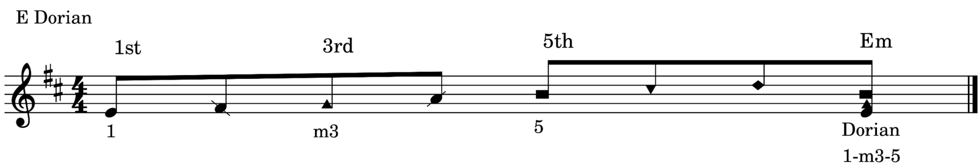


Figure 45 - The Dorian minor scale in E

The chords of the Ionian D major scale are underlaid with the scales' second note - E - as a bass note:

[91]

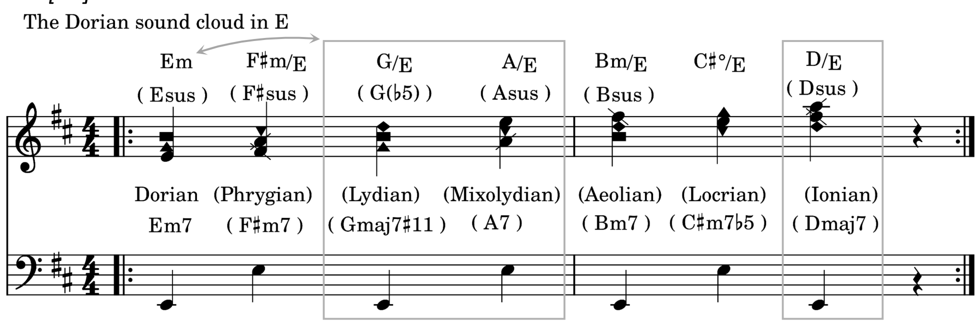


Figure 46 - The sound cloud of the Dorian minor scale in E

The combination of the fourth (Lydian), fifth (Mixolydian) and first (Ionian) degrees, here G/E, A/E and D/E (G major triad, A major triad and D major triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: C#° is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

In brackets below the actual chords are triads that also fit. The G(b5) triad should actually be G(#11), since the Lydian scale includes the combination 1-M3-#11. However, we have referred to the corresponding triad 1-M3-b5 as major(b5), see Chapter 2.2 (Three-note chords within an octave), point f).

The Lydian G/E forms the major parallel to the Dorian Em7 minor seventh four-note chord.

5.9.3 The Phrygian sound cloud

The Phrygian sound cloud is obtained by adding the 3rd note as a pedal point to the chords of the Ionian major scale. E Phrygian, for example, contains the notes of the Ionian C major scale:

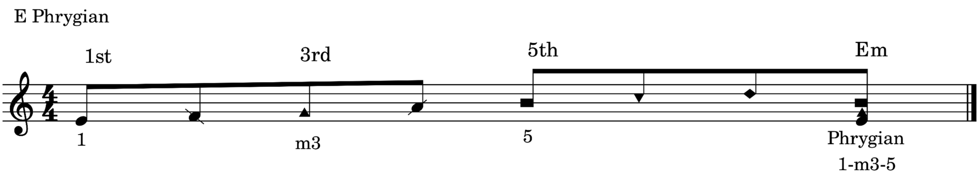


Figure 47 - The Phrygian minor scale in E

The chords of the Ionian C major scale are underlaid with the scale´s third note - E - as a bass note:

[92]

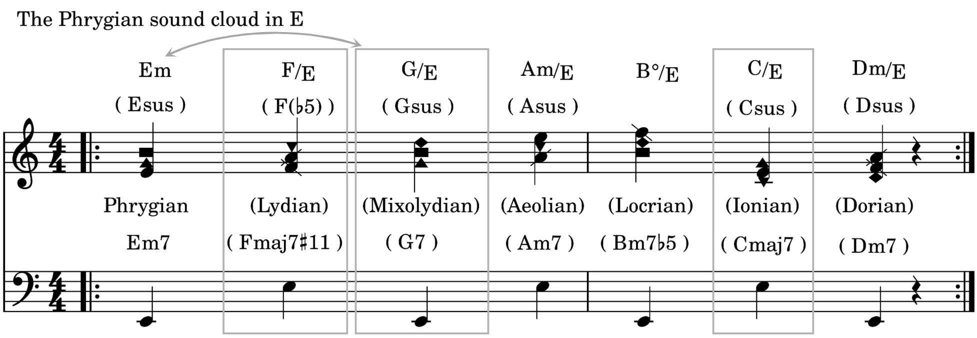


Figure 48 - The sound cloud of the Phrygian minor scale in E

The combination of the fourth (Lydian), fifth (Mixolydian) and first (Ionian) degrees, here F/E, G/E and C/E (F major triad, G major triad and C major triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: B° is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

In brackets below the actual chords are triads that also fit. The $F^{(b5)}$ triad should actually be $F^{(\#11)}$, since the Lydian scale includes the combination 1-M3-#11. However, we have referred to the corresponding triad 1-M3-b5 as $major^{(b5)}$, see Chapter 2.2 (Three-note chords within an octave), point f).

The Mixolydian G/E forms the major parallel to the Phrygian Em^7 minor seventh four-note chord.

5.9.4 The Lydian sound cloud

The Lydian sound cloud is obtained by adding the 4th note as a pedal point to the chords of the Ionian major scale. E Lydian, for example, contains the notes of the Ionian B major scale:

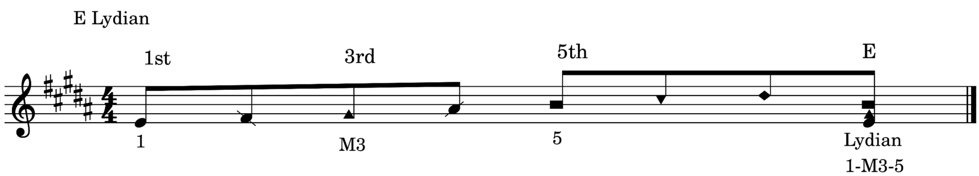


Figure 49 - The Lydian major scale in E

The chords of the Ionian B major scale are underlaid with the scale´s fourth note - E - as a bass note:

[93]

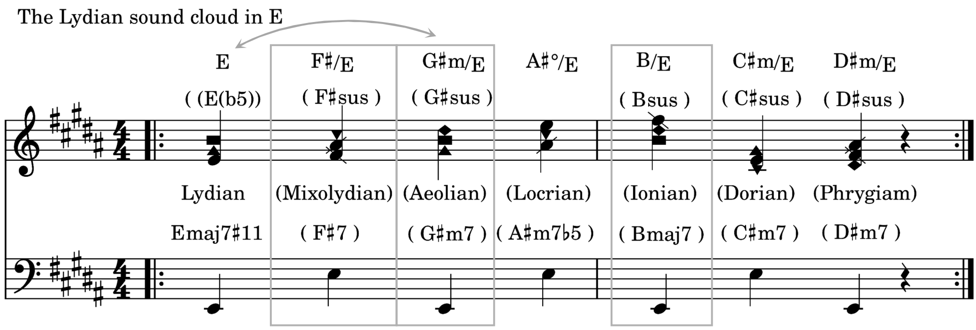


Figure 50 - The sound cloud of the Lydian major scale in E

The combination of the sixth (Aeolian), fifth (Mixolydian) and first (Ionian) degrees, here $G^{\#}m/E$ (G sharp minor triad over E in the bass), $F^{\#}/E$ and B/E (F sharp major triad and B major triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: $A^{\#\circ}$ is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

In brackets below the actual chords are triads that also fit. The $E^{(b5)}$ triad should actually be $E^{(\#11)}$, since the Lydian scale includes the combination 1-M3-#11. However, we have referred to the corresponding triad 1-M3-b5 as $\text{major}^{(b5)}$, see Chapter 2.2 (Three-note chords within an octave), point f).

The Aeolian $G^{\#}$m/E (G sharp minor triad over E in the bass) forms the minor parallel to the Lydian E^{maj7} major seventh four-note chord.

5.9.5 The Mixolydian sound cloud

The Mixolydian sound cloud is obtained by adding the 5th note as a pedal point to the chords of the Ionian major scale. E Mixolydian, for example, contains the notes of the Ionian A major scale:

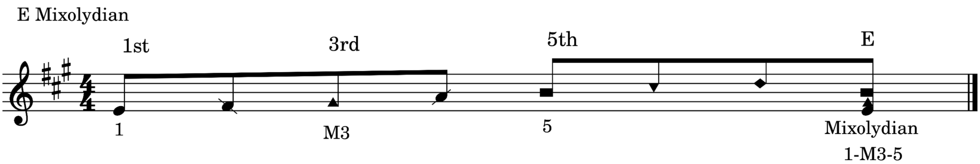


Figure 51 - The Mixolydian major scale in E

The chords of the Ionian A major scale are underlaid with the scale´s fifth note - E - as a bass note:

[94]

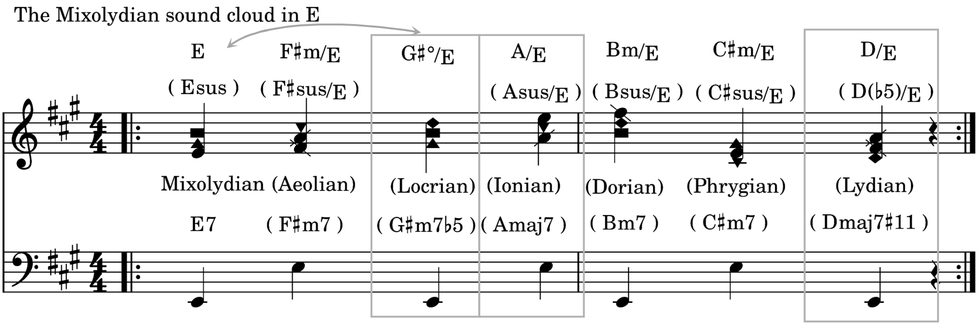


Figure 52 - The sound cloud of the Mixolydian major scale in E

The combination of the fourth (Lydian), seventh (Locrian) and first (Ionian) degrees, here D/E (D major triad over E in the bass), G#°/E (G sharp diminished triad over E in the bass) and A/E (A major triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: $G^{\#\circ}$ is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

In brackets below the actual chords are triads that also fit. The $D^{(b5)}$ triad should actually be $D^{(\#11)}$, since the Lydian scale includes the combination 1-M3-#11. However, we have referred to the corresponding triad 1-M3-b5 as major(b5), see Chapter 2.2 (Three-note chords within an octave), point f).

The G#°/E forms the parallel to the Mixolydian E^7 dominant seventh four-note chord.

5.9.6 The Aeolian sound cloud

The Aeolian sound cloud is obtained by adding the 6th note as a pedal point to the chords of the Ionian major scale. E Aeolian, for example, contains the notes of the Ionian G major scale:

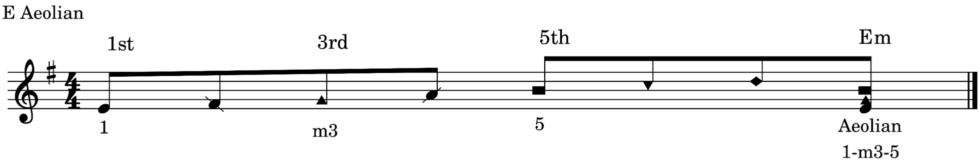


Figure 53 - The Aeolian minor scale in E

The chords of the Ionian G major scale are underlaid with the scale´s sixth note - E - as a bass note:

[95]

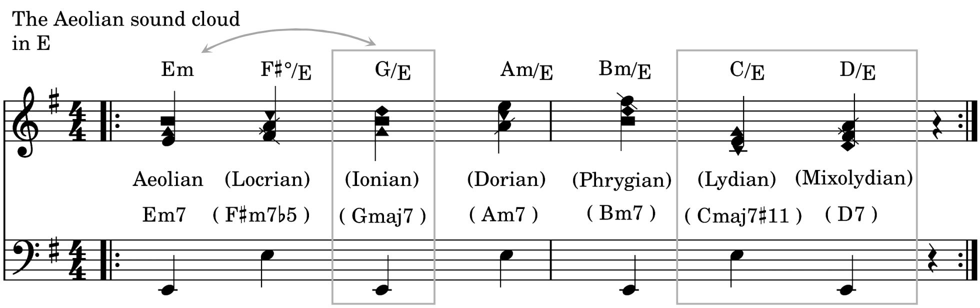


Figure 54 - The sound cloud of the Aeolian minor scale in E

The combination of the fourth (Lydian), fifth (Mixolydian) and first (Ionian) degrees, here C/E, D/E and G/E (C major triad, D major triad and G major triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: F#° is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

The Ionian G/E forms the major parallel to the Aeolian Em^7 minor seventh four-note chord.

5.9.7 The Locrian sound cloud

The Locrian sound cloud is obtained by adding the 7th note as a pedal point to the chords of the Ionian major scale. E Locrian, for example, contains the notes of the Ionian F major scale:

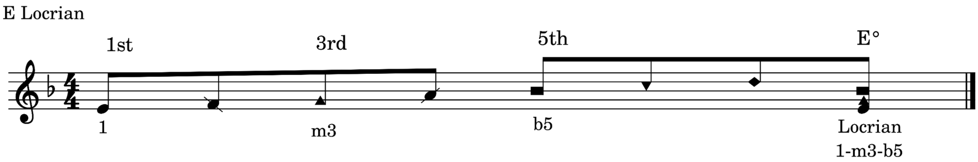


Figure 55 - The Locrian minor scale in E

The chords of the Ionian F major scale are underlaid with the scale´s seventh note - E - as a bass note:

[96]

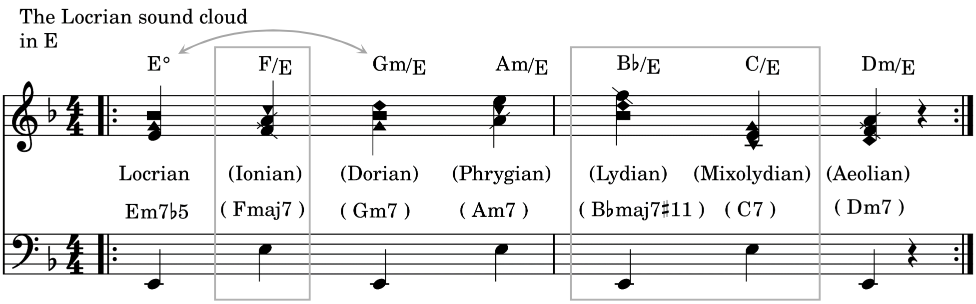


Figure 56 - The sound cloud of the Locrian half diminished minor scale in E

The combination of the fourth (Lydian), fifth (Mixolydian) and first (Ionian) degrees, here B^b/E, C/E and F/E (B^b major triad, C major triad and F major triad over E in the bass), sounds particularly interesting. In addition to the 3rd and 7th, all the other functions, namely root, 5th, 9th, 4th and 6th, are also obtained.

Attention: E° is a diminished triad and not a four-note chord. With the diminished seventh (b7), the diminished four-note contains a tone that is foreign to the scale.

The Dorian Gm/E (G minor triad over E in the bass) forms the parallel to the Locrian Em^{7b5} half-diminished minor seventh four-note chord.

[38]

6 The chromatic scale

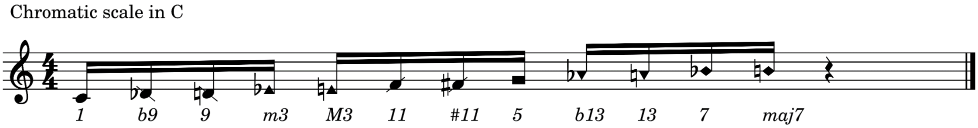


Figure 57 - The chromatic scale in C

The Chromatic Scale [38] contains all 12 tones in ascending order. It is not suitable for building a diatonic system because it behaves the same from all fundamental tones. So all chords that would be formed e.g. from the 1st, 4th, 7th and 10th tone would have the same structure (minor seventh chord) for all fundamental tones.

The term chromatic scale [36] describes the alteration of a tone, for example from F to F sharp or F flat. With the equal temperament with 12 tones commonly used today, see Chapter 1.4 (The equal temperament tone system with 12 tones), the sequence of 12 tones, for example from the note C onwards, results in:

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

Strictly speaking, this equality of the tones of, for example, D# = Eb only applies to the equal temperament with 12 tones, in which all intervals are the same size, regardless of the fundamental tone. It is also known as enharmonic equivalence [72]. This does not apply to other tunings, for example just intonation. It focuses on the fact that the fifth, major third, major second and major seventh have no deviations from the respective overtone (but all other intervals do), see chapter 1.1 (Analysis of the overtone spectrum). This means that the 12 intervals are not all the same size and the chromatic scales slightly differ depending on which tone you start from. For example, the tones D# and Eb differ slightly depending on which fundamental note you start from.

When it comes to enharmonic equivalence, it makes sense to consider up to three accidentals, since, for example, the scale F^{b} WTHT (whole-tone half-tone) contains the tones F^{b}, G^{b}, A^{bb}, B^{bb}, C^{bb}, D^{bb} and E^{bbb}, or $B^{\#}$ altered contains the tones $B^{\#}$, $C^{\#}$, $C^{\#\#\#}$, $D^{\#\#}$, $E^{\#\#}$, $G^{\#}$ and $A^{\#}$. If you allow up to three accidentals, the following table of enharmonic equivalences results:

C	**$C^{\#}$**	**D**	**$D^{\#}$**	**E**	**F**	**$F^{\#}$**	**G**	**$G^{\#}$**	**A**	**$A^{\#}$**	**B**
$B^{\#}$	$B^{\#\#}$	$C^{\#\#}$	$C^{\#\#\#}$	$D^{\#\#}$	$E^{\#}$	$E^{\#\#}$	$F^{\#\#}$	$F^{\#\#\#}$	$G^{\#\#}$	$G^{\#\#\#}$	$A^{\#\#}$
$A^{\#\#\#}$		$B^{\#\#\#}$			$D^{\#\#\#}$		$E^{\#\#\#}$				
D^{bb}	D^{b}	E^{bb}	E^{b}	F^{b}	G^{bb}	G^{b}	A^{bb}	A^{b}	B^{bb}	B^{b}	C^{b}
	E^{bbb}	F^{bbb}	F^{bb}	G^{bbb}		A^{bbb}		B^{bbb}	C^{bbb}	C^{bb}	D^{bbb}

Table 59 - The 12 tones and their enharmonic equaivalences up to a maximum of 3 accidentals

Many musicians who intonate by ear intuitively stick to the easily audible overtones and, for example, play the major third about 14 cents lower or the minor seventh even 31 cents lower so that they fit in with the usually easily audible overtones. The piano, on the other hand, is tuned to equal temperament as the best compromise, see Chapter 1.4 (The equal temperament tone system with 12 tones) so that the tones rub together. But as already mentioned, there is no such thing as a truly just intonation, see the chapter 1.1 (Analysis of the overtone spectrum).

6.1 Twelve-tone technique

So far we have always regarded scales that start from a fundamental note and reach the octave in 1 to 12 ascending steps. Of course, you can use any tone sequence as a basis and derive chords and chord progressions from these tone sequences. This is what Arnold Schoenberg [71] did with his twelve-tone technique [37]. He looks at all scales in which each of the 12 possible tones occurs exactly once. There are in total 11! (factorial of 11) = 39'916'800 of such scales. You can then form chords and tonal systems using each of these scales. However, this is a science in itself, so reference is made to the relevant literature.

It is important to differentiate between a seven-step diatonic system, which is based on the intervals prime or 1st, 9th, 3rd, 11th (4th), 5th, 13th (6th) and 7th, and the twelve-tone technique, whose structures are based on one of the many possible builds of the 12 tones of the chromatic scale.

7 Melodic minor and its modes and chords

Below we will build a tonal system based on the 7-step melodic minor scale. Melodic minor differs from the major scale in only one tone, namely the minor third instead of the major third. But this has serious consequences.

7.1 The melodic minor scale (MM1) and its minor major^7 chord

The melodic minor scale (MM1), here from the note A, looks like this:

[39]

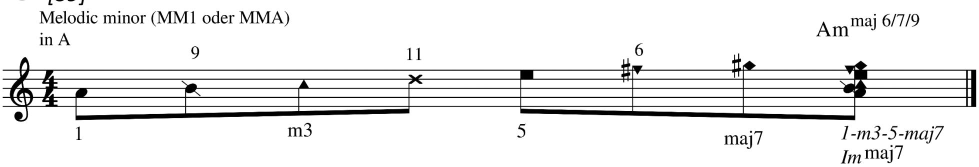


Figure 58 - The melodic minor scale (MM1) in A and its minor-major seventh chord

The minor major7, formed from the 1st, 3rd, 5th and 7th tone, is a minor chord with a major seventh and is the tonic chord on the 1st degree. The 11th is a note to avoid for all tonic types. See also the comments in the chapter 4.3 (Interval designations). The melodic minor scale MM1 is also known as melodic minor ascending (MMA).

7.2 The melodic minor scale on the 2nd degree (MM2) and its minor seventh chord

From the 2nd tone, here B, i.e. A melodic minor from the tone B, the following melodic minor scale results on the 2nd degree (MM2):

[40]

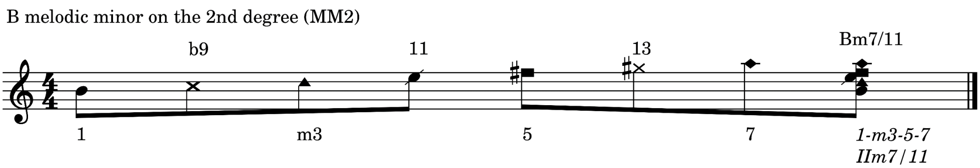


Figure 59 - The melodic minor scale on the 2nd degree (MM2) in B and its minor seventh chord

The IIm^7 chord, formed from the 1st, 3rd, 5th and 7th notes, is a minor seventh chord. The scale corresponds to the Dorian with the exception of the minor 9th (b9) instead of the major 9th (9). The minor 9th (b9) in minor chords sounds too dissonant and is therefore considered a tone to avoid. This also applies to the major 13th (13) in minor chords because it suggests a tonic or dominant type. See also the comments in the chapter 4.3 (Interval designations).

7.3 The melodic minor scale on the 3rd degree (MM3) and its major$^{7\#5}$ chord

From the 3rd tone, here C, i.e. A melodic minor from the tone C, the following melodic minor scale results on the 3rd degree (MM3):

[41]

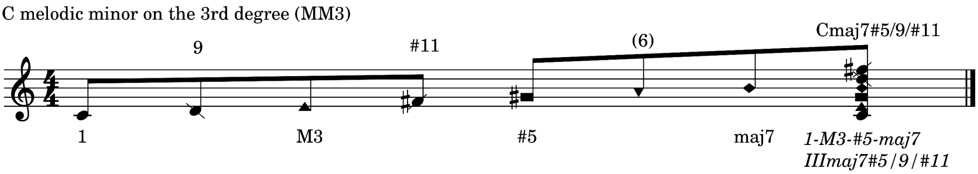


Figure 60 - The melodic minor scale on the 3rd degree (MM3) in C and its major$^{7\#5}$ chord

The III$^{maj7\#5}$ chord, here C$^{maj7\#5}$, formed from the 1st, 3rd, 5th and 7th notes, is a major^{7} chord with an augmented 5th (#5) and is the tonic parallel. The 6 is a minor second above the #5. They should not be used at the same time to avoid dissonance.

7.4 The melodic minor scale on the 4th degree (MM4, Lydian^{b7}, mixo$^{\#11}$) and its dominant seventh chord

From the 4th tone, here D, i.e. A melodic minor from the tone D, the following melodic minor scale results on the 4th degree (MM4):

[42]

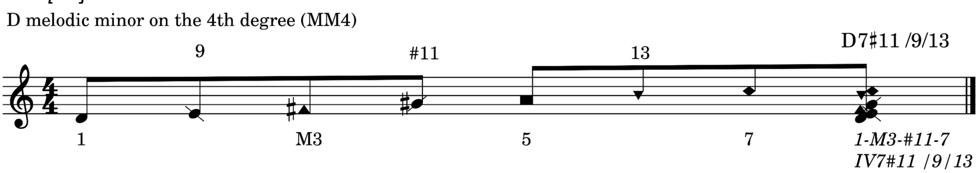


Figure 61 - The melodic minor scale on the 4th degree (MM4) in D and its dominant seventh chord

The IV^{7} chord, here D^{7}, formed from the 1st, 3rd, 5th and 7th notes, is a dominant seventh chord. MM4 is often referred to as Lydian^{b7} in English-speaking countries, and in German-speaking countries it is also called Mixo$^{\#11}$, which is more appropriate because it is used as a dominant scale and is identical to the Mixolydian scale except for #11. As part of this book, we simply call it MM4, i.e. melodic minor on the 4th degree. Typically, the IV$^{7\#11}$

dominant seventh chord is used as the so-called secondary dominant and replacement for the dominant on the 5th degree. We will look at this later. MM4 contains no avoid notes.

7.5 The melodic minor scale on the 5th degree (MM5) and its dominant seventh chord

From the 5th tone, here E, i.e. A melodic minor from the tone E, the following melodic minor scale results on the 5th degree (MM5):

[43]

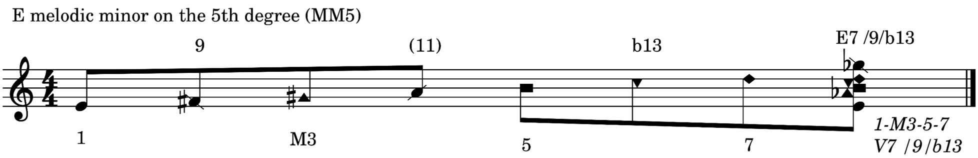


Figure 62 - The melodic minor scale on the 5th degree (MM5) in E and its dominant seventh chord

The V^7 chord, here E^7, formed from the 1st, 3rd, 5th and 7th notes, is a dominant seventh chord and has the function of the dominant on the 5th degree.

Here you have to decide again on the perfect 11th (11) or major 3rd (M3). With the perfect 11th (11) we get a sus4 chord with the major 3rd (M3) as the avoid note. With the major 3rd (M3) we get a dominant seventh chord with the perfect 11th (11) as the avoid tone note.

7.6 The melodic minor scale on the 6th degree (MM6, Locrian^9) and its half-diminished minor seventh chord

From the 6th note, here $F^\#$, i.e. A melodic minor from the note $F^\#$, the following melodic minor scale results on the 6th degree (MM6):

[44]

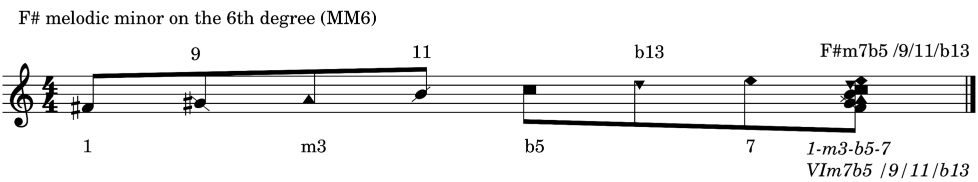


Figure 63 - The melodic minor scale on the 6th degree (MM6, also called Lorian^9) in $F^\#$ and its half-diminished minor seventh chord

The VIm^{7b5} chord, here $F^{\#m7b5}$, formed from the 1st, 3rd, 5th and 7th notes, is a half-diminished minor seventh chord with a diminished 5th (b5). MM6 is identical to the Locrian scale except for the major 9th (9). Therefore it is also referred to as Locrian^{9}. It contains no avoid notes.

7.7 The melodic minor scale on the 7th degree (MM7, altered) and its altered dominant seventh chord

From the 7th note, here $G^{\#}$, i.e. A melodic minor from the note $G^{\#}$, the following melodic minor scale results on the 7th degree (MM7):

[45]

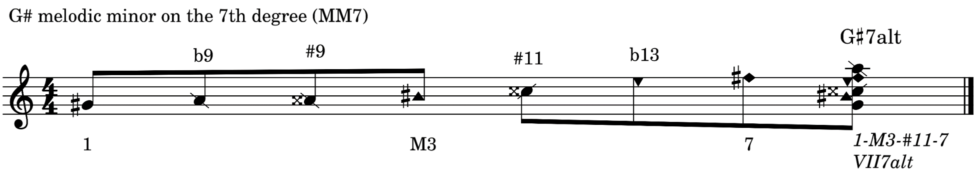


Figure 64 - The melodic minor scale on the 7th degree (MM7, altered) in $G^{\#}$ and its altered dominant seventh chord

The chord to be formed is the so-called altered dominant seventh chord with the tensions #11, b9, #9 and b13. MM7 is also synonymously referred to as the altered scale. It contains avoid notes.

In order for the functional assignment to be correct, the following notes must be reinterpreted enharmonically: The B becomes $A^{\#\#}$, the C becomes $B^{\#}$ and the D becomes $C^{\#\#}$, see chapter 3.3 (How to count).

The altered dominant is usually on the 5th degree and can be resolved into major or minor, see chapter 14 (Cadences and Cadence variants).

7.8 Conclusion

The following chords and scales can be derived from the melodic minor scale:

[46]

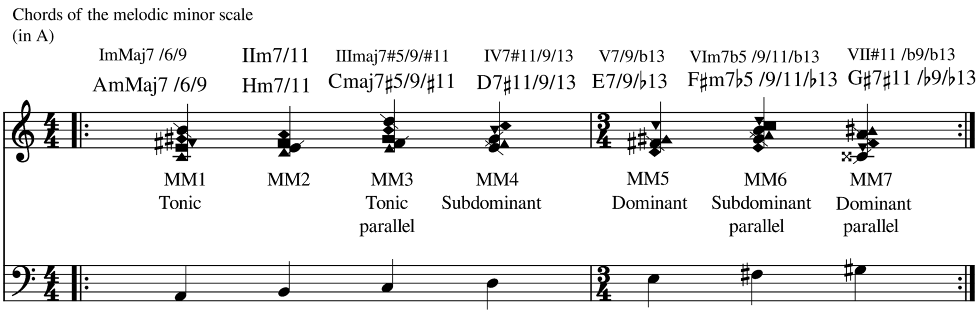


Figure 65 - The chords of the melodic minor scale in A and its modes

The characteristic feature of the melodic minor scale is that it contains three dominant seventh chords. The dominant seventh chords on the 4th (MM4, Mixo#11) and 7th degrees (MM7, altered) each contain the characteristic augmented 11th (#11).

The chord on the 1st degree, here the Am^{maj7}, is called the tonic [81], the one on the 5th degree, here E^7, as the dominant [83] and the one on the 4th degree, here $D^{7\#11}$, as the subdominant.

If you look at the parallel major key on the 3rd degree, here $C^{maj7\#5}$, as the tone center, tonic or I chord, the 4th becomes the 6th degree and the 5th becomes the 7th degree. Accordingly, the major chord on the 3rd degree is called tonic parallel, the one on the 6th degree is called subdominant parallel and the one on the 7th degree is called dominant parallel.

In jazz music, the dominant at the 5th degree (MM5) is rarely used. Instead, the dominant parallel (MM7, altered) as the altered dominant on the 5th degree is taken. The two dominants on the 4th (MM4, $Mixo^{\#11}$) and 7th (MM7, altered) degree can replace each other, with the altered dominant (MM7) always on the 5th degree and the MM4 dominant as the secondary dominant at a tritone distance at degree bII^7, i.e. one semitone above the tonic, see chapter 14 (Cadences and Cadence variants).

Below is an overview of the functions, chords, important tones and tones to avoid, as well as the tensions of the melodic minor scale and its modes:

Scale designation	Function	Chord (Example)	Important notes	Avoid notes 1)	Tensions
Melodic minor (MM1)	Tonic	Am^{maj7}	m3, maj7	11	9, 6
MM2		Hm^{7}	m3, 7	b9, (13)	11
MM3	Tonic parallel	$C^{maj7\#5}$	M3, #5, maj7	(6)	9, #11
MM4 (Lydian^{b7})	Subdominant	$D^{7\#11}$	M3, 7		9, #11, 13
MM5	Dominant	E^{7}	M3, 7	(11)	9, b13
MM6	Subdominant parallel	$F^{\#}m^{7}$	m3, b5, 7		9, 11, b13
MM7 (altered)	Dominant parallel	$G^{\#7\#11}$	M3, 7		b9, #9, #11, b13

Table 60 - The melodic minor scale and its modes, chords, tensions and avoid notes

1) Chapter 4.3 (Interval designations) explains the reason why some notes should be avoided.

7.9 Melodic minor modality and sound clouds

7.9.1 The melodic minor (MM1) sound cloud

The melodic minor (MM1) sound cloud is obtained by adding the root note as a pedal point to the chords of the melodic minor (MM1) scale. This is explained using the example of the melodic minor scale in E:

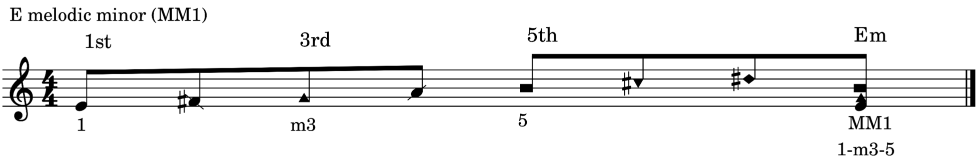


Figure 66 - The melodic minor (MM1) scale in E

The chords of the melodic minor scale in E are underlaid with the root note - E - as a bass note:

[97]

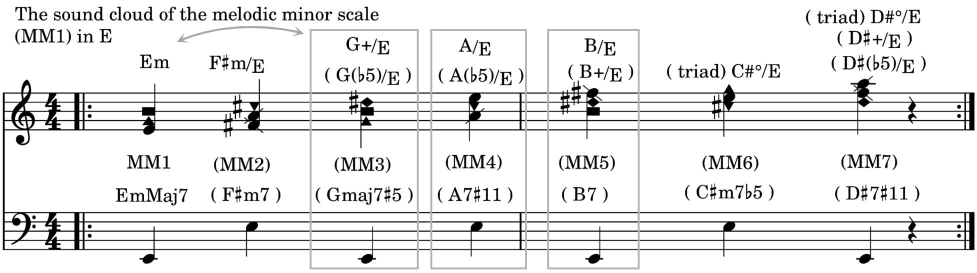


Figure 67 - The sound cloud of the melodic minor (MM1) scale in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. For the melodic minor sound cloud in E, for example, we take the triads Em, F$^{\#}$m, G^{+}, A, B, C$^{\#\circ}$ and D$^{\#\circ}$ from the chords Em^{maj7} (MM1), F$^{\#}$m^{7} (MM2), G$^{maj7\#5}$ (MM3), A^{7} (MM4), B^{7} (MM5), C$^{\#m7b5}$ (MM6) and D$^{\#7\#11/\#9}$ (MM7) and underlay them with the bass note E, where (MM1) ... (MM7) means that the respective chord is based on the corresponding melodic minor scale at the respective degree.

The combination of the third (MM3), fourth (MM4) and fifth (MM5) degrees, here G^{+}/E, A/E and B/E (augmented G triad, A major and B major triad over E in the bass), sounds particularly interesting. In addition to the third and seventh, all the other functions, namely root, fifth, ninth, fourth and sixth, are also obtained.

Attention: The chords C$^{\#\circ}$ and D$^{\#\circ}$ based on the MM6 and MM7 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM6 and MM7 scales.

The G^{+}/E based on the MM3 scale forms the major parallel to the Em^{maj7} minor major seventh four-note chord based on the melodic minor (MM1) scale.

7.9.2 The melodic minor sound cloud on the 2nd degree (MM2)

The sound cloud of the melodic minor scale on the 2nd degree (MM2) is obtained by adding the 2nd note as a pedal point to the chords of the melodic minor (MM1) scale. E melodic minor on the 2nd degree, for example, contains the notes of the D melodic minor scale:

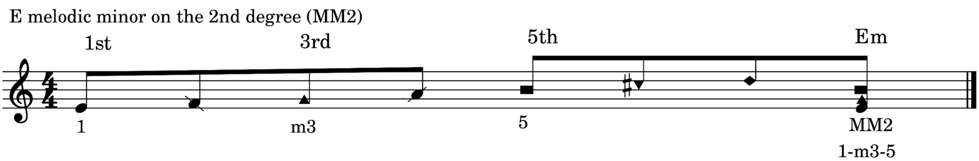


Figure 68 - The melodic minor scale on the 2nd degree (MM2) in E

The chords of the melodic minor scale in D are underlaid with the scale´s 2nd note - E - as a bass note:

[98]

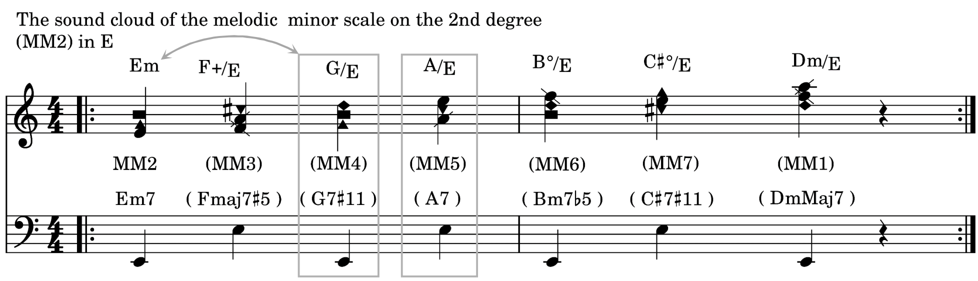


Figure 69 - The sound cloud of the melodic minor scale on the 2nd degree (MM2) in E

The combination of the fourth (MM4) and fifth (MM5) degrees, here G/E and A/E (G and A major triad over E in the bass), sounds particularly interesting. In addition to the third and seventh, the root, fifth, fourth and sixth, are also obtained. The minor ninth sounds very dissonant in a minor chord, which is why the F^+/E on the third degree (MM3) is omitted here.

Attention: The chords B° and $C^{\#\circ}$ based on the MM6 and MM7 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM6 and MM7 scales.

The G/E based on the MM4 scale forms the major parallel to the Em^7 minor seventh four-note chord based on the MM2 scale.

7.9.3 The melodic minor sound cloud on the 3rd degree (MM3)

The sound cloud of the melodic minor scale on the 3rd degree (MM3) is obtained by adding the 3rd note as a pedal point to the chords of the melodic minor scale (MM1). E melodic minor on the 3rd degree, for example, contains the notes of the C# melodic minor scale:

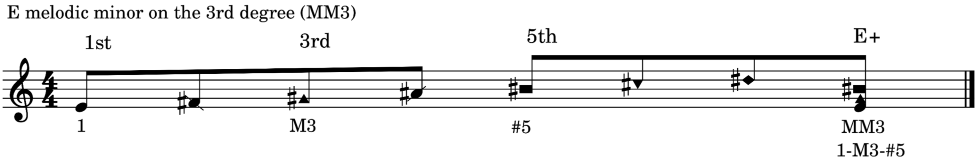


Figure 70 - The melodic minor scale on the 3rd degree (MM3) in E

The chords of the melodic minor scale in C# are underlaid with the scale´s 3rd note - E - as a bass note:

[99]

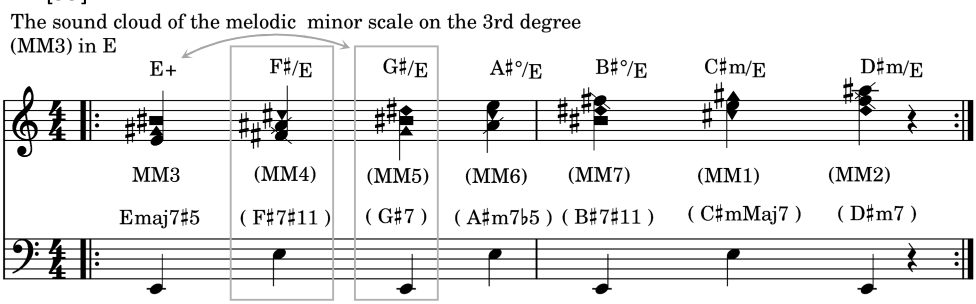


Figure 71 - The sound cloud of the melodic minor scale on the 3rd degree (MM3) in E

The combination of the fourth (MM4) and fifth (MM5) degrees, here F#/E, G#/E (F sharp major triad and G sharp major triad over E in the bass), sounds particularly interesting. In addition to the third and seventh, all the other functions, namely root, fifth, ninth, fourth and sixth, are also obtained.

Attention: The chords $A^{\#°}$ and $B^{\#°}$ based on the MM6 and MM7 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM6 and MM7 scales.

The $G^{\#}$/E based on the MM5 scale forms the parallel to the $E^{maj7\#5}$ major seventh four-note chord with augmented 5th based on the MM3 scale.

7.9.4 The melodic minor sound cloud on the 4th degree (MM4, Lydian^{b7})

The sound cloud of the melodic minor scale on the 4th degree (MM4, Lydian^{b7}) is obtained by adding the 4th note as a pedal point to the chords of the melodic minor scale (MM1). E melodic minor on the 4th degree, for example, contains the notes of the B melodic minor scale:

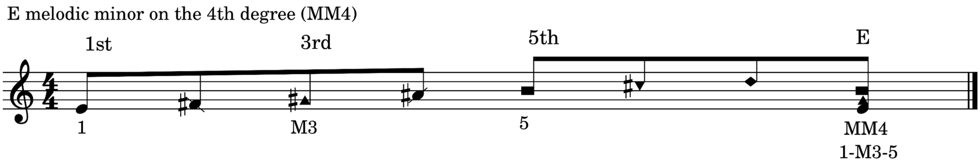


Figure 72 - The melodic minor scale on the 4th degree (MM4) in E

The chords of the melodic minor scale in B are underlaid with the scale´s 4th note - E - as a bass note:

[100]

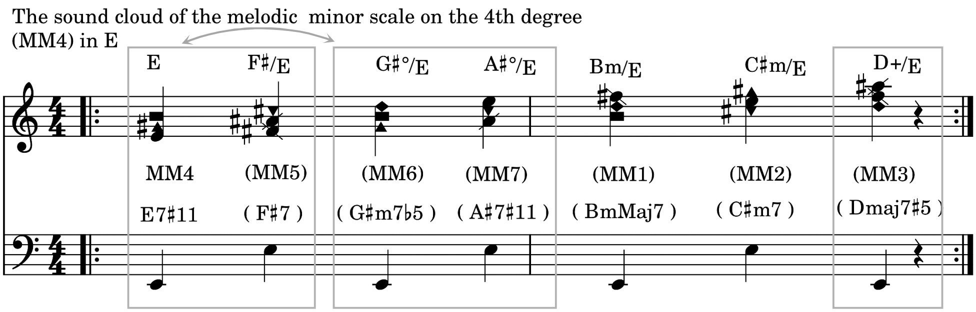


Figure 73 - The sound cloud of the melodic minor scale on the 4th degree (MM4) in E

The sound is characterized by the two major triads spaced a major second apart on the first and second degrees with the MM4 and MM5 scales, here E and F#/E (E major triad and F# major triad over E in the bass) as well the two diminished triads on the third and fourth degrees with MM6 and MM7 scales, here G#°/E and A#°/E (G#- and A#-diminished over E in the bass). You have to be careful not to play diminished four-note chords instead of triads, because the diminished sevenths, in this case the F and G as b9 and #9, are outside the scale of MM4.

The augmented D+/E on the seventh degree with the MM3 scale also shapes the sound of E melodic minor on the fourth degree.

Attention: The chords G#° and A#° based on the MM6 and MM7 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM6 and MM7 scales.

The G#°/E based on the MM6 scale forms the parallel to the E^7 dominant seventh four-note chord based on the MM4 scale.

7.9.5 The melodic minor sound cloud on the 5th degree (MM5)

The sound cloud of the melodic minor scale on the 5th degree (MM5) is obtained by adding the 5th note as a pedal point to the chords of the melodic minor scale (MM1). E melodic minor on the 5th degree, for example, contains the notes of the A melodic minor scale:

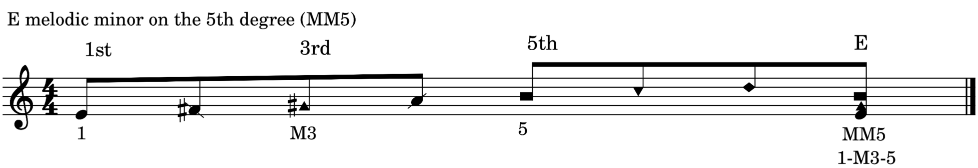


Figure 74 - The melodic minor scale on the 5th degree (MM5) in E

The chords of the melodic minor scale in A are underlaid with the scale´s 5th note - E - as a bass note:

[101]

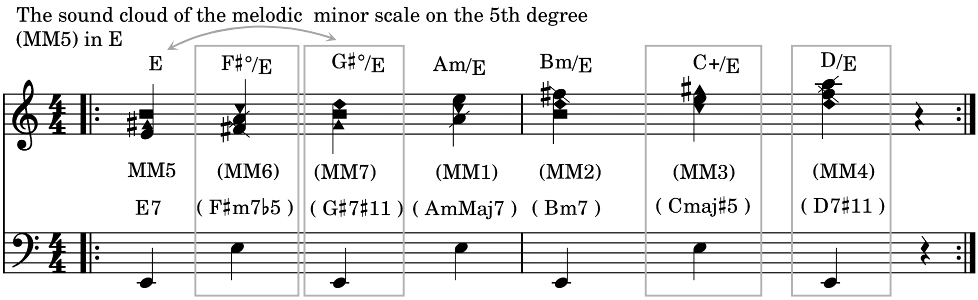


Figure 75 - The sound cloud of the melodic minor scale on the 5th degree (MM5) in E

The combination of the sixth (MM6), seventh (MM7), third (MM3) and fourth (MM4) degrees, here F#°/E, G#°/E (diminished F sharp and G sharp triad over E in the bass) and C+/E and D/E (augmented C triad and D major triad over E in the bass), sounds particularly interesting. In addition to the third and seventh, all the other functions, namely root, fifth, ninth, fourth and sixth, are also obtained.

Attention: The chords F#° and G#° based on the MM6 and MM7 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM6 and MM7 scales.

The G#°/E based on the MM7 scale forms the parallel to the E^7 dominant seventh four-note chord based on the MM5 scale.

7.9.6 The melodic minor sound cloud on the 6th degree (MM6)

The sound cloud of the melodic minor scale on the 6th degree (MM6) is obtained by adding the 6th note as a pedal point to the chords of the melodic minor scale (MM1). E melodic minor on the 6th degree, for example, contains the notes of the G melodic minor scale:

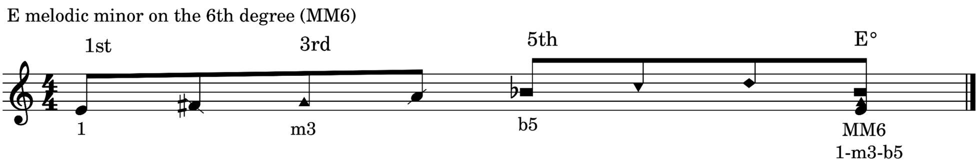


Figure 76 - The melodic minor scale on the 6th degree (MM6) in E

The chords of the melodic minor scale in G are underlaid with the scale´s 6th note - E - as a bass note:

[102]

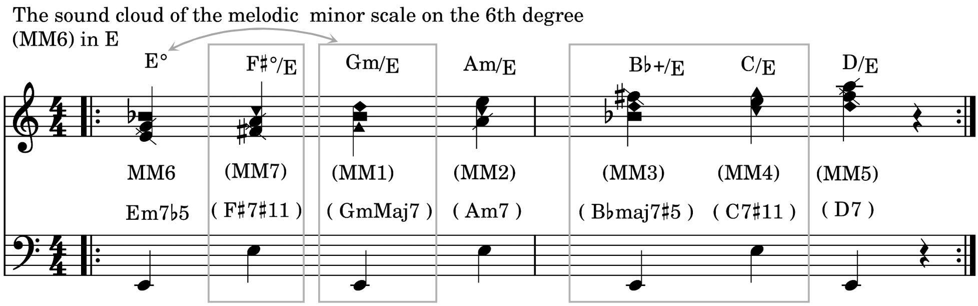


Figure 77 - The sound cloud of the melodic minor scale on the 6th degree (MM6) in E

The combination of the seventh (MM7), first (MM1), third (MM3) and fourth (MM4) degrees, here $F^{\#\circ}$/E, Gm/E, B^{b+}/E and C/E (diminished F sharp triad, G minor triad, augmented B flat triad and C major triad over E in the bass), sounds particularly interesting. In addition to the third and seventh, all the other functions, namely root, fifth, ninth, fourth and sixth, are also obtained.

Attention: The chords E° and $F^{\#\circ}$ based on the MM6 and MM7 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM6 and MM7 scales.

The Gm/E based on the MM1 scale forms the parallel to the Em^{7b5} half diminished minor seventh four-note chord based on the MM6 scale.

7.9.7 The melodic minor sound cloud on the 7th degree (MM7, altered)

The sound cloud of the melodic minor scale on the 7th degree (MM7, altered) is obtained by adding the 7th note as a pedal point to the chords of the melodic minor scale (MM1). E melodic minor on the 7th degree, for example, contains the notes of the F melodic minor scale:

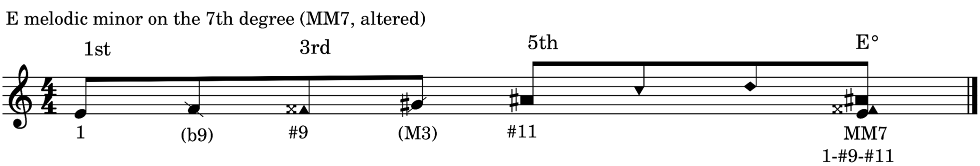


Figure 78 - The melodic minor scale on the 7th degree (MM7, altered) in E

Note:

> The MM7 (altered) scale in E is enharmonically reinterpreted because it contains a minor and major 3rd and the minor 3rd becomes the #9. The notes E, F, G, A^b, B^b, C und D are reinterpreted as E, F, $F^{\#\#}$, $G^\#$, $A^\#$, C und D, see chapter 3.3 (How to count).

The chords of the melodic minor scale in F are underlaid with the scale´s 7th note - E - as a bass note:

[103]

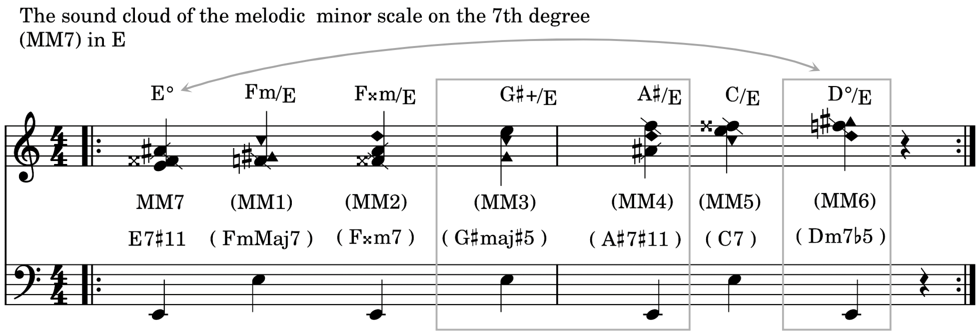


Figure 79 - The sound cloud of the melodic minor scale on the 7th degree (MM7, altered) in E

The combination of the third (MM3), fourth (MM4) and sixth (MM6) degrees, here G$^{\#+}$/E, A$^{\#}$/E and D°/E (G sharp augmented triad, A sharp major triad and diminished D triad over E in the bass), sounds particularly interesting. In addition to the third and seventh, all other functions, namely the fundamental, fifth, ninth, fourth and sixth, are included.

Since the MM7 (altered) scale deviates from the standard scheme due to the two ninths (b9 and #9), the 1st, 3rd and 5th notes result in a diminished chord, although the chord belonging to MM7 or altered is actually a dominant seventh chord. For this reason, we switch to the MM6 parallel with the diminished D°/E chord. This delivers the expected major third in the MM7 (altered) sound.

Attention: The chords E° and D° based on the MM7 and MM6 scales are diminished triads and not four-note chords. The diminished seventh (b7) in the four-note chords are not included in the MM7 and MM6 scales.

The G°/E based on the MM6 scale forms the parallel to the E^{7} dominant seventh four-note chord based on the MM7 scale.

8 Harmonic minor and its modes and chords

The harmonic minor scale with the structure 1 - 9 - m3 - 11- 5 - b6 - maj7 is a very commonly used scale worldwide. The minor third between the b6 and the maj7 gives it its extraordinary, dramatizing character.

8.1 The harmonic minor (HM1) scale and its minor major^7 chord

The harmonic minor scale HM1, here from the note A, is shown as follows:

[48]

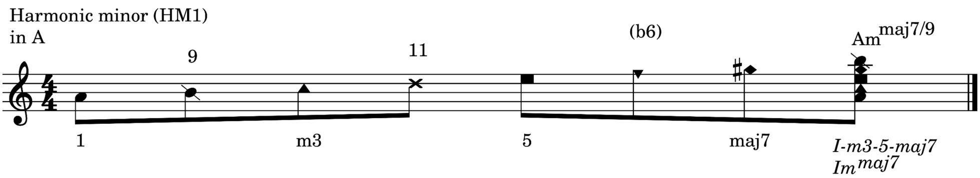


Figure 80 - The harmonic minor scale (HM1) in A and its minor major seventh chord

The Im^{maj7} chord, formed from the 1st, 3rd, 5th and 7th notes, is, like melodic minor, a minor chord with a major seventh (maj7). There is only one difference, namely the minor 6th (b6) instead of the major 6th (6). The minor 6th (b6) is a semitone above the 5th and is therefore a tone to avoid. The perfect 11th (11) is a tone to be avoided in all tonic types. See also the notes in chapter 4.3 (Interval designations).

8.2 The harmonic minor scale on the 2nd degree (HM2) and its minor^{7b5} chord

From the 2nd tone, here B, i.e. A harmonic minor from the tone B, the following harmonic minor scale on the 2nd degree (HM2) results:

[49]

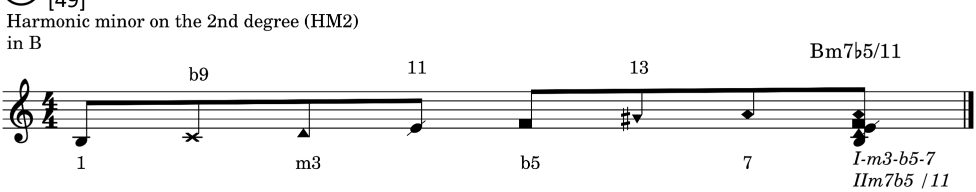


Figure 81 - The harmonic minor scale on the 2nd degree (HM2) in B and its half diminished minor seventh chord

The IIm^{7b5} chord formed from the 1st, 3rd, 5th and 7th notes is again a minor seventh chord with a diminished 5th (b5). The scale corresponds to the Locrian one, with the exception of the major 13th (13) instead of the minor 13th (b13). The minor 9th (b9) is generally a tone to avoid in minor chords because it is a semitone above the fundamental tone (1) and sounds disharmonious. Our ear only “accepts” the b9 for dominant seventh chords. See also note 2 in chapter 4.3 (Interval designations).

8.3 The harmonic minor scale on the 3rd degree (HM3) and its major$^{7\#5}$ chord

From the 3rd tone, here C, i.e. A harmonic minor from the tone C, the following harmonic minor scale on the 3rd degree (HM3) results:

[50]

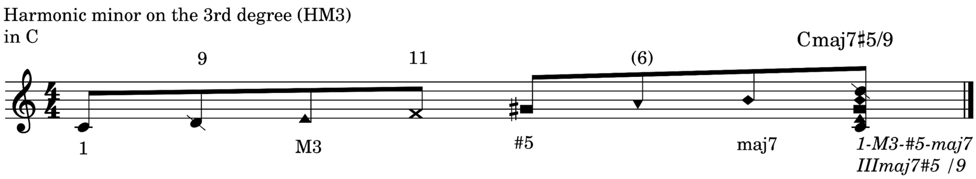


Figure 82 - The harmonic minor scale on the 3rd degree (HM3) in C and its major$^{7\#5}$ chord

The bIII$^{maj7\#5}$ chord, here E$^{bmaj7\#5}$, formed from the 1st, 3rd, 5th and 7th notes, is a major^{7} chord with an augmented 5th. It contains an augmented triad. The major 6th (6) is a minor second above the augmented 5th (#5), and therefore sounds dissonant and should be avoided. Alternatively, you can do without the augmented 5th (#5) and use the major 6th (6). The perfect 11th (11) is also a disharmonious tone to avoid in major chords. See also notes 4 and 5 in the chapter 4.3 (Interval designations).

8.4 The harmonic minor scale on the 4th degree (HM4) and its minor seventh chord

From the 4th tone, here D, i.e. A harmonic minor from the tone D, the following harmonic minor scale on the 4th degree (HM4) results:

[51]

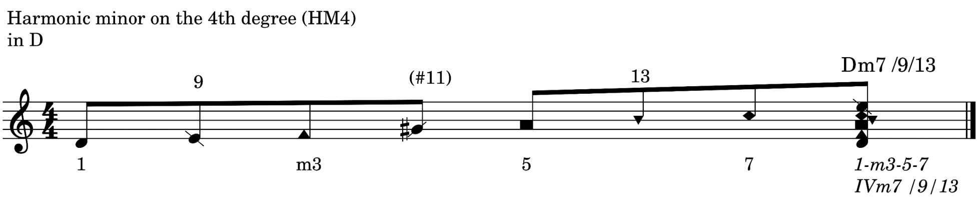


Figure 83 - The harmonic minor scale on the 4th degree (HM4) in D and its minor seventh chord

The IVm^7 chord, here Dm^7, formed from the 1st, 3rd, 5th and 7th notes, is a minor seventh chord. HM4 is identical to the Dorian scale except for the augmented 11th (#11).

Since the augmented 11th (#11) and perfect 5th (5) are a minor second apart, they are only played alternatively, i.e. either you use the augmented 11th (#11) and thus create a half-diminished sound (the #11 corresponds to a b5), or you forego the augmented 11th (#11) and play the perfect 5th (5).

8.5 The harmonic minor scale on the 5th degree (HM5) and its dominant seventh chord

From the 5th tone, here E, i.e. A harmonic minor from the tone E, the following harmonic minor scale results on the 5th degree (HM5):

[52]

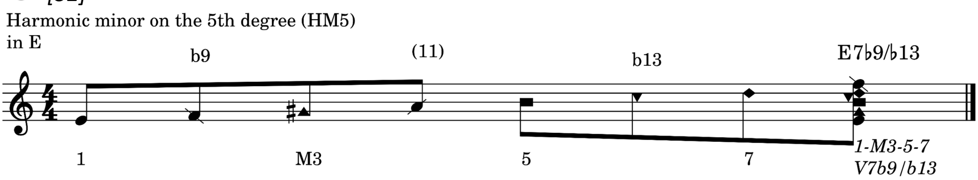


Figure 84 - The harmonic minor scale on the 5th degree (HM5) in E and its dominant seventh chord with the b9 and b13 as tensions

The V^7 chord, here E^7, formed from the 1st, 3rd, 5th and 7th notes, is a dominant seventh chord. HM5 has the minor 9th (b9) and minor 13th (b13) as tensions, which lead to the resolution in the minor key. The perfect 11th (11) gives the dominant chord a sus4 character, i.e. the 11th (11) and major 3rd (M3) are played alternatively, i.e. not at the same time.

8.6 The harmonic minor scale on the 6th degree (HM6) and its major$^{7\#11}$ chord

From the 6th tone, here F, i.e. A harmonic minor from the tone F, the following harmonic minor scale on the 6th degree (HM6) results:

[53]

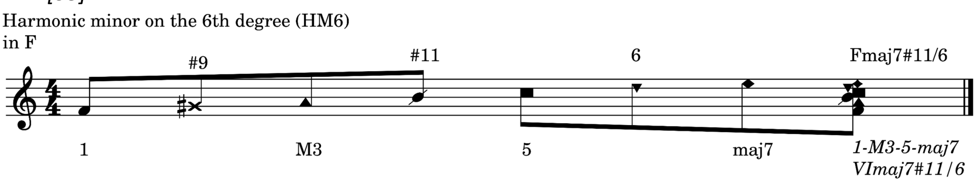


Figure 85 - The harmonic minor scale on the 6th degree (HM6) in F and its major seventh chord

The bVI^{maj7} chord, here F^{maj7}, formed from the 1st, 3rd, 5th and 7th notes, is a major seventh with an augmented 11th (#11) as tension. HM6 is identical to the Lydian scale except for the augmented 9th (#9). The augmented 9th (#9) is considered a dissonant tone to avoid in major chords. See also note 2 in chapter 4.3 (Interval designations).

8.7 The harmonic minor scale on the 7th degree (HM7) and its diminished chord

From the 7th tone, here G$^{\#}$, i.e. A harmonic minor from the tone G$^{\#}$, the following harmonic minor scale on the 7th degree (HM7) results:

[54]

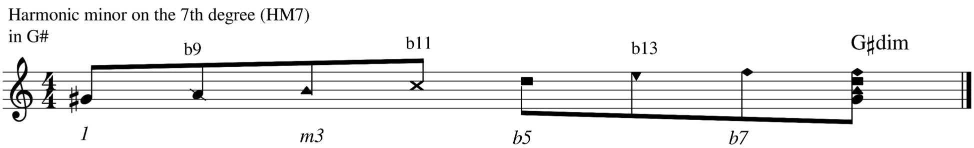


Figure 86 - The harmonic minor scale on the 7th degree (HM7) in G$^{\#}$

The HM7 scale has a minor and major third. This suggests referring to the minor 3rd as #9, as we did with the altered scale, see Chapter 7.7 (The melodic minor scale on the 7th degree (MM7, altered) and its altered dominant seventh chord). However, since it has a diminished 7th (b7), interpreting it as a diminished scale with a diminished chord makes the most sense. The major third is of course a note to avoid and is referred to here as b11.

8.8 Conclusion

The following chords and scales can be derived from the harmonic minor scale:

[55]

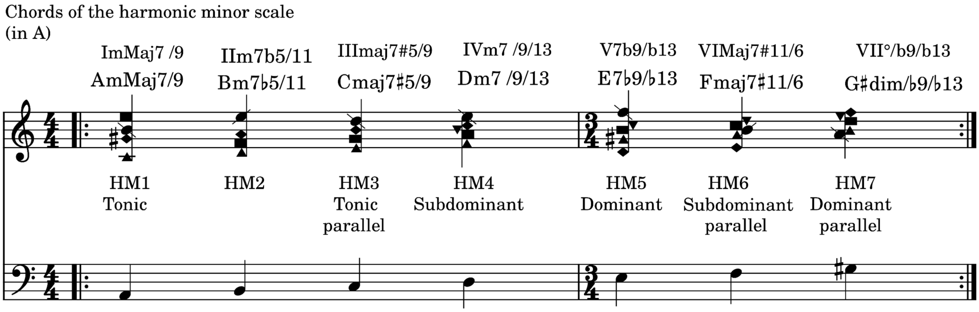


Figure 87 - The harmonic minor scale in A and its modi and chords

The chord on the 1st degree, here Am^{maj7}, is called the tonic [81], the one on the 5th degree, here E^{7}, the dominant [83] and the one on the 4th degree, here Dm^{7}, the "subdominant " - in quotation marks because you expect a major chord and not a minor chord with a dominant.

If you consider the parallel major key on the 3rd degree, here C$^{maj7\#5}$, as a tonal center, tonic or I chord, the 4th becomes the 6th degree and the 5th becomes the 7th degree. Accordingly, the major chord on the 3rd degree is called the tonic parallel, the one on the 6th degree is called the subdominant parallel and the one on the 7th degree is called the dominant parallel.

The 2-5-I progression of the harmonic minor scale, here Bm^{7b5} - E$^{7b9/b13}$ - Am^{maj7}, can be found in all musical styles and directions, see Chapter 14 (Cadences and Cadence variants).

Below is an overview of the functions, chords, important tones and avoid tones, as well as the tensions for the scales derived from the harmonic minor scales:

Scale designation	**Function**	**Chord (Example)**	**Important notes**	**Avoid notes** 1)	**Tensions**
Harmonic minor (HM1)	Tonic	Cm^{maj7}	m3, maj7	11, b6	9
HM2		Cm^{7b5}	m3, b5, 7	b9	11, 13
HM3	Tonic parallel	C$^{maj7\#5}$	M3, #5, maj7	11, (6)	9
HM4	„Subdominant“	Cm^{7}	m3, 7	(#11)	9, 13
HM5	Dominant	C^{7}	M3, 7	(11)	b9, b13
HM6	Subdominant parallel	C^{maj7}	M3, #11, maj7	#9	6
HM7	Dominant parallel	C^{dim}	m3, b5, b7	b11 (M3)	b9, b13

Table 61- The harmonic minor scale and its modes, chords and tensions and avoid notes

1) Chapter 4.3 (Interval designations) explains the reasons why certain tones should be avoided.

8.9 Harmonic minor modality and sound clouds

8.9.1 The harmonic minor (HM1) sound cloud

The harmonic minor (HM1) sound cloud is obtained by adding the root note as a pedal point to the chords of the harmonic minor (HM1) scale. This is explained using the example of the harmonic minor scale in E:

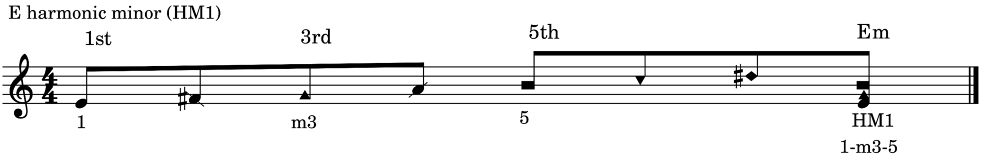


Figure 88 - The harmonic minor scale (HM1) in E

The chords of the harmonic minor scale in E are underlaid with the scale´s root note E as a bass note:

[109]

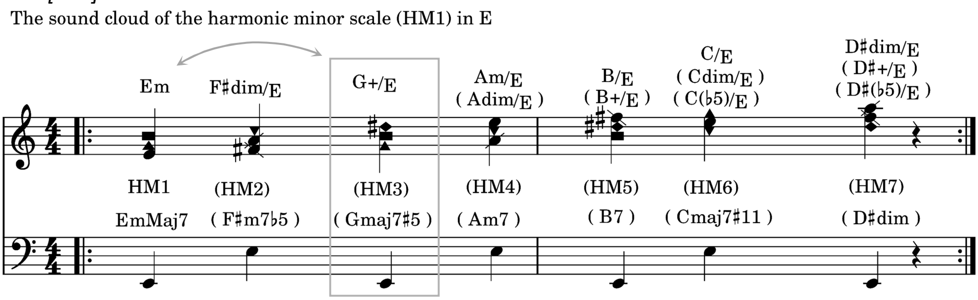


Figure 89 - The sound cloud of the harmonic minor (HM1) scale in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. For the harmonic minor sound cloud in E, for example, we take the triads Em, $F^{\#\circ}$, G^{+}, Am, B, C and $D^{\#\circ}$ from the chords Em^{maj7} (HM1), $F^{\#}m^{7b5}$ (HM2), $G^{maj7\#5}$ (HM3), Am^{7} (HM4), B^{7} (HM5), $C^{maj7\#11}$ (HM6) and $D^{\#\circ}$ (HM7) and underlay them with the bass note E, where (HM1) ... (HM7) means that the respective chord is based on the corresponding harmonic minor scale at the respective degree.

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here B/E and C/E (B and C major triad over E in the bass), are particularly interesting.

Here the $F^{\#dim}$ and $D^{\#dim}$ four-note chords based on the HM2 and HM7 scales are listed instead of the $F^{\#\circ}$ and $D^{\#\circ}$ triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The G^{+}/E based on the HM3 scale forms the major parallel to the Em^{maj7} minor major seventh four-note chord based on the harmonic minor (HM1) scale.

8.9.2 The harmonic minor sound cloud on the 2nd degree (HM2)

The sound cloud of the harmonic minor scale on the 2nd degree (HM2) is obtained by adding the 2nd note as a pedal point to the chords of the harmonic minor (HM1) scale. E HM2, for example, contains the notes of the harmonic minor scale in D:

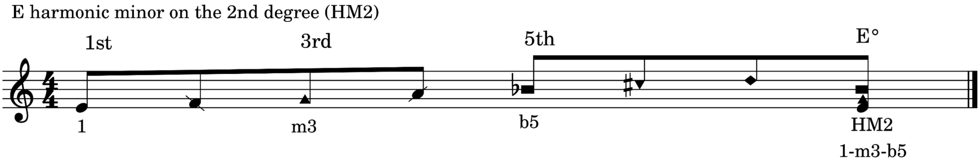


Figure 90 - The harmonic minor scale on the 2nd degree (HM2) in E

The chords of the harmonic minor scale in D are underlaid with the scale´s 2nd note - E - as a bass note:

[110]

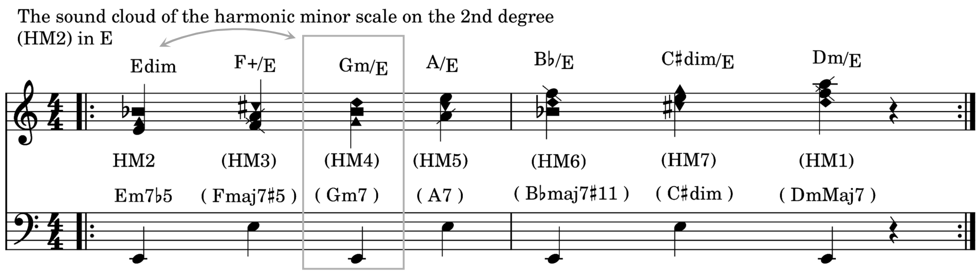


Figure 91 - The sound cloud of the harmonic minor scale on the 2nd degree (HM2) in E

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here A/E and B^{b}/E (A and B flat major triad over E in the bass), are particularly interesting.

Here the E^{dim} and C$^{\#dim}$ four-note chords based on the HM2 and HM7 scales are listed instead of the E° and C$^{\#}$° triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The Gm/E based on the HM4 scale forms the parallel to the Em^{7b5} half-diminished minor seventh four-note chord based on the HM2 scale.

8.9.3 The harmonic minor sound cloud on the 3rd degree (HM3)

The sound cloud of the harmonic minor scale on the 3rd degree (HM3) is obtained by adding the 3rd note as a pedal point to the chords of the harmonic minor scale (HM1). E HM3, for example, contains the notes of the harmonic minor scale in C$^{\#}$:

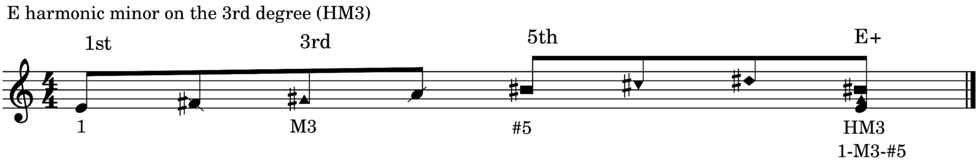


Figure 92 - The harmonic minor scale on the 3rd degree (HM3) in E

The chords of the harmonic minor scale in C# are underlaid with the scale´s 3rd note - E - as a bass note:

[111]

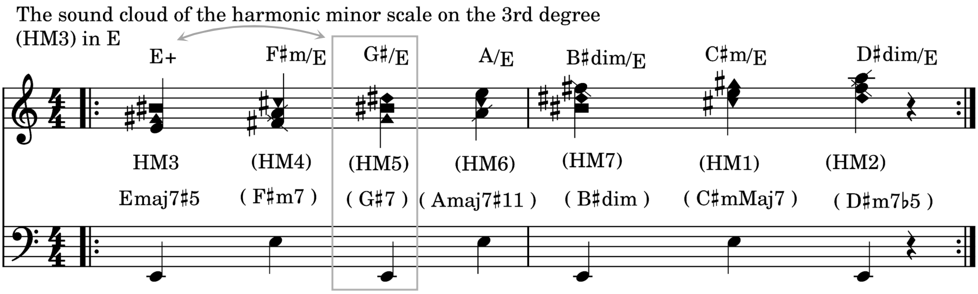


Figure 93 - The sound cloud of the harmonic minor scale on the 3rd degree (HM3) in E

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here G#/E and A/E (G sharp and A major triad over E in the bass), are particularly interesting.

Here the D#dim and B#dim four-note chords based on the HM2 and HM7 scales are listed instead of the D#° and B#° triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The G#/E based on the HM5 scale forms the parallel to the E maj7#5 major seventh four-note chord with augmented 5th based on the HM3 scale.

8.9.4 The harmonic minor sound cloud on the 4th degree (HM4)

The sound cloud of the harmonic minor scale on the 4th degree (HM4) is obtained by adding the 4th note as a pedal point to the chords of the harmonic minor scale (HM1). E HM4, for example, contains the notes of the harmonic minor scale in B:

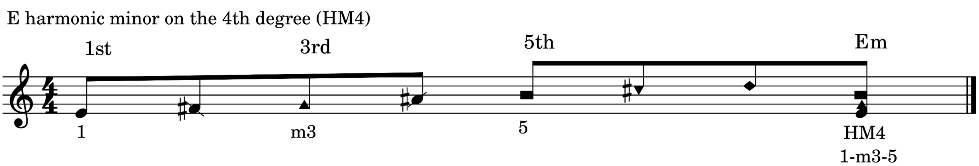


Figure 94 - The harmonic minor scale on the 4th degree (HM4) in E

The chords of the harmonic minor scale in B are underlaid with the scale´s 4th note - E - as a bass note:

[112]

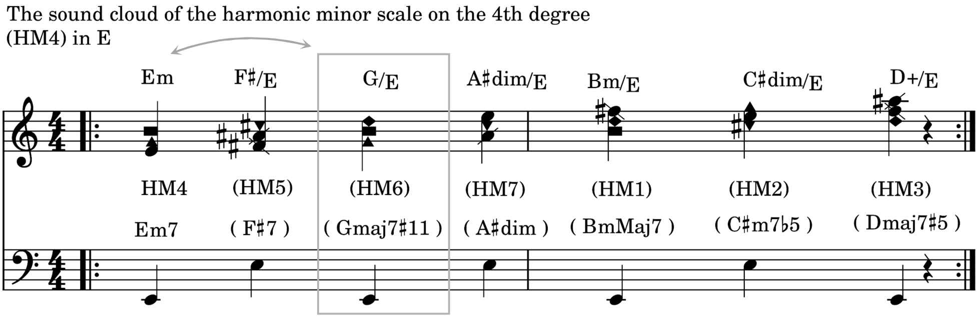


Figure 95 - The sound cloud of the harmonic minor scale on the 4th degree (HM4) in E

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here F#/E and G/E (F sharp and G major triad over E in the bass), are particularly interesting.

Here the C#dim and A#dim four-note chords based on the HM2 and HM7 scales are listed instead of the C#° and A#° triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The G/E based on the HM6 scale forms the parallel to the Em^7 minor seventh four-note chord based on the HM4 scale.

8.9.5 The harmonic minor sound cloud on the 5th degree (HM5)

The sound cloud of the harmonic minor scale on the 5th degree (HM5) is obtained by adding the 5th note as a pedal point to the chords of the harmonic minor scale (HM1). E HM5, for example, contains the notes of the harmonic minor scale in A:

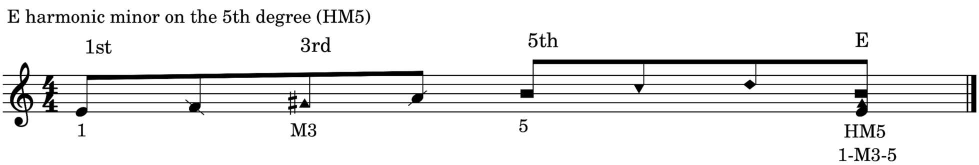


Figure 96 - The harmonic minor scale on the 5th degree (HM5) in E

The chords of the harmonic minor scale in A are underlaid with the scales' 5th note - E - as a bass note:

[113]

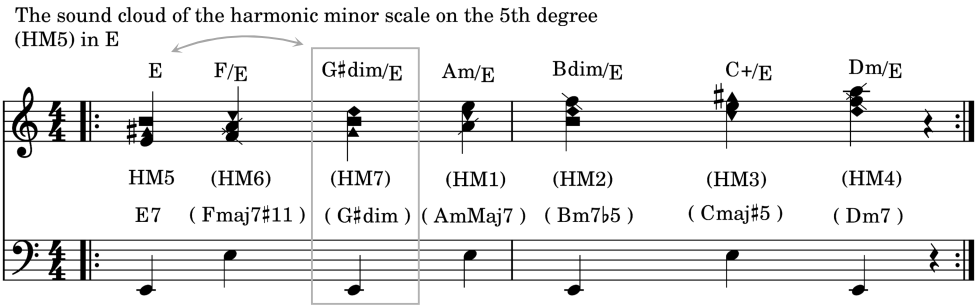


Figure 97 - The sound cloud of the harmonic minor scale on the 5th degree (HM5) in E

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here E and F/E (F major triad over E in the bass), are particularly interesting.

Here the B^{dim} and $G^{\#dim}$ four-note chords based on the HM2 and HM7 scales are listed instead of the B° and $G^{\#}$° triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The $G^{\#}$°/E based on the HM7 scale forms the parallel to the E^7 dominant seventh four-note chord based on the HM5 scale.

8.9.6 The harmonic minor sound cloud on the 6th degree (HM6)

The sound cloud of the harmonic minor scale on the 6th degree (HM6) is obtained by adding the 6th note as a pedal point to the chords of the harmonic minor scale (HM1). E HM6, for example, contains the notes of the harmonic minor scale in $G^{\#}$:

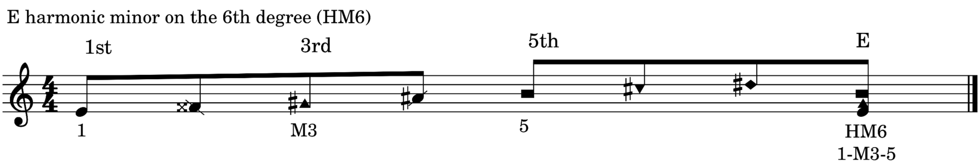


Figure 98 - The harmonic minor scale on the 6th degree (HM6) in E

The chords of the harmonic minor scale in $G^{\#}$ are underlaid with the scale´s 6th note - E - as a bass note:

[114]

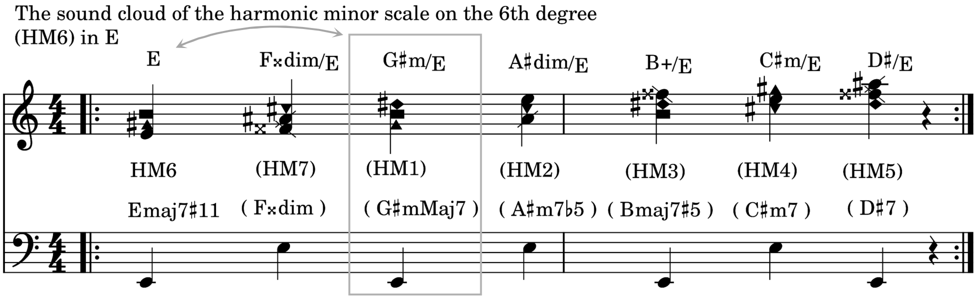


Figure 99 - The sound cloud of the harmonic minor scale on the 6th degree (HM6) in E

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here D$^{\#}$/E (D sharp major triad over E in the bass) and E (E major triad), are particularly interesting.

Here the A$^{\#dim}$ and F$^{\#\#dim}$ four-note chords based on the HM2 and HM7 scales are listed instead of the A$^{\#°}$ and F$^{\#\#°}$ triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The G$^{\#}$m/E based on the HM1 scale forms the parallel to the E^{maj7} four-note chord based on the HM6 scale.

8.9.7 The harmonic minor sound cloud on the 7th degree (HM7)

The sound cloud of the harmonic minor scale on the 7th degree (HM7) is obtained by adding the 7th note as a pedal point to the chords of the harmonic minor scale (HM1). E HM7, for example, contains the notes of the harmonic minor scale in F:

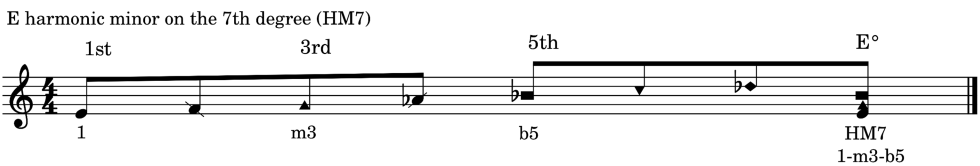


Figure 100 - The sound cloud of the harmonic minor scale on the 7th degree (HM7) in E

The chords of the harmonic minor scale in F are underlaid with the scale´s 7th note - E - as a bass note:

[115]

The sound cloud of the harmonic minor scale on the 7th degree (HM7) in E

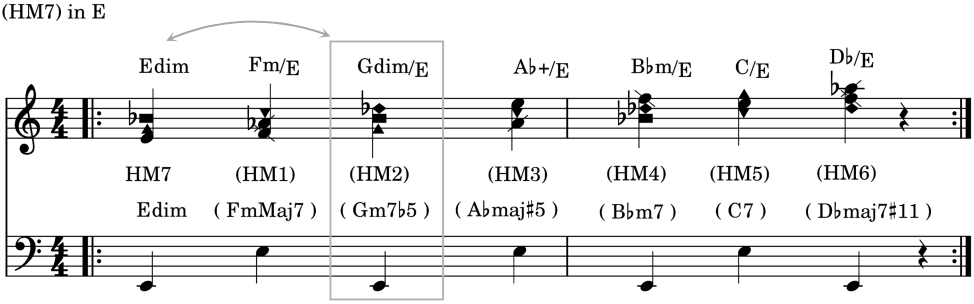


Figure 101 - The sound cloud of the harmonic minor scale on the 7th degree (HM7) in E

All combinations sound good here. The two major chords spaced a minor second apart on the fifth (HM5) and sixth degrees (HM6), here C/E and D^{b}/E (C and D flat major triad over E in the bass), are particularly interesting.

Here the G^{dim} and E^{dim} four-note chords based on the HM2 and HM7 scales are listed instead of the G° and E° triads to show that the b7 can also be played as a sounding sixth because it is included in the HM2 and HM7 scales.

The G°/E based on the HM2 scale forms the parallel to the diminished four-note chord in E based on the HM7 scale.

9 Harmonic major and its modes and chords

The harmonic major scale with the structure 1 - 9 - M3 - 11- 5 - b6 - maj7 has, like the harmonic minor scale, the minor third between the b6 and the maj7, but a major third (M3) instead of the minor third.

9.1 The harmonic major (HD1) scale and its major⁷ chord

The harmonic major scale HD1, here from the note C, is shown as follows:

[48a]

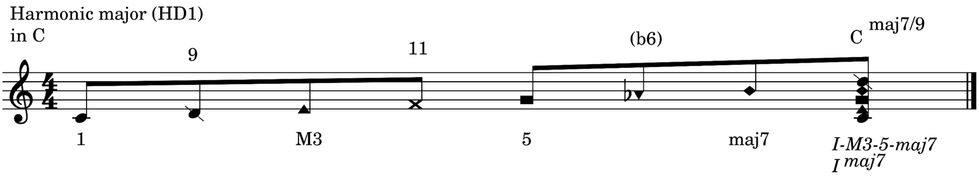


Figure 102 - The harmonic major scale (HD1) scale in C and its major seventh chord

The I^{maj7} chord, formed from the 1st, 3rd, 5th and 7th notes, is a major chord with a major seventh (maj7). The minor 6th (b6) is a semitone above the 5th and is therefore a tone to avoid. The perfect 11th (11) is a tone to be avoided in all tonic types. See also the notes in chapter 4.3 (Interval designations).

9.2 The harmonic major scale on the 2nd degree (HD2) and its minor^{7b5} chord

From the 2nd tone, here D, i.e. C harmonic major from the tone D, the following harmonic major scale on the 2nd degree (HM2) results:

[49a]

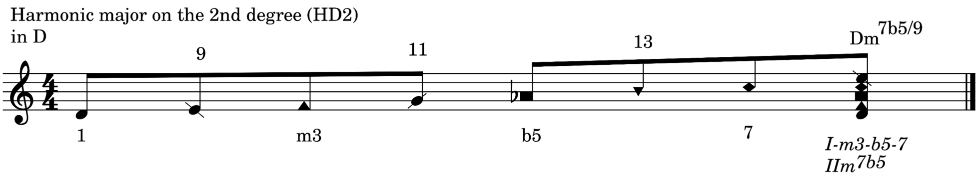


Figure 103 - The harmonic major scale on the 2nd degree (HD2) in D and its half diminished minor seventh chord

The IIm^{7b5} chord, formed from the 1st, 3rd, 5th and 7th notes, is a minor seventh chord with a diminished fifth (b5). The scale corresponds to the MM6 scale (Locrian9) with the exception of the major 13th (13) instead of the minor 13th (b13). The HD2 scale contains no avoid notes.

9.3 The harmonic major scale on the 3rd degree (HD3) and its dominant sept$^{b9/b13}$ chord

From the 3rd tone, here E, i.e. C harmonic major from the tone E, the following harmonic major scale on the 3rd degree (HD3) results:

[50a]

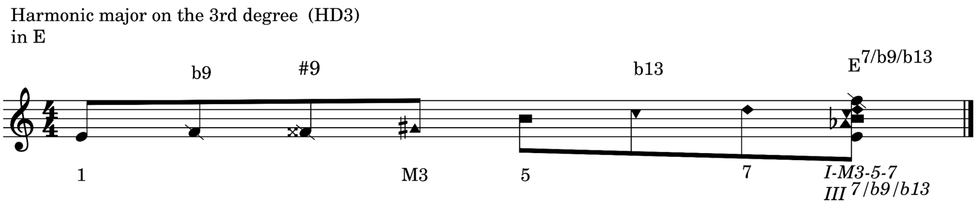


Figure 104 - The harmonic major scale on the 3rd degree (HD3) in E and its dominant sept $^{b9/b13}$ chord

The III$^{7/b9/b13}$ chord, here E$^{7/b9/b13}$, formed from the 1st, 3rd, 5th and 7th notes, is a dominant seventh chord with the options b9, #9 and b13. The scale corresponds to the HM5 scale with the exception of the augmented 9th (#9) instead of the 11th (11). Or it corresponds to the altered scale (MM7), except that it contains a perfect fifth (5) instead of the augmented fourth (#11).The HD3 scale contains no avoid notes.

9.4 The harmonic major scale on the 4th degree (HD4) and its minor major^7 chord

From the 4th tone, here F, i.e. C harmonic major from the tone F, the following harmonic major scale on the 4th degree (HD4) results:

[51a]

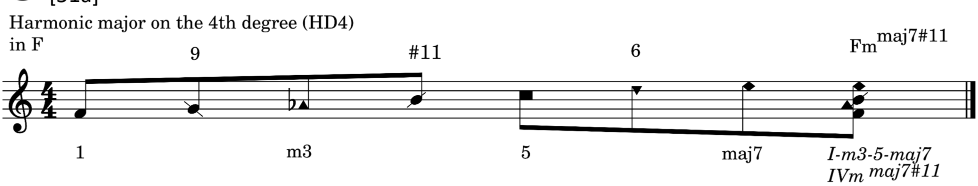


Figure 105 - The harmonic major scale on the 4th degree (HD4) in F and its minor major^7 chord

The IVm^7 chord, here Fm^{maj7}, formed from the 1st, 3rd, 5th and 7th notes, is a minor major^7 chord with an augmented 11th (#11). HD4 is, so to speak, the minor version of the Lydian scale and contains no avoid notes.

9.5 The harmonic major scale on the 5th degree (HD5) and its dominant seventh chord

From the 5th tone, here G, i.e. C harmonic major from the tone E, the following harmonic major scale results on the 5th degree (HD5):

[52a]

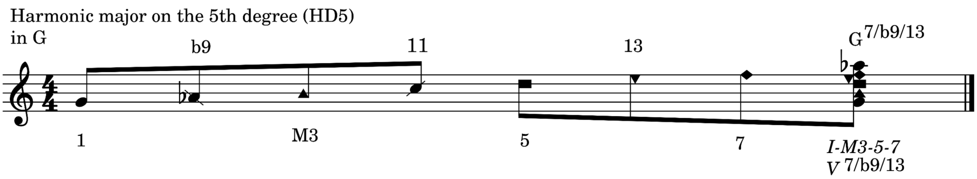


Figure 106 - The harmonic major scale on the 5th degree (HD5) in G and its dominant seventh chord with the b9 and 13 as tensions

The V^7 chord, here G^7, formed from the 1st, 3rd, 5th and 7th notes, is a dominant seventh chord. HD5 has the minor 9th (b9) and major 13th (13) as tensions. The perfect 11th (11) gives the dominant chord a sus4 character, i.e. the 11th (11) and major 3rd (M3) are played alternatively, i.e. not at the same time.

9.6 The harmonic major scale on the 6th degree (HD6) and its major$^{7/\#11/\#5}$ chord

From the 6th tone, here A^b, i.e. C harmonic major from the tone A^b, the following harmonic major scale on the 6th degree (HD6) results:

[53a]

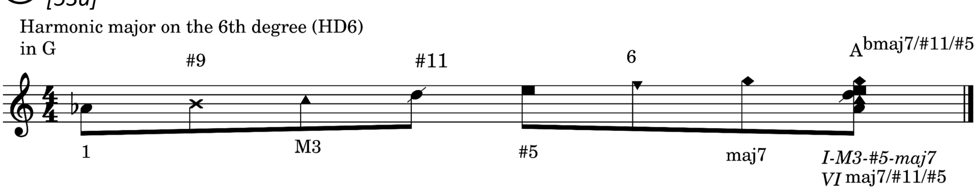


Figure 107 - The harmonic major scale on the 6th degree (HD6) in A^b and its major$^{7/\#11/\#5}$ chord

The VI$^{maj7/\#5}$ chord, here A$^{bmaj7/\#5}$, formed from the 1st, 3rd, 5th and 7th notes, is a major seventh with an augmented 5th (#5) and augmented (#11) as tension. The augmented 9th (#9) is considered a dissonant avoid note in major chords. See also note 2 in chapter 4.3 (Interval designations).

9.7 The harmonic major scale on the 7th degree (HD7) and its diminished chord

From the 7th tone, here B, i.e. C harmonic major from the tone B, the following harmonic major scale on the 7th degree (HD7) results:

[54a]

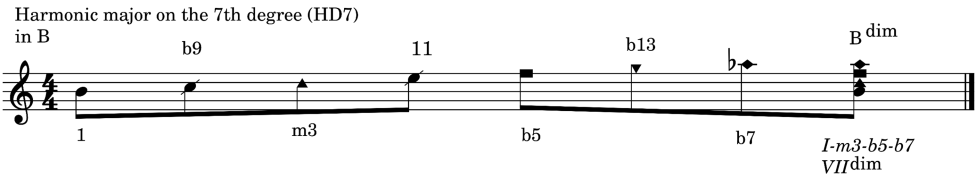


Figure 108 - The harmonic major scale on the 7th degree (HD7) in B

The VII^{dim} chord, here B^{dim}, formed from the 1st, 3rd, 5th and 7th notes, is a diminished four-note chord with a minor ninth (b9), perfect eleventh (11) and minor thirteenth (b13) as options.

9.8 Conclusion

The following chords and scales can be derived from the harmonic major scale:

[55]

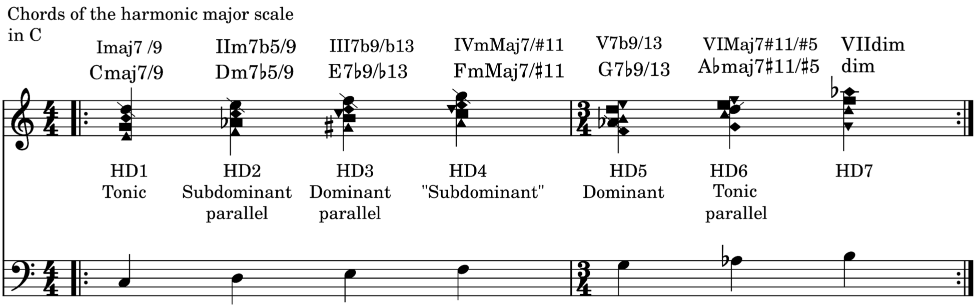


Figure 109 - The harmonic major scale in C and its modi and chords

The chord on the 1st degree, here C$^{maj7/9}$, is called the tonic [81], the one on the 5th degree, here G$^{7/b9/13}$, the dominant [83] and the one on the 4th degree, here Fm$^{maj7\#11}$, the “subdominant “ - in quotation marks because you expect a major chord and not a minor chord with a dominant.

If you consider the parallel key on the 6th degree, here A$^{bmaj7\#5}$, as a tonal center, tonic or I chord, the 4th becomes the 2nd degree and the 5th becomes the 3rd degree. Accordingly, the chord on the 6th degree is called the tonic parallel, the one on the 2nd degree is called the subdominant parallel and the one on the 3rd degree is called the dominant parallel.

Below is an overview of the functions, chords, important tones and avoid tones, as well as the tensions for the scales derived from the harmonic major scales:

Scale designation	**Function**	**Chord (Example)**	**Important notes**	**Avoid notes** [1)]	**Tensions**
Harmonic minor (HD1)	Tonic	$C^{maj7/9}$	M3, maj7	11, (b6)	9
HD2	Subdominant parallel	$Cm^{7b5/9}$	m3, b5, 7	--	9, 11, 13
HD3	Dominant parallel	$C^{7/b9/b13}$	M3, 7	--	b9, #9, b13
HD4	„Subdominant“	$Cm^{maj7\#11}$	m3, maj7	--	9, #11, 6
HD5	Dominant	$C^{7/b9/13}$	M3, 7	(11)	b9, 13
HD6	Tonic parallel	$C^{maj7\#11/\#5}$	M3, #5, maj7	6, #9	#11, 6
HD7		C^{dim}	m3, b5, b7	--	b9, 11, b13

Table 62 - The harmonic major scale and its modes, chords and tensions and avoid notes

1) Chapter 4.3 (Interval designations) explains the reasons why certain tones should be avoided.

9.9 Harmonic major modality and sound clouds

9.9.1 The harmonic major (HD1) sound cloud

The harmonic major (HD1) sound cloud is obtained by adding the root note as a pedal point to the chords of the harmonic major (HD1) scale. This is explained using the example of the harmonic major scale in E:

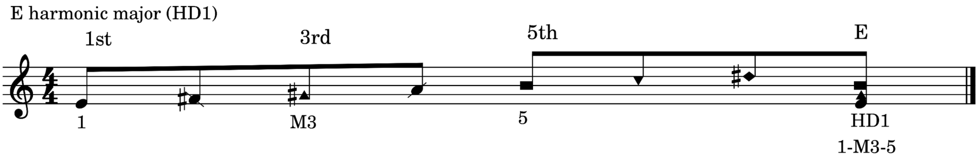


Figure 110 - The harmonic major scale (HD1) in E

The chords of the harmonic major scale in E are underlaid with the scale´s root note - E - as a bass note:

[109a]

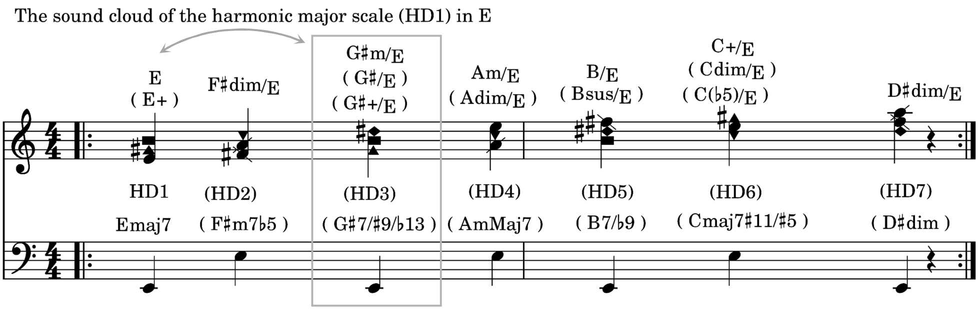


Figure 111 - The sound cloud of the harmonic major (HD1) scale in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. For the harmonic major sound cloud in E, for example, we take the triads E, $F^{\#\circ}$, $G^{\#}$m, Am, B, C^{+} und $D^{\#\circ}$ from the chords E^{maj7} (HD1), $F^{\#}m^{7b5}$ (HD2), $G^{\#7\#9/b13}$ (HD3), Am^{maj7} (HD4), B^{7b9} (HD5), $C^{maj7\#11/\#5}$ (HD6) und $D^{\#dim}$ (HD7) and underlay them with the bass note E, where (HD1) ... (HD7) means that the respective chord is based on the corresponding harmonic major scale at the respective degree.

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here $G^{\#}$m/E and Am/E ($G^{\#}$ and A minor triad over E in the bass) in combination with the diminished triad on the second degree (HD2), here $F^{\#\circ}$, sound particularly interesting.

The $G^{\#}$m/E based on the HD3 scale is the parallel to the E^{maj7} chord based on the HD1 scale. The minor third (m3) is actually an augmented ninth (#9), so that the sound cloud includes both an $G^{\#}$m/E and $G^{\#}$/E ($G^{\#}$ minor and $G^{\#}$ major triad above E in the bass).

Here the diminished four-note chords $F^{\#dim}$ and $D^{\#dim}$ based on the HD2 and HD7 scales are listed instead of the triads $F^{\#°}$ and $D^{\#°}$ to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

9.9.2 The harmonic major sound cloud on the 2nd degree (HD2)

The sound cloud of the harmonic major scale on the 2nd degree (HD2) is obtained by adding the 2nd note as a pedal point to the chords of the harmonic (HD1) scale. E HD2, for example, contains the notes of the harmonic major scale in D:

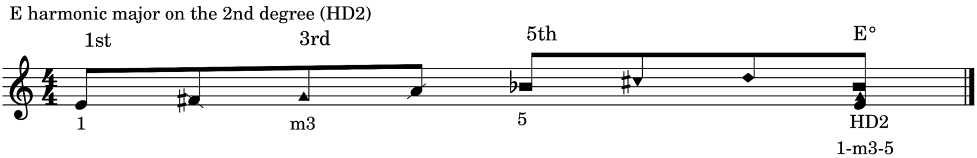


Figure 112 - The harmonic major scale on the 2nd degree (HD2) in E

The chords of the harmonic major scale in D are underlaid with the scale´s 2nd note - E - as a bass note:

[110a]

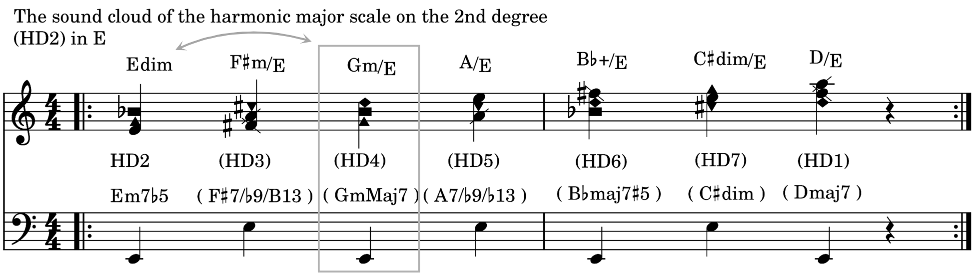


Figure 113 - The sound cloud of the harmonic major scale on the 2nd degree (HD2) in E

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here $F^{\#}$m/E and Gm/E ($F^{\#}$ and G minor triad over E in the bass) in combination with the diminished triad on the second degree (HD2), here E°, sound particularly interesting.

The Gm/E based on the HD4 scale is the parallel to the Em^{7b5} chord based on the HD2 scale.

The minor third (m3) of $F^{\#}$m/E based on the HD3 scale is actually an augmented ninth (#9), so that the sound cloud includes both an $F^{\#}$m/E and $F^{\#}$/E ($F^{\#}$ minor and $F^{\#}$ major triad over E in the bass).

Here the diminished four-note chords E^{dim} and $C^{\#dim}$ based on the HD2 and HD7 scales are listed instead of the triads E° and $C^{\#°}$ to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

9.9.3 The harmonic major sound cloud on the 3rd degree (HD3)

The sound cloud of the harmonic major scale on the 3rd degree (HD3) is obtained by adding the 3rd note as a pedal point to the chords of the harmonic major scale (HD1). E HD3, for example, contains the notes of the harmonic major scale in C:

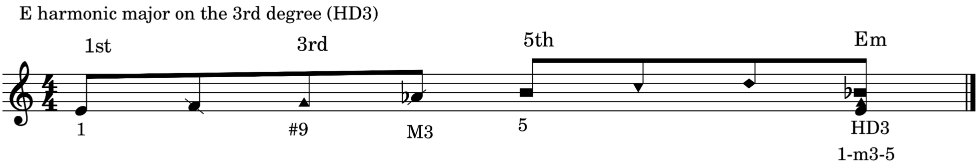


Figure 114 - The harmonic major scale on the 3rd degree (HD3) in E

The chords of the harmonic major scale in C are underlaid with the scale´s 3rd note - E - as a bass note:

[111a]

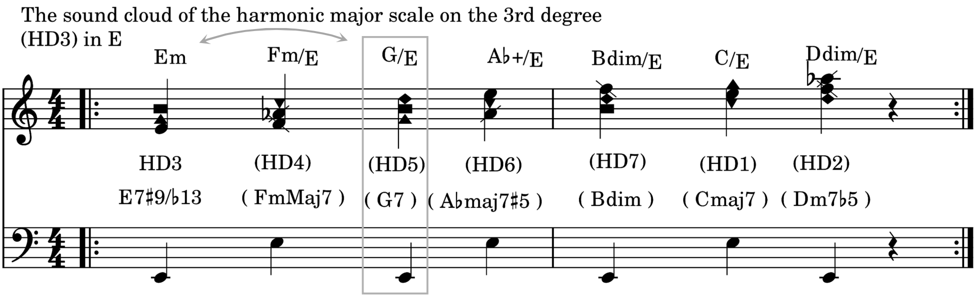


Figure 115 - The sound cloud of the harmonic major scale on the 3rd degree (HD3) in E

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here Em and Fm/E (F minor triad over E in the bass) in combination with the diminished triad on the second degree (HD2), here D°, sound particularly interesting.

The G/E based on the HD5 scale is the parallel to the $E^{7\#9/b13}$ chord based on the HD3 scale.

The minor third (m3) of Em based on the HD3 scale is actually an augmented ninth (#9), so that the sound cloud includes both an Em and E (E minor and E major triad).

Here the diminished four-note chords D^{dim} and B^{dim} based on the HD2 and HD7 scales are listed instead of the triads D° and B° to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

9.9.4 The harmonic major sound cloud on the 4th degree (HD4)

The sound cloud of the harmonic major scale on the 4th degree (HD4) is obtained by adding the 4th note as a pedal point to the chords of the harmonic major scale (HD1). E HD4, for example, contains the notes of the harmonic major scale in B:

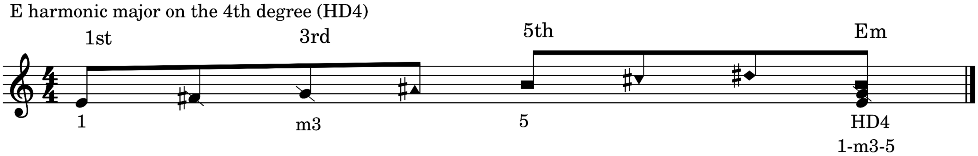


Figure 116 - The harmonic major scale on the 4th degree (HD4) in E

The chords of the harmonic major scale in B are underlaid with the scale´s 4th note - E - as a bass note:

[112a]

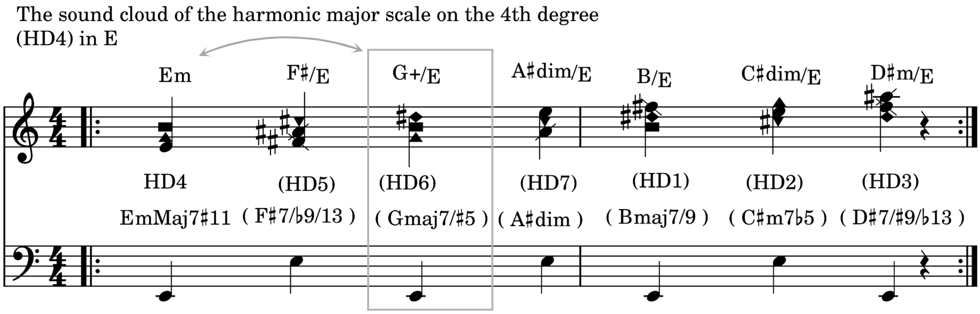


Figure 117 - The sound cloud of the harmonic major scale on the 4th degree (HD4) in E

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here D$^{\#}$m/E (D$^{\#}$ minor triad over E in the bass) and Em in combination with the diminished triad on the second degree (HD2), here C$^{\#°}$, sound particularly interesting.

The G+/E based on the HD5 scale is the parallel to the Em$^{maj7\#11}$ chord based on the HD4 scale.

The minor third (m3) of Em based on the HD3 scale is actually an augmented ninth (#9), so that the sound cloud includes both a D$^{\#}$m and D$^{\#}$ (D$^{\#}$ minor and D$^{\#}$ major triad).

Here the diminished four-note chords C$^{\#dim}$ and A$^{\#dim}$ based on the HD2 and HD7 scales are listed instead of the triads C$^{\#°}$ and A$^{\#°}$ to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

9.9.5 The harmonic major sound cloud on the 5th degree (HD5)

The sound cloud of the harmonic major scale on the 5th degree (HD5) is obtained by adding the 5th note as a pedal point to the chords of the harmonic major scale (HD1). E HD5, for example, contains the notes of the harmonic major scale in A:

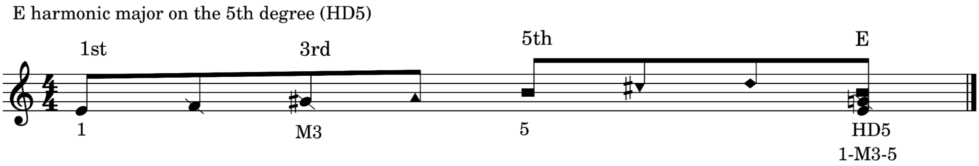


Figure 118 - The harmonic major scale on the 5th degree (HD5) in E

The chords of the harmonic major scale in A are underlaid with the scales' 5th note - E - as a bass note:

[113a]

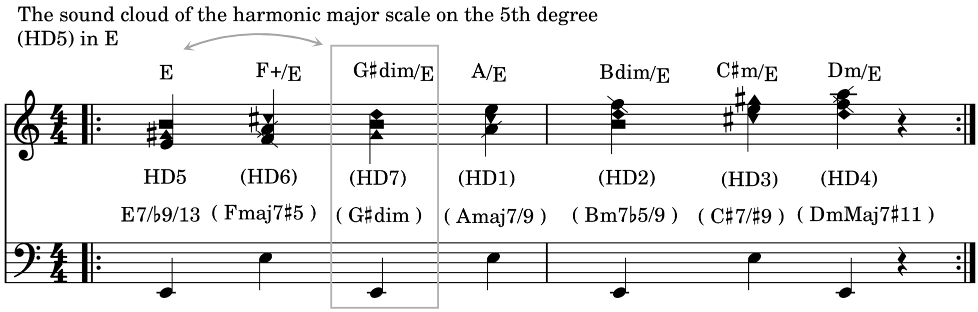


Figure 119 - The sound cloud of the harmonic major scale on the 5th degree (HD5) in E

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here $C^{\#}$m/E and Dm/E ($C^{\#}$ minor triad and D minor triad over E in the bass) in combination with the diminished triad on the second degree (HD2), here B°, sound particularly interesting.

The $G^{\#dim}$/E based on the HD5 scale is the parallel to the $E^{7/b9/13}$ chord based on the HD5 scale.

The minor third (m3) of $C^{\#}$m based on the HD3 scale is actually an augmented ninth (#9), so that the sound cloud includes both a $C^{\#}$m and $C^{\#}$ ($C^{\#}$ minor and $C^{\#}$ major triad).

Here the diminished four-note chords B^{dim} and $G^{\#dim}$ based on the HD2 and HD7 scales are listed instead of the triads B° and $G^{\#}$° to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

9.9.6 The harmonic major sound cloud on the 6th degree (HD6)

The sound cloud of the harmonic major scale on the 6th degree (HD6) is obtained by adding the 6th note as a pedal point to the chords of the harmonic major scale (HD1). E HD6, for example, contains the notes of the harmonic major scale in $G^{\#}$:

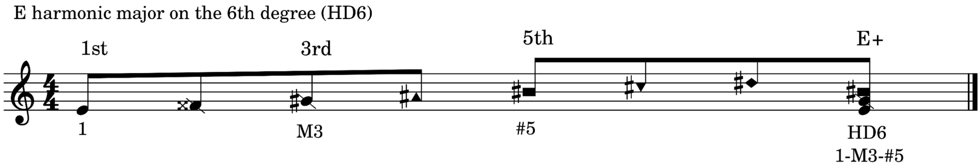


Figure 120 - The harmonic major scale on the 6th degree (HD6) in E

The chords of the harmonic major scale in G$^{\#}$ are underlaid with the scale´s 6th note - E - as a bass note:

[114a]

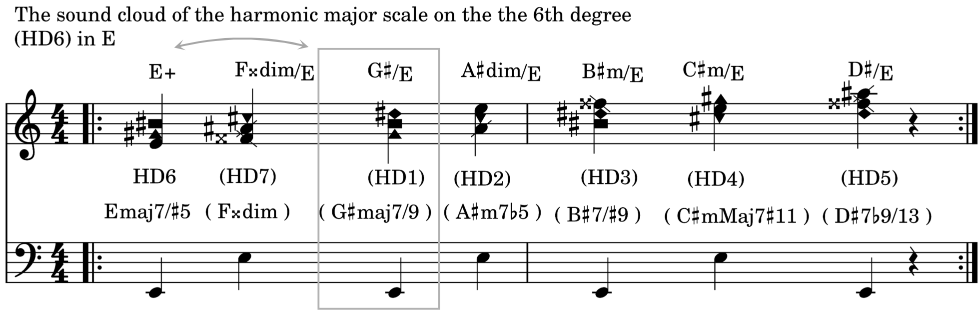


Figure 121 - The sound cloud of the harmonic major scale on the 6th degree (HD6) in E

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here B$^{\#}$m/E and C$^{\#}$m/E (B$^{\#}$ minor triad and C$^{\#}$ minor triad over E in the bass) in combination with the diminished triad on the second degree (HD2), here A$^{\#°}$, sound particularly interesting.

The G$^{\#}$/E based on the HD1 scale is the parallel to the E$^{maj7/\#5}$ chord based on the HD6 scale.

The minor third (m3) of B$^{\#}$m based on the HD3 scale is actually an augmented ninth (#9), so that the sound cloud includes both a B$^{\#}$m and B$^{\#}$ (B$^{\#}$ minor and B$^{\#}$ major triad).

Here the diminished four-note chords A$^{\#dim}$ and F$^{\#\#dim}$ based on the HD2 and HD7 scales are listed instead of the triads A$^{\#°}$ and F$^{\#\#°}$ to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

9.9.7 The harmonic major sound cloud on the 7th degree (HD7)

The sound cloud of the harmonic major scale on the 7th degree (HD7) is obtained by adding the 7th note as a pedal point to the chords of the harmonic major scale (HD1). E HD7, for example, contains the notes of the harmonic major scale in F:

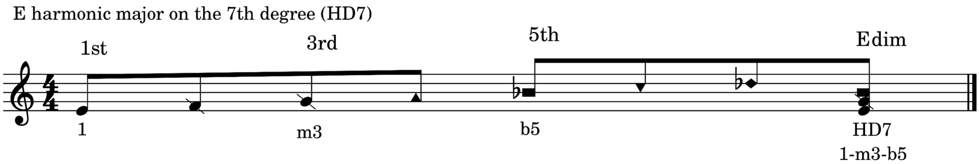


Figure 122 - The sound cloud of the harmonic major scale on the 7th degree (HD7) in E

The chords of the harmonic major scale in F are underlaid with the scale´s 7th note - E - as a bass note:

[115]

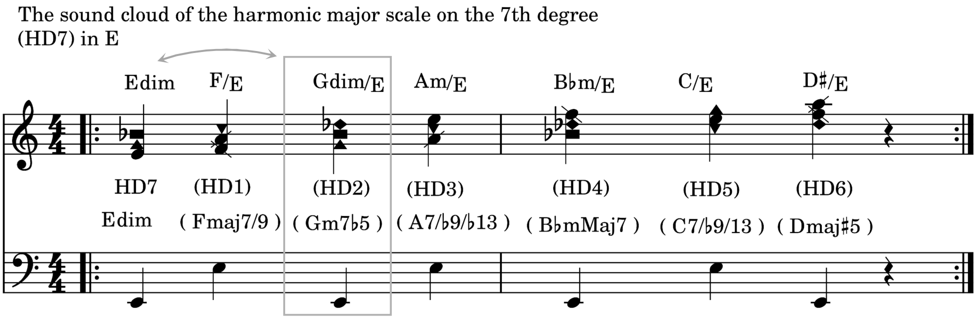


Figure 123 - The sound cloud of the harmonic major scale on the 7th degree (HD7) in E

The two minor chords at a distance of a minor second on the third (HD3) and fourth degree (HD4), here Am/E and B^{b}m/E (A minor triad and B^{b} minor triad over E in the bass) in combination with the diminished triad on the second degree (HD2), here G°, sound particularly interesting.

The G^{dim}/E based on the HD2 scale is the parallel to the E^{dim} chord based on the HD7 scale.

The minor third (m3) of Am based on the HD3 scale is actually an augmented ninth (#9), so that the sound cloud includes both a Am and A (A minor and A major triad).

Here the diminished four-note chords G^{dim} and E^{dim} based on the HD2 and HD7 scales are listed instead of the triads G° and E° to show that the b7 can also be played as a sounding sixth because it is included in the HD2 and HD7 scales.

10 Double harmonic minor and its modes and chords

The double harmonic minor scale with the structure 1 - 9 - m3 - #11 - 5 - b6 - maj7 is a very widespread scale in the Arabic and Oriental world. It has two consecutive semitones in the sequence #11-5-b6 and two minor thirds between m3 and #11 as well as b6 and maj7, which give it its extraordinary, dramatizing character.

10.1 The double harmonic minor (DHM1) scale and its minor major^{7} chord

The double harmonic minor scale HM1, here from the note A, is shown as follows:

[48c]

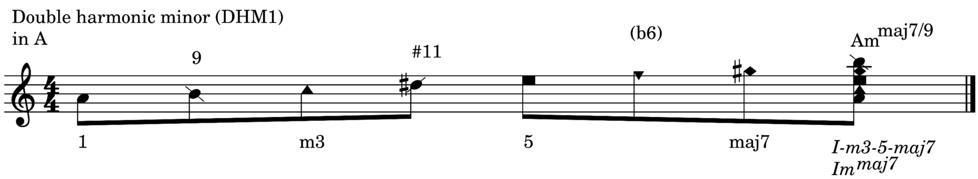


Figure 124 - The double harmonic minor (DHM1) scale in A and its minor major seventh chord

The Im^{maj7} chord, formed from the 1st, 3rd, 5th and 7th notes, is, like the melodic and harmonic minor, a minor chord with a major seventh (maj7). The minor sixth (b6) is a semitone above the fifth and is therefore a tone to avoid. The fifth is surrounded by two semitone tones, #11 and b6. The scale has a minor third between the m3 and #11 on the one hand and the b6 and maj7 on the other.

10.2 The double harmonic minor scale on the 2nd degree (DHM2) and its dominant^{7b5} chord

From the 2nd tone, here B, i.e. A double harmonic minor from the tone B, the following double harmonic minor scale on the 2nd degree (DHM2) results:

[49b]

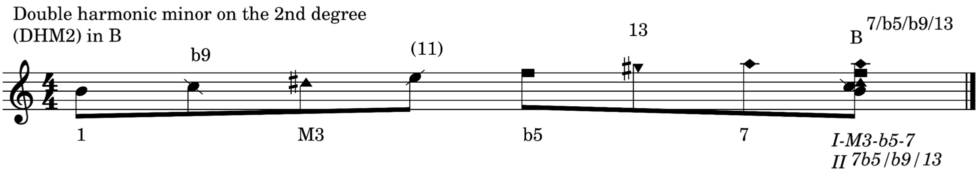


Figure 125 - The double harmonic minor scale on the 2nd degree (DHM2) in B and its dominant seventh chord

The II^{7b5} chord, formed from the 1st, 3rd, 5th and 7th notes, is a dominant seventh chord with a diminished fifth (b5). The perfect eleventh (11) gives the dominant chord a sus4 character that does not fit the altered character created by the b5 (sounding #11) and is therefore bracketed here as avoid note.

10.3 The double harmonic minor scale on the 3rd degree (DHM3) and its major$^{7\#5}$ chord

From the 3rd tone, here C, i.e. A double harmonic minor from the tone C, the following double harmonic minor scale on the 3rd degree (DHM3) results:

[50b]

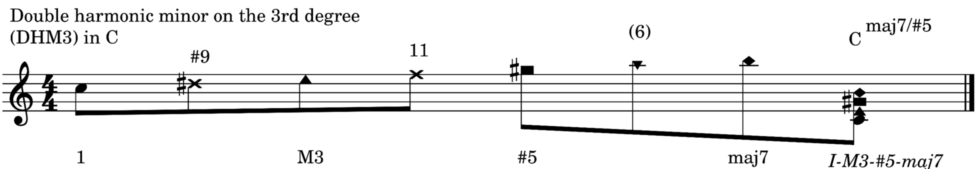


Figure 126 - The double harmonic minor scale on the 3rd degree (DHM3) in C and its major$^{7\#5}$ chord

The III$^{maj7\#5}$ chord, here C$^{maj7\#5}$, formed from the 1st, 3rd, 5th and 7th notes, is a major^{7} chord with an augmented 5th. It contains an augmented triad. The major 6th (6) is a minor second above the augmented 5th (#5), and therefore sounds dissonant and should be avoided. Alternatively, you can do without the augmented 5th (#5) and use the major 6th (6). The augmented ninth (#9) Is a sounding minor third and therefore an avoid note in a major chord. The perfect 11th (11) is also a disharmonious tone to avoid in major chords. See also notes 4 and 5 in the chapter 4.3 (Interval designations).

10.4 The double harmonic minor scale on the 4th degree (DHM4)

From the 4th tone, here D$^{\#}$, i.e. A double harmonic minor from the tone D$^{\#}$, the following double harmonic minor scale on the 4th degree (DHM4) results:

[51b]

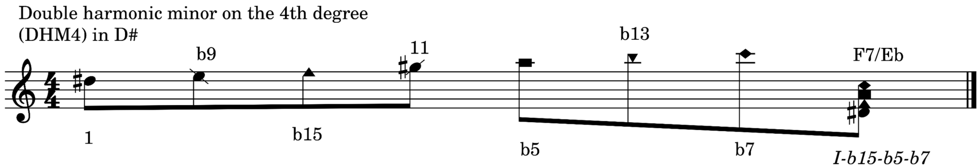


Figure 127 - The double harmonic minor scale on the 4th degree (DHM4) in D#

This shows why, with the exception of this double harmonic minor scale, we restrict ourselves to scales that do not have two consecutive semitones. The b15 is a sounding ninth, i.e. the third is missing in this scale. In addition, the chord formed from the 1st, 3rd, 5th and 7th notes corresponds to the third inversion of a dominant seventh chord. Here F^7/E^b, i.e. an F^7 with the seventh E^b in the bass. This scale cannot be classified harmonically.

10.5 The double harmonic minor scale on the 5th degree (DHM5) and its major^7 chord

From the 5th tone, here E, i.e. A double harmonic minor from the tone E, the following double harmonic minor scale results on the 5th degree (DHM5):

[52b]

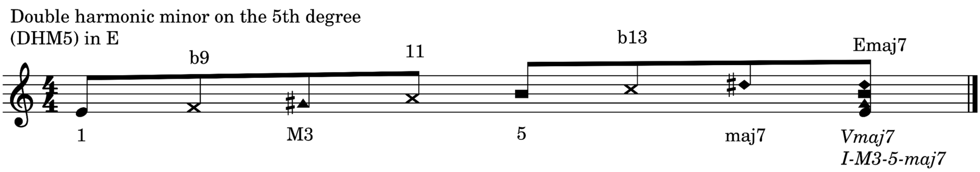


Figure 128 - The double harmonic minor scale on the 5th degree (DHM5) in E and its major seventh chord

The V^{maj7} chord, here E^{maj7}, formed from the 1st, 3rd, 5th and 7th notes, is a major^7 chord. The minor ninth (b9) and the perfect eleventh (11) are tones to be avoided in the major^7 chord, as is the minor thirteenth (b13), see also the notes in chapter 4.3 (Interval designations).

10.6 The double harmonic minor scale on the 6th degree (DHM6) and its major$^{7\#11}$ chord

From the 6th tone, here F, i.e. A double harmonic minor from the tone F, the following double harmonic minor scale on the 6th degree (DHM6) results:

[53b]

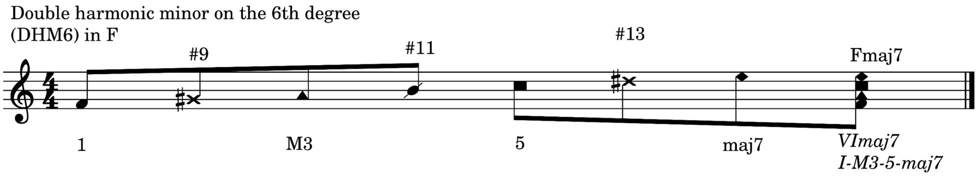


Figure 129 - The double harmonic minor scale on the 6th degree (DHM6) in F and its major$^{7\#11}$ chord

The VI^{maj7} chord, here F^{maj7}, formed from the 1st, 3rd, 5th and 7th notes, is a major seventh with an augmented 11th (#11) as tension. The augmented 9th (#9) is considered a dissonant tone to avoid in major chords. See also note 2 in chapter 4.3 (Interval designations). The augmented thirteenth (#13) is a sounding minor seventh, so the DHM6 scale contains both a sounding minor and major seventh, as well as a minor and major third, and is therefore difficult to classify harmonically.

10.7 The double harmonic minor scale on the 7th degree (DHM7) and its major^6 chord

From the 7th tone, here G$^\#$, i.e. A double harmonic minor from the tone G$^\#$, the following double harmonic minor scale on the 7th degree (DHM7) results:

[54b]

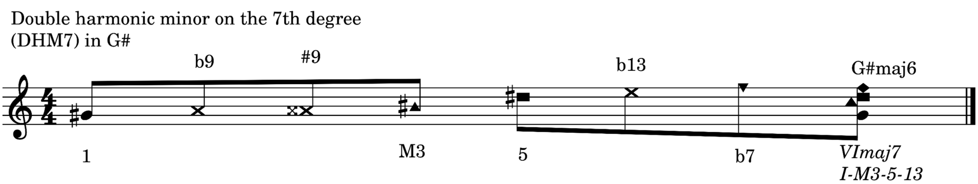


Figure 130 - The double harmonic minor scale on the 7th degree (DHM7) in G$^\#$

The DHM7 scale has a sounding minor and major third as well as a minor and major sixth, which makes it difficult to classify harmonically. It makes sense to designate the minor third as #9 and accordingly the major sixth or thirteenth (13) as the diminished seventh b7. The result is a sounding Major^6 chord with the options b9, #9 and b13 as avoid notes.

10.8 Conclusion

The following chords and scales can be derived from the double harmonic minor scale:

[55b]

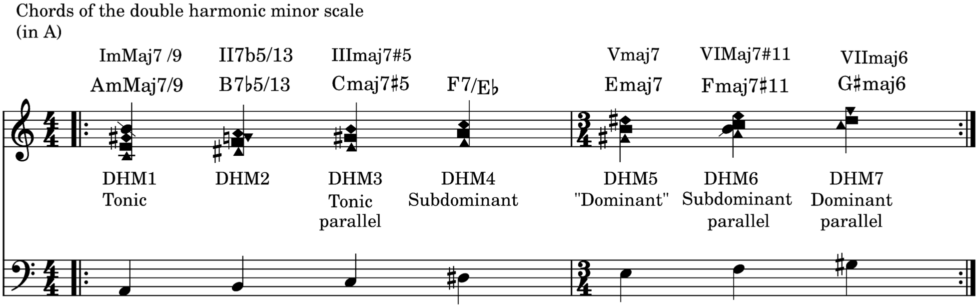


Figure 131 - The double harmonic minor scale in A and its modi and chords

The chord on the 1st degree, here Am^{maj7}, is called the tonic [81], the one on the 5th degree, here E^{maj7}, the dominant [83] and the one on the 4th degree, here F^7/E^b, as the subdominant.

If you consider the parallel major key on the 3rd degree, here $C^{maj7\#5}$, as a tonal center, tonic or I chord, the 4th becomes the 6th degree and the 5th becomes the 7th degree. Accordingly, the major chord on the 3rd degree is called the tonic parallel, the one on the 6th degree is called the subdominant parallel and the one on the 7th degree is called the dominant parallel.

Below is an overview of the functions, chords, important tones and avoid tones, as well as the tensions for the scales derived from the double harmonic minor scales:

Scale designation	Function	Chord (Example)	Important notes	Avoid notes 1)	Tensions
Double Harmonic minor (HM1)	Tonic	Cm^{maj7}	m3, maj7	(b6)	9, #11
DHM2		C^{7b5}	M3, b5, 7	(11)	B9, 13
DHM3	Tonic parallel	$C^{maj7\#5}$	M3, #5, maj7	11, (6), #9	
DHM4	Subdominant	D^7/C 2)	1, b9, 11, b13	(b5)	b15
DHM5	Dominant	C^{maj7}	M3, 5, maj7	b9, 11, b13	
DHM6	Subdominant parallel	$C^{maj7\#11}$	M3, 5, maj7	#9, #13	#11
DHM7	Dominant parallel	C^{maj6}	M3, 5, b7	b9, #9, b13	--

Table 63- The double harmonic minor scale and its modes, chords and tensions and avoid notes

1) Chapter 4.3 (Interval designations) explains the reasons why certain tones should be avoided.

2) The DHM4 scale is difficult to classify harmonically. What makes the most sense is reinterpreting the first degree as a minor seventh. For example, the C DHM4 scale then includes a D^7/C chord, i.e. the following reinterpretations are made:
1 -> 7
b9 -> 1
11 -> M3
b13 -> 5
b15 -> b9
(b5) -> (11).

10.9 Double harmonic minor modality and sound clouds

10.9.1 The double harmonic minor (DHM1) sound cloud

The double harmonic minor (DHM1) sound cloud is obtained by adding the root note as a pedal point to the chords of the double harmonic minor (DHM1) scale. This is explained using the example of the double harmonic minor scale in E:

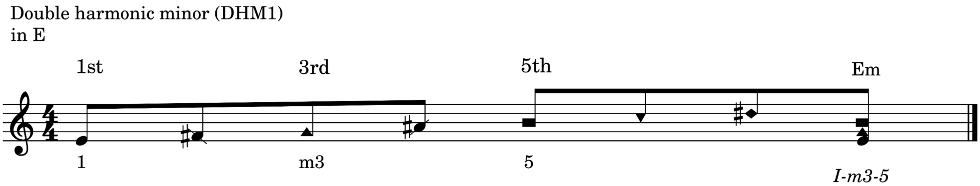


Figure 132 - The double harmonic minor scale (DHM1) in E

The chords of the double harmonic minor scale in E are underlaid with the scale´s root note - E - as a bass note:

[109b]

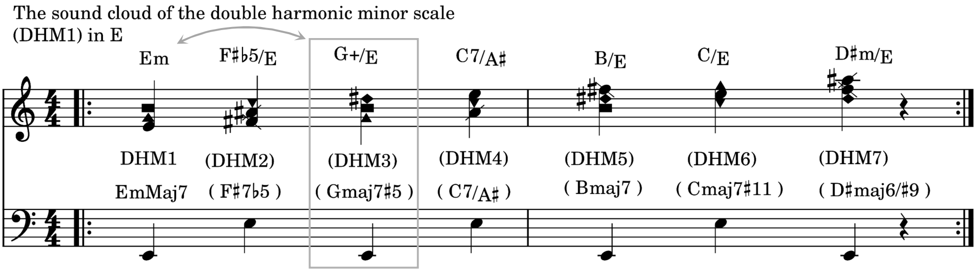


Figure 133 - The sound cloud of the double harmonic minor (DHM1) scale in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. For the double harmonic minor sound cloud in E, for example, we take the triads

Em, F$^{\#b5}$, G^{+}, A$^{\#}$-C-E, B, C und D$^{\#m}$ from the chords Em^{maj7} (DHM1), F$^{\#7b5}$ (DHM2), G$^{maj7\#5}$ (DHM3), C^{7}/A$^{\#}$ (DHM4), B^{maj7} (DHM5), C$^{maj7\#11}$ (DHM6) und D$^{\#maj6}$ (DHM7) and underlay them with the bass note E, where (DHM1) ... (DHM7) means that the respective chord is based on the corresponding harmonic minor scale at the respective degree.

Particularly interesting - as with the harmonic minor scale - are the two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here B/E and C/E (B and C major triad over E in the bass).

The G^{+}/E based on the DHM3 scale forms - as with the harmonic minor scale - the major parallel to the Em^{maj7} minor major seventh four-note chord based on the double harmonic minor (DHM1) scale.

10.9.2 The double harmonic minor sound cloud on the 2nd degree (DHM2)

The sound cloud of the double harmonic minor scale on the 2nd degree (DHM2) is obtained by adding the 2nd note as a pedal point to the chords of the double harmonic minor (DHM1) scale. E DHM2, for example, contains the notes of the double harmonic minor scale in D

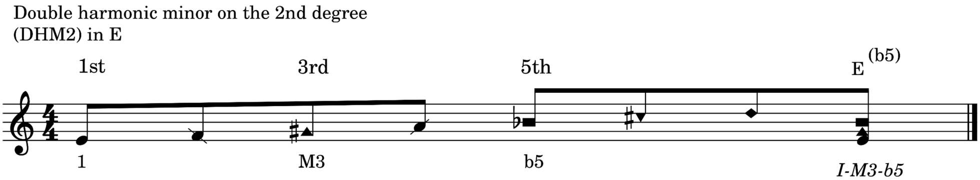


Figure 134 - The double harmonic minor scale on the 2nd degree (HM2) in E

The chords of the double harmonic minor scale in D are underlaid with the scale´ 2nd note - E - of as a bass note:

[110b]

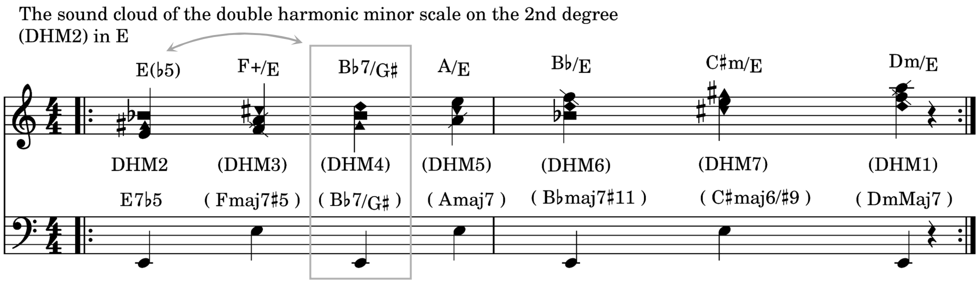


Figure 135 - The sound cloud of the double harmonic minor scale on the 2nd degree (DHM2) in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. For the sound cloud of the double harmonic minor scale on the 2nd degree (DHM2) in E, for example, we take the triads E(b5), F^{+}, G$^{\#}$-B^{b}-D, A, B^{b}, C$^{\#m}$ and Dm from the chords E^{7b5} (DHM2), F$^{maj7\#5}$ (DHM3), B^{b7}/G$^{\#}$ (DHM4), A^{maj7} (DHM5), B$^{bmaj7\#11}$ (DHM6), C$^{maj6/\#9}$

(DHM7) and Dm^{maj7} (DHM1) and underlay them with the bass note E, where (DHM1) ... (DHM7) means that the respective chord is based on the corresponding harmonic minor scale at the respective degree.

Particularly interesting - as with the harmonic minor scale - are the two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here A/E and B^{b}/E (A and B flat major triad over E in the bass).

The (G$^{\#}$-B^{b}-D)/E based on the DHM4 scale forms the parallel to the E^{7b5} four-note chord based on the DHM2 scale.

10.9.3 The double harmonic minor sound cloud on the 3rd degree (DHM3)

The sound cloud of the double harmonic minor scale on the 3rd degree (DHM3) is obtained by adding the 3rd note as a pedal point to the chords of the double harmonic minor scale (DHM1). E DHM3, for example, contains the notes of the double harmonic minor scale in C$^{\#}$:

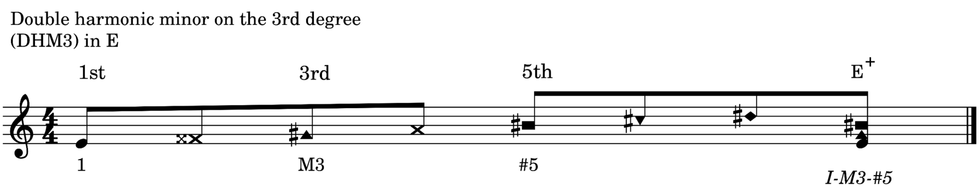


Figure 136 - The double harmonic minor scale on the 3rd degree (HDM3) in E

The chords of the double harmonic minor scale in C$^{\#}$ are underlaid with the scale´s 3rd note - E - as a bass note:

[111b]

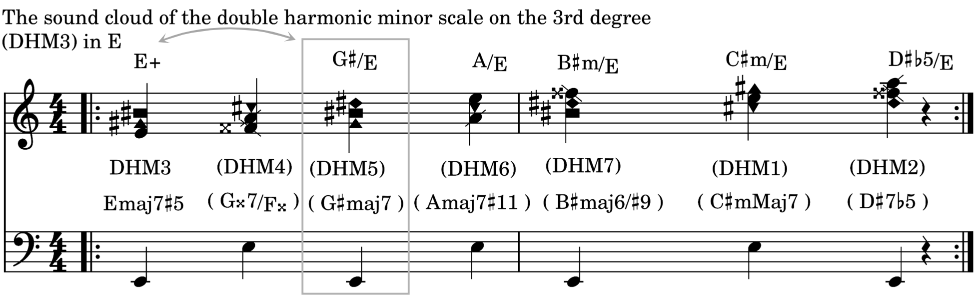


Figure 137 - The sound cloud of the double harmonic minor scale on the 3rd degree (DHM3) in E

The two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here G$^{\#}$/E and A/E (G sharp and A major triad over E in the bass), are particularly interesting.

The G$^{\#}$/E based on the DHM5 scale forms the parallel to the E$^{maj7\#5}$ major seventh four-note chord with augmented 5th based on the DHM3 scale.

10.9.4 The double harmonic minor sound cloud on the 4th degree (DHM4)

The sound cloud of the double harmonic minor scale on the 4th degree (DHM4) is obtained by adding the 4th note as a pedal point to the chords of the double harmonic minor scale (DHM1). E DHM4, for example, contains the notes of the double harmonic minor scale in B^b:

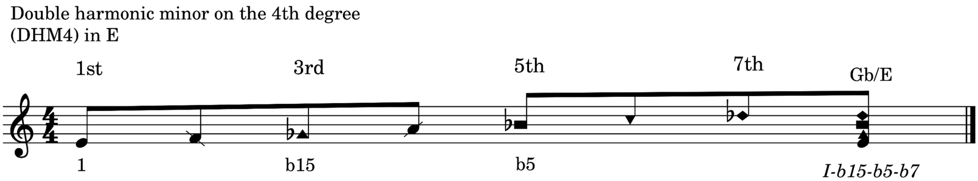


Figure 138 - The double harmonic minor scale on the 4th degree (DHM4) in E

The chords of the double harmonic minor scale in B^b are underlaid with the scale´s 4th note - E - as a bass note:

[112b]

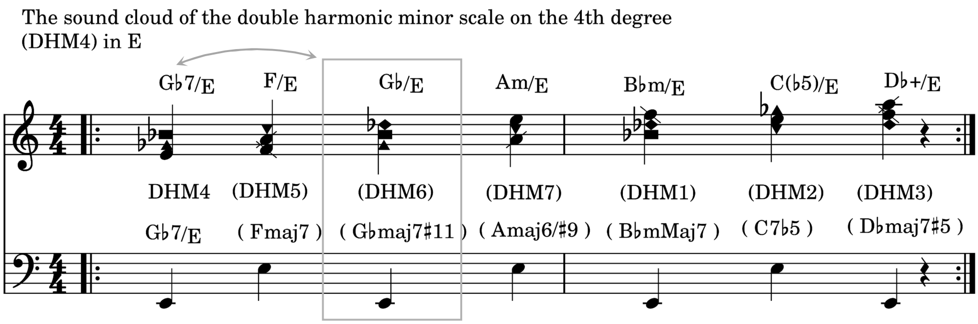


Figure 139 - The sound cloud of the double harmonic minor scale on the 4th degree (DHM4) in E

The two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here F/E and G^b/E (F and G flat major triad over E in the bass), are particularly interesting.

The G^b/E, built on the DHM6 scale, is the parallel to the G^{b7}/E - four-note-chord built on the DHM4 scale (which is strictly speaking, a G^{b7}/F^b, i.e. the third inversion of the G^{b7} chord).

10.9.5 The double harmonic minor sound cloud on the 5th degree (DHM5)

The sound cloud of the double harmonic minor scale on the 5th degree (DHM5) is obtained by adding the 5th note as a pedal point to the chords of the double harmonic minor scale (DHM1). E DHM5, for example, contains the notes of the double harmonic minor scale in A:

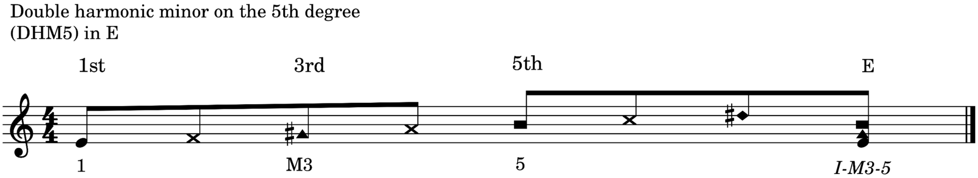


Figure 140 - The double harmonic minor scale on the 5th degree (DHM5) in E

The chords of the double harmonic minor scale in A are underlaid with the scale´s 5th note - E - as a bass note:

[113b]

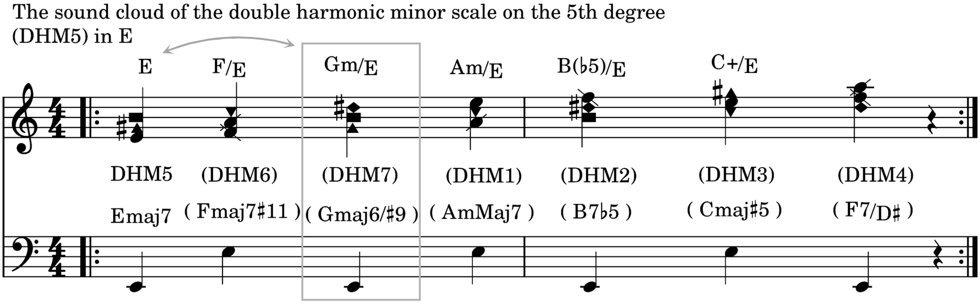


Figure 141 - The sound cloud of the double harmonic minor scale on the 5th degree (DHM5) in E

The two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here E and F/E (F major triad over E in the bass), are particularly interesting.

The Gm/E based on the DHM7 scale forms the parallel to the E^{maj7} major seventh four-note chord based on the DHM5 scale.

10.9.6 The double harmonic minor sound cloud on the 6th degree (DHM6)

The sound cloud of the double harmonic minor scale on the 6th degree (DHM6) is obtained by adding the 6th note as a pedal point to the chords of the double harmonic minor scale (DHM1). E DHM6, for example, contains the notes of the double harmonic minor scale in $G^{\#}$:

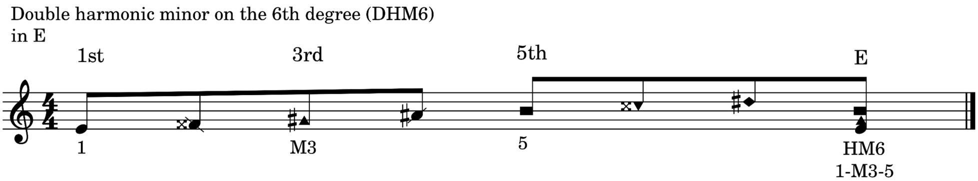


Figure 142 - The double harmonic minor scale on the 6th degree (DHM6) in E

The chords of the double harmonic minor scale in $G^{\#}$ are underlaid with the scale´s 6th note - E - as a bass note:

[114b]

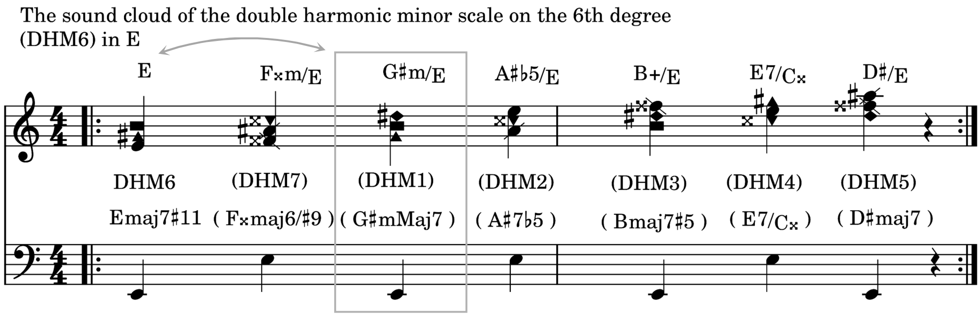


Figure 143 - The sound cloud of the double harmonic minor scale on the 6th degree (DHM6) in E

The two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here D#/E (D sharp major triad over E in the bass) and E (E major triad), are particularly interesting.

The G#m/E based on the DHM1 scale forms the parallel to the E^{maj7} four-note chord based on the DHM6 scale.

10.9.7 The double harmonic minor sound cloud on the 7th degree (DHM7)

The sound cloud of the double harmonic minor scale on the 7th degree (DHM7) is obtained by adding the 7th note as a pedal point to the chords of the double harmonic minor scale (DHM1). E DHM7, for example, contains the notes of the double harmonic minor scale in F:

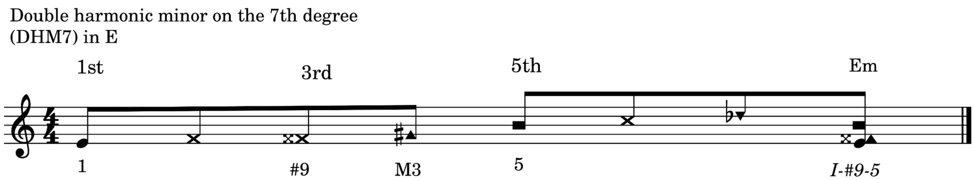


Figure 144 - The sound cloud of the double harmonic minor scale on the 7th degree (DHM7) in E

The chords of the double harmonic minor scale in F are underlaid with the scale´s 7th note - E - as a bass note:

[115b]

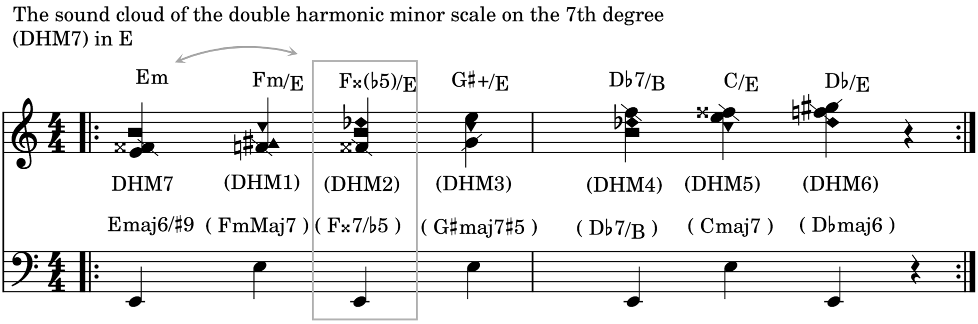


Figure 145 - The sound cloud of the harmonic minor scale on the 7th degree (HM7) in E

The two major chords spaced a minor second apart on the fifth (DHM5) and sixth degrees (DHM6), here C/E and D^{b}/E (C and D flat major triad over E in the bass), are particularly interesting.

The F$^{\#\#(b5)}$/E based on the DHM2 scale forms the parallel to the E$^{maj6/\#9}$ four-note chord in E based on the DHM7 scale.

11 The diminished scale and its diminished seventh chords

11.1 The whole-tone half-tone scale

The whole-tone half-tone scale is an 8-tone scale that we want to describe using a 7-tone system. This means that the scale is enharmonically ambiguous. The following representation seems to make the most sense for the whole-tone half-tone scale, which is also called the diminished scale [57]:

[59]

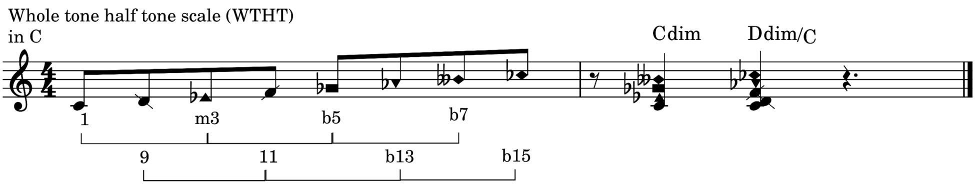


Figure 146 - The whole-tone half-tone scale (WTHT) in C (also called diminished or octatonic scale)

Due to the symmetry of the scale, stacking the 1st, 3rd, 5th, and 7th notes, stacking the 2nd, 4th, 6th, and 8th notes, etc. results in only diminished chords [60]. The designation b15 must be used instead of maj7 because the whole-tone half-tone scale already contains a seventh - the diminished seventh (b7).

11.2 The half-tone whole-tone scale

The half-tone whole-tone scale is on the 2nd degree of the whole-tone half-tone scale (and vice versa):

[58]

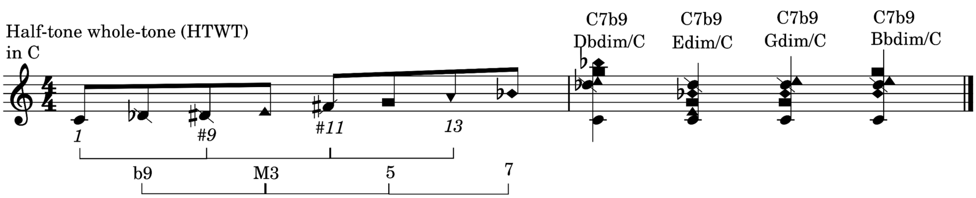


Figure 147 - The half-tone whole-tone scale (HTWT) in C

Due to the symmetry of the scale, the layering of the 1st, 3rd, 5th and 7th tone, the layering of the 2nd, 4th, 6th and 8th tone, etc. always results in a diminished chord [60], i.e. between the b9, M3, 5 and 7 on the one hand and the 1, #9, #11 and 13 on the other hand there is always a minor third, i.e. three semitone steps.

Diminished chords can replace any altered V^{7b9} chord starting from the b9, M3, 5 or 7. For example, the chord C^{7b9} can be replaced by D^{bdim}/C, i.e. D^{b} diminished four-note chord with C in the bass, as well as E^{dim}/C, G^{dim}/C or B^{bdim}/C.

The diminished chord is often used as a replacement for an intermediate dominant, but is usually not found on the 5th degree. This is examined in more detail in chapter 14 (Cadences and Cadence variants).

11.3 Conclusion

he whole-tone half-tone scale and the half-tone whole-tone scale become interesting because of the diminished chords they contain and their function as a replacement for a dominant. This is examined in more detail in Chapter 14 (Cadences and Cadence variants).

Depending on the context, the whole-tone half-tone scale or the half-tone whole-tone scale is played over the diminished chord.

Below is an overview of the functions, chords, important and avoid notes, as well as the tensions of the whole-tone half-tone and the half-tone whole-tone scale:

Scale designation	Function	Chord (Example)	Important notes	Avoid notes 1)	Tensions
whole-tone half-tone scale	Subdominant	C^{dim}	m3, b5, b7		9, 11, b13, b15 1)
half-tone whole-tone scale	Dominant	D^{bdim}/C	M3, 7		b9, #9, #11, 13

Table 64 - The whole-tone half-tone scale and the half-tone whole-tone scale and its chords, tensions and avoid notes

1) The designation b15 must be used instead of maj7 because the whole-tone half-tone scale already contains a seventh - the b7.

11.4 Diminished scale modality and sound clouds

In contrast to functional harmony, in which chords are brought into a II-V-I cadence sequence, for example, see Chapter 14 (Cadences and Cadence variants), modality refers to the creation of sound clouds in which the different chords (modes) of a scale are combined.

11.4.1 The sound cloud of the whole-tone half-tone scale

The sound cloud of the whole-tone half-tone scale (WTHT) is obtained by underlaying the fundamental tone as a pedal point or pedal tone to the chords of the whole-tone half-tone scale. This is explained using the example of the whole-tone half-tone scale in E:

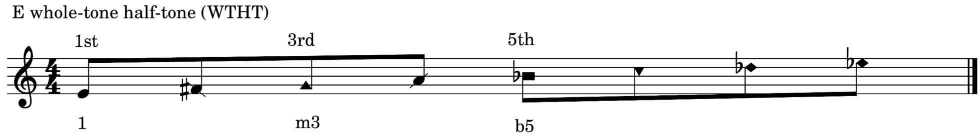


Figure 148 - The whole-tone half-tone (WTHT) scale in E

The chords of the whole-tone half-tone scale in E are underlaid with the scale´s root note - E - as a bass note:

[119]

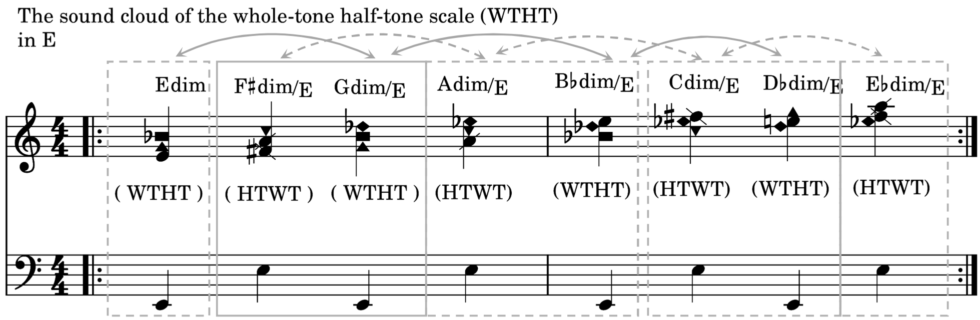


Figure 149 - The sound cloud of the whole-tone half-tone (WTHT) scale in E

For the sound cloud of the whole-tone half-tone scale in E, for example, the chords E^{dim} (WTHT), $F^{\#dim}$ (HTWT), G^{dim} (WTHT), A^{dim} (HTWT), B^{bdim} (WTHT), C^{dim} (HTWT), D^{bdim} (WTHT) and E^{bdim} (HTWT) are underlaid with the bass note E, where (WTHT) or (HTWT) means that the respective chord is based on the whole-tone half-tone scale (WTHT) or half-tone whole-tone scale (HTWT).

Due to the symmetry of the whole-tone half-tone scale, only diminished chords result and the pattern repeats itself every two steps, i.e. every second chord corresponds to the first. Here the diminished chords E^{dim}, G^{dim}, B^{bdim} and D^{bdim} correspond on one side and $F^{\#dim}$, A^{dim}, C^{dim} and E^{bdim} on the other side. The combination $F^{\#dim}$/E and G^{dim}/E (F sharp and G diminished four-note chords over E in the bass) sounds interesting. In addition to the third and seventh, you also get all the other functions, namely the root, fifth, ninth, fourth and sixth. The combination of the two consecutive chords, here A^{dim}/E and B^{bdim}/E, C^{dim}/E and D^{bdim}/E as well as E^{bdim}/E and E etc. is repeated accordingly. The second possible combination is repeated in the same way, here E^{dim} and $F^{\#dim}$/E, G^{dim}/E and A^{dim}/E, B^{bdim}/E and C^{dim}/E as well as D^{bdim}/E and E^{bdim}/E.

11.4.2 The sound cloud of the half-tone whole-tone scale

The sound cloud of the half-tone whole-tone scale (HTWT) is obtained by underlaying the fundamental tone as a pedal point or pedal tone to the chords of the half-tone whole-tone scale. This is explained using the example of the half-tone whole-tone scale in E:

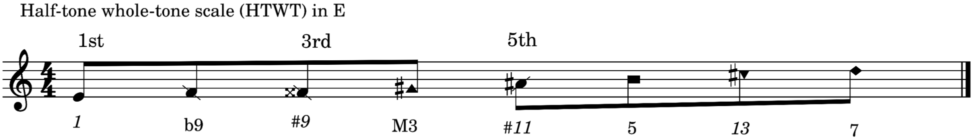


Figure 150 - The half-tone whole-tone (HTWT) scale in E

The chords of the half-tone whole-tone scale in E are underlaid with the scale´s root note - E - as a bass note:

[120]

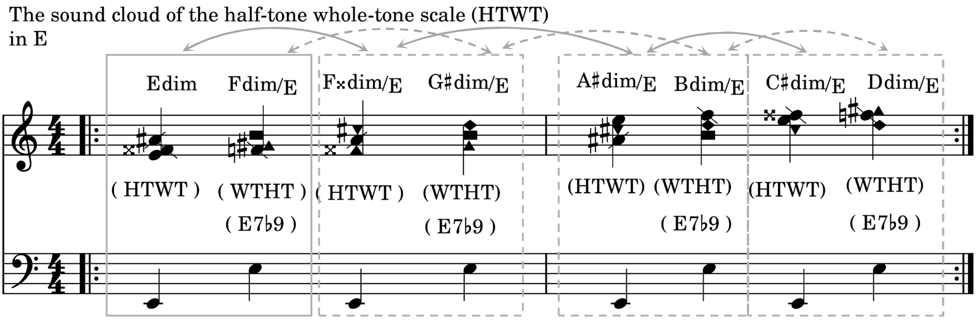


Figure 151 - The sound cloud of the half-tone whole-tone (HTWT) scale in E

For the sound cloud of the half-tone whole-tone scale in E, for example, the four-note chords E^{dim} (HTWT), F^{dim} (WTHT), $F^{\#\#dim}$ (HTWT), $G^{\#dim}$ (WTHT), $A^{\#dim}$ (HTWT), B^{dim} (WTHT), $C^{\#dim}$ (HTWT) and D^{dim} (WTHT) are underlayed with the bass note E, where (WTHT) or (HTWT) means that the respective chord is based on the whole-tone half-tone scale (WTHT) or half-tone whole-tone scale (HTWT).

Due to the symmetry of the half-tone whole tone scale, only diminished chords result and the pattern repeats every two steps, i.e. every second chord corresponds to the first. Here the diminished chords E^{dim}, $F^{\#\#dim}$, $A^{\#dim}$ and $C^{\#dim}$ correspond on one side and F^{dim}, $G^{\#dim}$, B^{dim} and D^{dim} on the other side. The combination F^{dim}/E (F diminished four-note chord over E in the bass) and E^{dim} sounds interesting. In addition to the third and seventh, you also get all the other functions, namely the root, fifth, ninth, fourth and sixth. The combination of the two consecutive chords, here E^{dim} and F^{dim}/E, $F^{\#\#dim}$/E and $G^{\#dim}$/E, $A^{\#dim}$/E and B^{dim}/E as well as $C^{\#dim}$/E and D^{dim}/E etc. is repeated each accordingly. The second possible combination is repeated in the same way, here F^{dim} and $F^{\#\#dim}$/E, $G^{\#dim}$/E and $A^{\#dim}$/E, B^{dim}/E and $C^{\#dim}$/E as well as D^{dim}/E and E^{dim}.

It should be emphasized that each second chord, here F^{dim}/E, $G^{\#dim}$/E, B^{dim}/E and D^{dim}/E, corresponds to a complete dominant seventh b9 chord, here E^{7b9}. Any of these combinations can completely replace the E^{7b9}.

12 The whole-tone scale and its augmented triads

The whole tone scale [61] only contains six tones. Therefore, we have to forego one function in a seven-step system. In this case it makes sense to leave out the fifth:

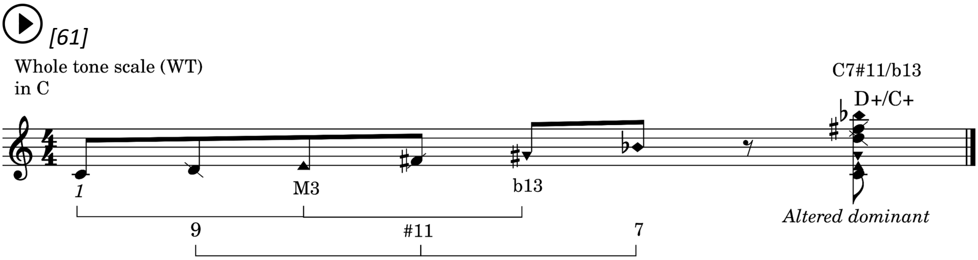


Figure 152 - The whole-tone scale in C

If you take the 1st, 3rd and 5th tone or the 2nd, 4th and 6th tone, the whole-tone scale contains two so-called augmented triads [62], i.e. a stack of two major thirds. Augmented triads are generally denoted with a +, for example C^{+}.

Because of its symmetry, the whole-tone scale contains only augmented chords.

The second augmented triad, here from the note D, contains the major ninth (9), augmented eleventh (#11) and minor seventh (7). All 6 tones together (C^{+}/D^{+}) form an altered dominant seventh chord, here $C^{7\#11/b13}$. The augmented chords are altered dominant seventh chords and are usually on the 5th degree. This is examined in more detail in Chapter 14 (Cadences and Cadence variants).

12.1 The whole-tone scale modality and sound clouds

In contrast to functional harmony, in which chords are brought into a II-V-I cadence sequence, for example, see Chapter 14 (Cadences and Cadence variants), modality refers to the creation of sound clouds in which the different chords (modes) of a scale are combined.

Note

In the context of modality and sound clouds, the so-called avoid notes are deliberately excluded.

12.1.1 The sound cloud of the whole-tone scale

The sound cloud of the whole-tone (WT) is obtained by underlaying the fundamental tone as a pedal point or pedal tone to the chords of the whole-tone scale. This is explained using the example of the whole-tone scale in E:

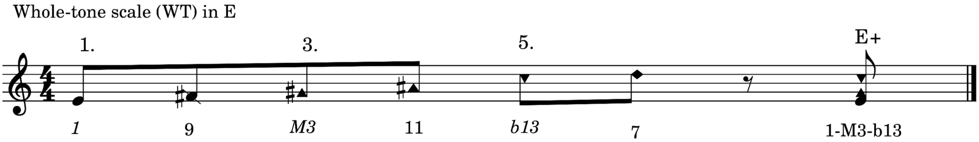


Figure 153 - The whole-tone (WT) scale in E

The chords of the whole-tone scale in E are underlaid with the scale´s root note - E - as a bass note:

[121]

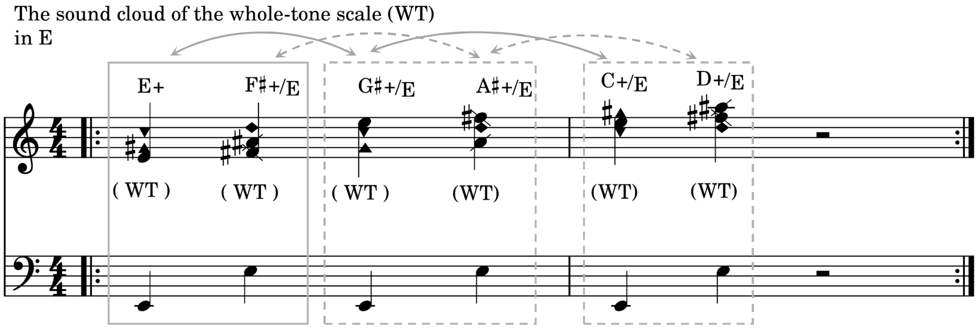


Figure 154 - The sound cloud of the whole-tone (WT) scale in E

For the sound cloud of the whole tone scale in E, the chords E^{+} (GT), $F^{\#+}$ (GT), $G^{\#+}$ (GT), $A^{\#+}$ (GT), C^{+} (GT) and D^{+} (GT) are underlaid with the bass note E , where (GT) means that the respective chord is based on the whole tone scale (GT).

Due to the symmetry of the whole-tone scale, only augmented chords result and the pattern repeats every two steps, i.e. every second chord corresponds to the first. Here the augmented chords E^{+}, $G^{\#+}$ and C^{+} correspond on one side and $F^{\#+}$, $A^{\#+}$ and D^{+} on the other side. The combination of E^{+} and $F^{\#+}$/E (E augmented and F sharp augmented over E in the bass) sounds interesting. In addition to the third and seventh, you also get all the other functions, namely the root, fifth, ninth, fourth and sixth. The combination of the two consecutive chords, here E^{+} and $F^{\#+}$/E, $G^{\#+}$/E and $A^{\#+}$/E as well as C^{+}/E and D^{+}/E etc. is repeated accordingly. The second possible combination is repeated in the same way, here $F^{\#+}$/E and $G^{\#+}$/E, $A^{\#+}$/E and C^{+}/E as well as D^{+}/E and E^{+}.

13 From the minor pentatonic scale to the blues

13.1 The minor pentatonic scale (MP1) with blue note

[64]

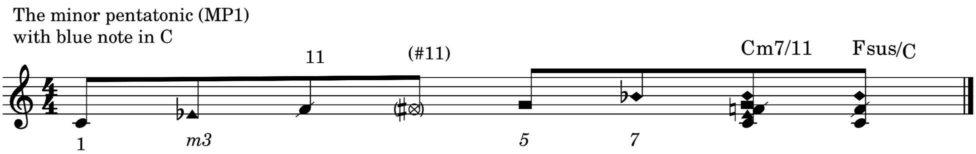


Figure 155 - The minor pentatonic scale (MP1) with blue note in C

The minor pentatonic scale consists of 5 tones, which are supplemented by the so-called blue note [122]. This means we have to eliminate two functions again in a seven-steps system. The above representation seems to make the most sense, i.e. we leave out the ninth and sixth. The minor pentatonic on the 1st degree (MP1) contains a minor seventh chord with the 11th as tension. Considering it as F^{sus}/C, i.e. F^{sus} triad over C in the bass, makes sense in the context of sound clouds, see Chapter 13.9 (The sound cloud of the minor pentatonic scale).

The minor pentatonic scale is fully contained in the minor scales Aeolian, Phrygian, Dorian and MM2. With the blue note #11 or b5, the minor pentatonic scale becomes the minor blues scale.

13.2 The minor pentatonic scale on the 2nd degree (MP2) with blue note

[65]

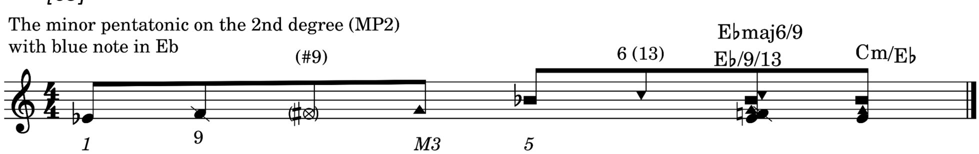


Figure 156 - The minor pentatonic on the 2nd degree (MP2) with blue note in E^b

In the minor pentatonic scale on the 2nd degree, the seventh is missing. It contains a major sixth chord. We can interpret this as E^{bmaj} with the 6 and 9, or as a dominant chord in Eb with the tensions 9 and 13. The consideration as Cm/E^{b}, i.e. C minor triad over E^{b} in the bass, makes sense in the context of sound clouds, see Chapter 13.9 (The sound cloud of the minor pentatonic scale).

The minor pentatonic scale on the 2nd degree (MP2) is fully contained in the major scales Ionian, Mixolydian, Lydian and MM4. It is, so to speak, the parallel major blues key and is therefore also referred to as major pentatonic. With the blue note #9, the minor pentatonic scale on the 2nd degree (MP2) becomes the major blues scale.

13.3 The minor pentatonic scale on the 3rd degree (MP3) with blue note

[66]

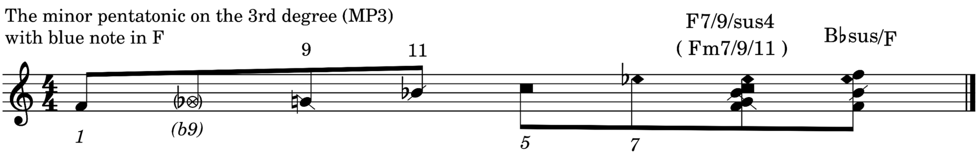


Figure 157 - The minor pentatonic on the 3rd degree (MP3) with blue note in F

The third is missing in the minor pentatonic on the 3rd degree. It contains a sus4 chord with tensions 9 and 11. This $F^{7/9/sus4}$ chord could also be interpreted as $Fm^{7/9/11}$ with a missing minor third (m3). Considering it as B^{bsus}/F, i.e. B^{b}-sus triad over F in the bass, makes sense in the context of sound clouds, see Chapter 13.9 (The sound cloud of the minor pentatonic scale).

The minor pentatonic scale on the 3rd degree (MP3) is completely contained in the Dorian, Aeolian, Mixolydian (sus4) and MM5 scales. The blue note, here the G^{b}, is in this case the minor ninth (b9).

13.4 The minor pentatonic scale on the 4th degree (MP4) with blue note

[67]

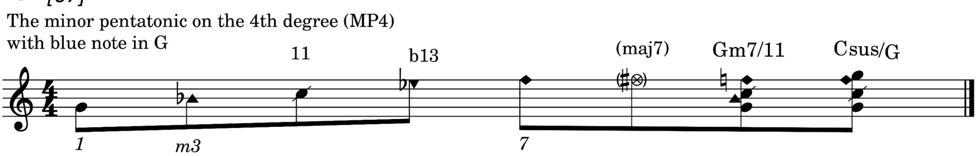


Figure 158 - The minor pentatonic on the 4th degree with blue note in G

The minor pentatonic on the 4th degree contains a minor seventh chord with the tensions 11 and b13, although the minor 13th (b13) is considered a tone to be avoided in all minor keys, see note 6 in chapter 4.3 (Interval designations). Considering it as C^{sus}/G, i.e. C-sus triad over G in the bass, makes sense in the context of sound clouds, see Chapter 13.9 (The sound cloud of the minor pentatonic scale).

13.5 The minor pentatonic scale on the 5th degree (MP5) with blue note

[68]

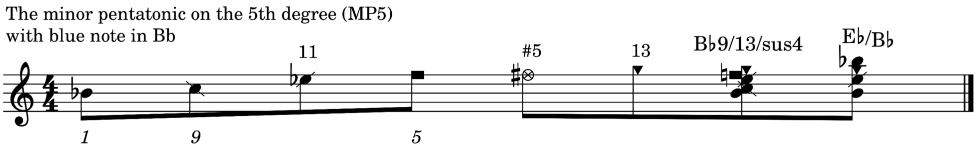


Figure 159 - The minor pentatonic on the 5th degree with blue note in B^b

On the 5th degree of the minor pentatonic scale, the third and seventh are missing. The scale contains a sus4 chord with the tensions 9 and 13. Viewing it as E^b/B^b, i.e. E^b major triad over B^b in the bass, makes sense in the context of sound cloud, see Chapter 11.9 (The sound cloud of the minor pentatonic).

The minor pentatonic on the 5th degree (MP5) is completely contained in the Mixolydian (sus4), Dorian, Ionian and MM1 scales. The blue note, here the F$^{\#}$, is in this case #5 or b13.

13.6 The 12-bar minor blues

The 12-bar minor blues is typically played in its simple form with the chords shown:

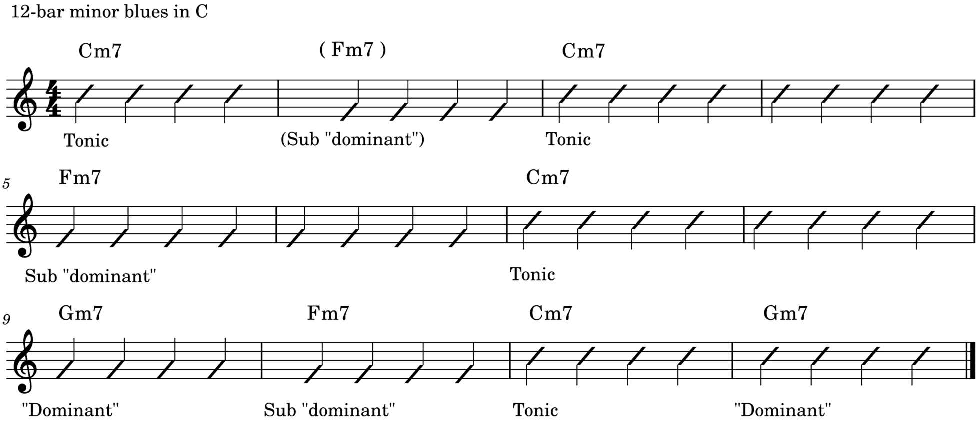


Figure 160 - The twelve bar minor blues in C

The simplest 12-bar minor blues is played with three minor chords, here in C: Cm^7, Fm^7 and Gm^7. As we saw above, the same minor pentatonic fits over all three chords, i.e. in this example you play the C minor pentatonic with blue note over all three chords Cm^7, Fm^7 and Gm^7. This is why the minor blues is very popular, especially among musical beginners, as it is very easy to improvise over it. This type of minor blues is rather unusual in jazz. The terms dominant and subdominant are put in quotation marks here because they are on the 4th and 5th degrees, but one would expect major chords in a dominant.

13.7 The 12-bar major blues

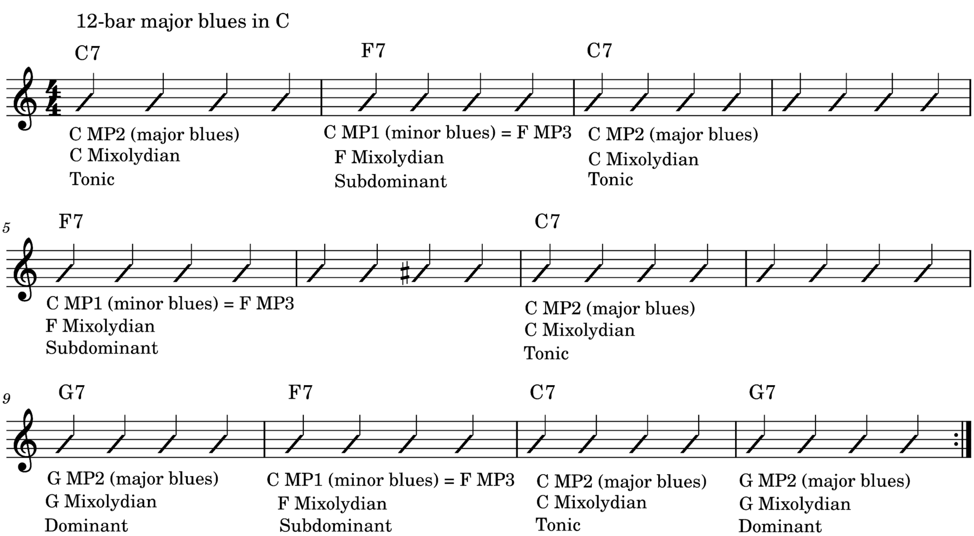


Figure 161 The 12-bar major blues in C

The simple form of the 12-bar major blues consists of three chords, here in the example C^7, F^7 and G^7. The minor pentatonic on the 2nd degree (MP2) including the blue note (major blue scale) in C is played via the 1st chord, the tonic (here C^7).

The minor pentatonic (MP3) including the blue note in F is played via the subdominant (here F^7), which corresponds to the minor pentatonic (MP1) including the blue note in C.

The minor pentatonic on the 2nd degree (MP2) including the blue note (major scale) in G is played via the 3rd chord, the dominant (here G^7).

Since all three chords are dominant seventh chords, the respective Mixolydian scale can of course also be played.

13.8 The 12-bar jazz blues

The 12-bar jazz blues is an extension of the 12-bar major blues described above:

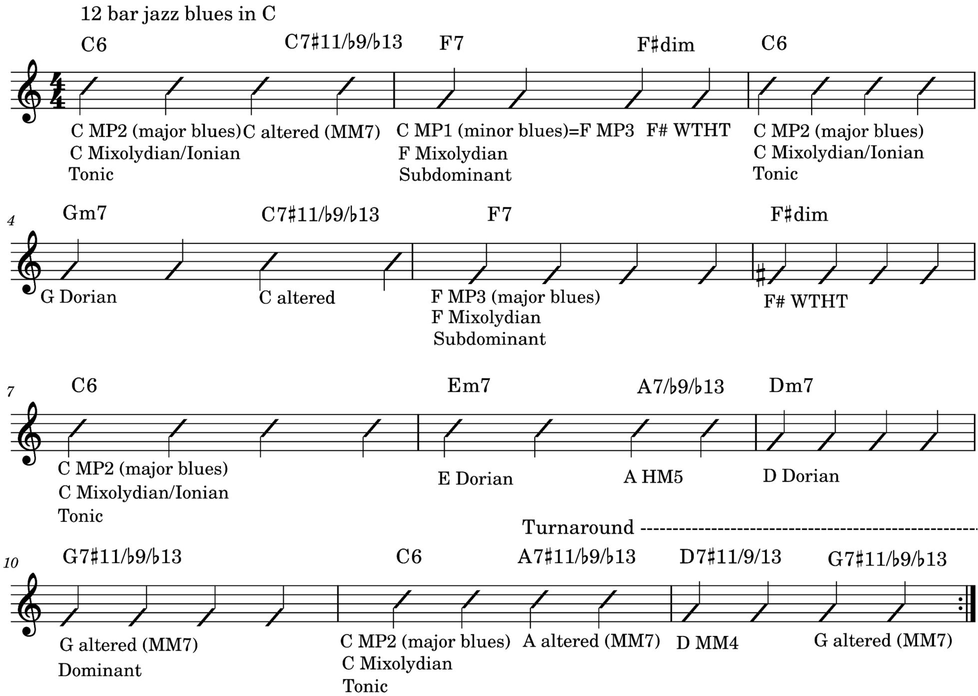


Figure 162 - The 12 bar jazz blues

Jazz blues in its current form was extremely influenced by Charlie Parker [70]. In the typical Charlie Parker blues, e.g. "Billie's Bounce", the tonic is a sixth chord, although it remains unclear whether it is played as a dominant seventh chord with a Mixolydian scale or, as is typical for the tonic, as a major 6 chord with an Ionian scale. If you leave out the seventh, then both scales, Mixolydian and Ionian, are identical.

In this example we show the blues in C so that we can better understand the changes compared to the simple 12 bar major blues from above. The II-V-I progression in bars 8 and 9 ($Em^7 \rightarrow A^{7/b9/b13} \rightarrow Dm^7$) and the turnaround in bars 11 and 12 ($A^{7/\#11/b9/b13} \rightarrow D^{7\#11/9/13} \rightarrow G^{7\#11/b9/b13} \rightarrow C^6$)were added. This turnaround contains so-called II-V progressions in different variations, which always lead back to the tonic, here C^6. Here is a V7→V7→V7 variant that is often found in jazz: the sequence of dominant seventh chords downwards in the circle of fifths or upwards in the circle of fourths. As a rule, altered (MM7) and Mixo#11 (MM4) are used alternately, with the last dominant seventh chord, which leads to the tonic, being an altered one. This is described in more detail in chapter 14 (Cadences and Cadence variants).

13.9 The sound cloud of the minor pentatonic scale

In contrast to functional harmony, in which chords are brought into a II-V-I cadence sequence, for example, see Chapter 14 (Cadences and Cadence variants), modality refers to the creation of sound clouds in which the different chords (modes) of a scale are combined.

13.9.1 The sound cloud of the minor pentatonic (MP1)

The sound cloud of the minor pentatonic (MP1) is obtained by underlaying the fundamental tone as a pedal point or pedal tone to the chords of the minor pentatonic (MP1) scale. This is explained using the example of the minor pentatonic scale in E:

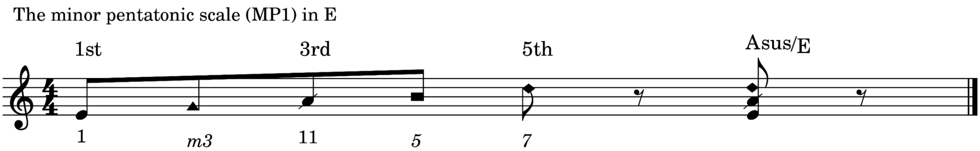


Figure 163 - The minor pentatonic scale (MP1) in E

The chords of the minor pentatonic scale in E are underlaid with the scale´s root note - E - as a bass note:

[123]

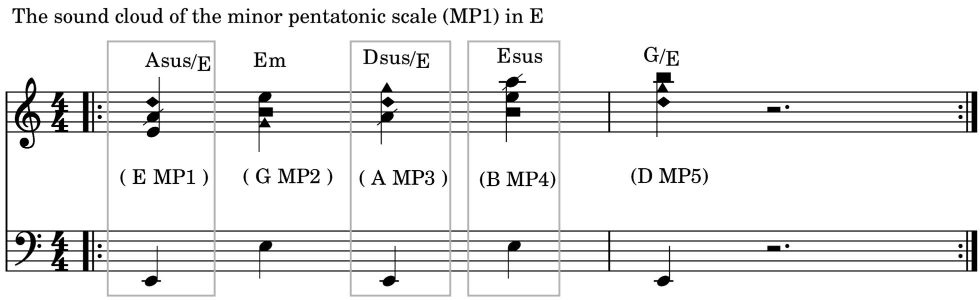


Figure 164 - The sound cloud of the minor pentatonic scale (MP1) in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. In the minor pentatonic scale in E, the triad formed from the 1st, 3rd and 5th notes corresponds to an A^{sus}/E, i.e. the second inversion of the A^{sus} chord.

From the second note of the minor pentatonic MP1 - here in E, i.e. G MP2 - the triad formed from the 1st, 3rd and 5th tone results in an Em/G, i.e. the first inversion of the Em chord. Since we have the bass note E under it, it is only designated as Em.

From the third tone of the minor pentatonic MP1 - here in E, i.e. A MP3 - the triad formed from the 1st, 3rd and 5th tone results in a D^{sus}/A, i.e. the second inversion of the D^{sus} triad. Since we again have the bass note E under it, we call the chord D^{sus}/E i.e. D^{sus} over E in the bass.

From the fourth tone of the minor pentatonic MP1 - here in E, i.e. B MP4 - the triad formed from the 1st, 3rd and 5th tone results in an E^{sus}/B, i.e. the second inversion of the E^{sus} triad. Since we again have the bass note E under it, we call the chord E^{sus}.

From the fifth tone of the minor pentatonic MP1 - here in E, i.e. D MP5 - the triad formed from the 1st, 3rd and 5th tone results in a G/D, i.e. the second inversion of the G major triad. Since we again have the bass note E under it, we refer to the chord as G/E, i.e. G major triad over E in the bass.

For the sound cloud of the minor pentatonic in E, the triads A^{sus} (E MP1), Em (G MP2), D^{sus} (A MP3), E^{sus} (B MP4) and G (D MP5) are underlayed with the bass note E, where (MP1) ... (MP5) means that the respective chord is based on the corresponding minor pentatonic scale at the respective degree.

All combinations sound good here. The three sus triads on the 1st, 3rd and 4th stages sound particularly interesting, here A^{sus}/E, D^{sus}/E and E^{sus} (A^{sus} and D^{sus} triad over E in the bass and E^{sus} triad).

13.9.2 The sound cloud of the minor pentatonic on the 2nd degree (MP2)

The sound cloud of the minor pentatonic on the 2nd degree (MP2) is obtained by underlaying the second tone as a pedal point or pedal tone to the minor pentatonic chords (MP1). E MP2, for example, contains the tones of the minor pentatonic scale in $C^{\#}$:

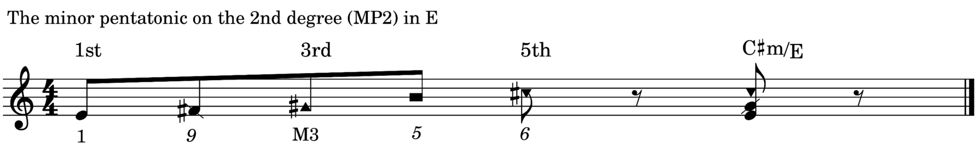


Figure 165 - The minor pentatonic scale on the 2nd degree (MP2) in E

The chords of the minor pentatonic in $C^{\#}$ are underlaid with the scale´s second note - E - as a bass note:

[123]

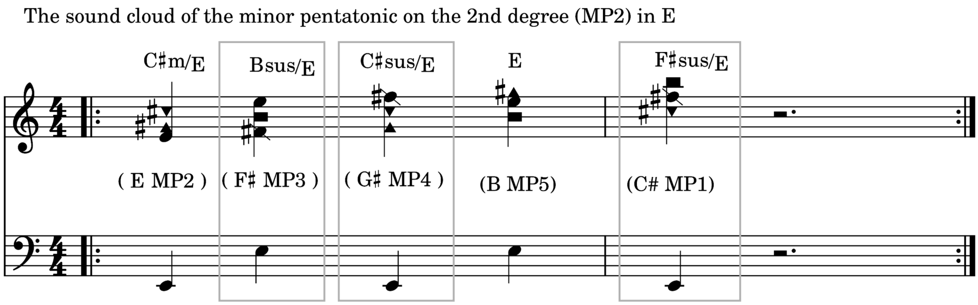


Figure 166 - The sound cloud of the minor pentatonic scale on the 2nd degree (MP2) in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. In the minor pentatonic scale on the 2nd degree in E, the triad formed from the 1st, 3rd and 5th notes corresponds to a $C^{\#}m/E$, i.e. the first inversion of the $C^{\#}$ minor chord.

From the second note of the minor pentatonic MP2 - here in E, i.e. $F^{\#}$ MP3 - the triad formed from the 1st, 3rd and 5th tone results in a $B^{sus}/F^{\#}$, i.e. the 2nd inversion of the B^{sus} chord. Since we have the bass note E under it, it is designated as B^{sus}/E.

From the third note of the minor pentatonic MP2 - here in E, i.e. $G^{\#}$ MP4 - the triad formed from the 1st, 3rd and 5th tone results in a $C^{\#sus}/G$, i.e. the second inversion of the $C^{\#sus}$ triad. Since we again have the bass note E under it, we designate the chord as $C^{\#sus}/E$ i.e. $C^{\#sus}$ over E in the bass.

From the fourth note of the minor pentatonic MP2 - here in E, i.e. B MP5 - the triad formed from the 1st, 3rd and 5th tone results in an E/B, i.e. the second inversion of the E major triad. Since we again have the bass note E under it, we will simply call the chord E major.

From the fifth note of the minor pentatonic MP2 - here in E, i.e. $C^{\#}$ MP1 - the triad formed from the 1st, 3rd and 5th tone results in an $F^{\#sus}/C^{\#}$, i.e. the second inversion of the $F^{\#sus}$ triad. Since we again have the bass note E under it, we designate the chord as $F^{\#sus}/E$, i.e. $F^{\#}$-sus triad over E in the bass.

For the sound cloud of the minor pentatonic on the 2nd degree (MP2) in E, the triads $C^{\#}m$ (E MP2), B^{sus} ($F^{\#}$ MP3), $C^{\#sus}$ ($G^{\#}$ MP4), E (B MP5) and $F^{\#sus}$ ($C^{\#}$ MP1) are underlayed with the bass note E, where (MP1) ... (MP5) means that the respective chord is based on the corresponding minor pentatonic at the respective degree.

All combinations sound good here. The three sus triads on the 2nd, 3rd and 5th degree sound particularly interesting, here B^{sus}/E, $C^{\#sus}/E$ and $F^{\#sus}/E$ (B^{sus} -, $C^{\#sus}$ - and $F^{\#sus}$ - triad over E in bass).

13.9.3 The sound cloud of the minor pentatonic on the 3rd degree (MP3)

The sound cloud of the minor pentatonic on the 3rd degree (MP3) is obtained by underlaying the third tone as a pedal point or pedal tone to the minor pentatonic chords (MP1). E MP3, for example, contains the tones of the minor pentatonic scale in B:

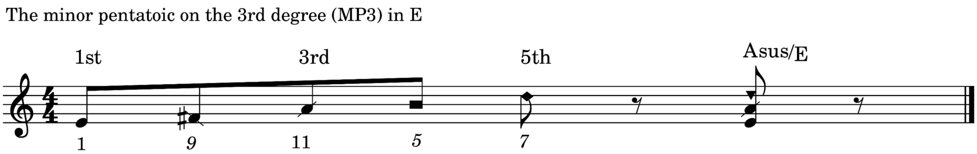


Figure 167 - The minor pentatonic on the 3rd degree (MP3) in E

The chords of the minor pentatonic in B are underlaid with the scale´s third note - E - as a bass note:

[125]

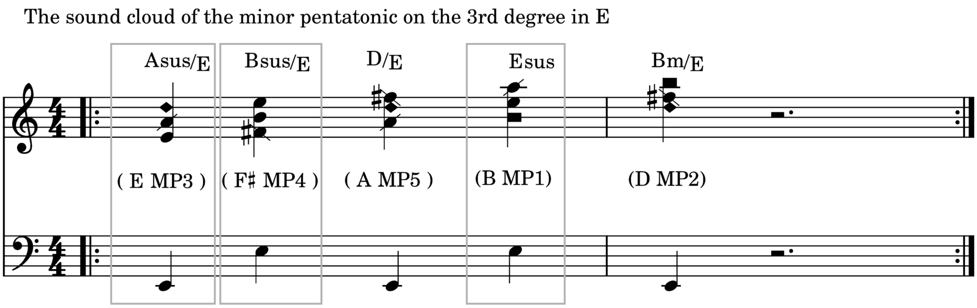


Figure 168 - The sound cloud of the minor pentatonic on the 3rd degree (MP3) in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. In the minor pentatonic scale on the 3rd degree in E, the triad formed from the 1st, 3rd and 5th notes corresponds to a A^{sus}/E, i.e. the second inversion of the A^{sus} chord.

From the second note of the minor pentatonic MP3 - here in E, i.e. $F^{\#}$ MP4 - the triad formed from the 1st, 3rd and 5th tone results in a $B^{sus}/F^{\#}$, i.e. the 2nd inversion of the B^{sus} chord. Since we have the bass note E under it, it is designated as B^{sus}/E.

From the third note of the minor pentatonic MP3 - here in E, i.e. A MP5 - the triad formed from the 1st, 3rd and 5th tone results in a D/A, i.e. the second inversion of the D triad. Since we again have the bass note E under it, we designate the chord as D/E i.e. D over E in the bass.

From the fourth note of the minor pentatonic MP3 - here in E, i.e. B MP1 - the triad formed from the 1st, 3rd and 5th tone results in an E^{sus}/B, i.e. the second inversion of the E sus triad. Since we again have the bass note E under it, we will simply call the chord E^{sus}.

From the fifth note of the minor pentatonic MP3 - here in E, i.e. D MP2 - the triad formed from the 1st, 3rd and 5th tone results in an Bm/D, i.e. the first inversion of the Bm triad.

Since we again have the bass note E under it, we designate the chord as Bm/E, i.e. Bm triad over E in the bass.

For the sound cloud of the minor pentatonic on the 3rd degree (MP3) in E, the triads A^{sus} (E MP3), B^{sus} ($F^{\#}$ MP4), D (A MP5), E^{sus} (B MP1) and Bm (D MP2) are underlayed with the bass note E, where (MP1) ... (MP5) means that the respective chord is based on the corresponding minor pentatonic at the respective degree.

All combinations sound good here. The three sus triads on the 2nd, 3rd and 5th degree sound particularly interesting, here A^{sus}/E, B^{sus}/E and E^{sus}/E (A^{sus} -, B^{sus} triad over E in bass and E^{sus} triad).

13.9.4 The sound cloud of the minor pentatonic on the 4th degree (MP4)

The sound cloud of the minor pentatonic on the 4th degree (MP4) is obtained by underlaying the fourth tone as a pedal point or pedal tone to the minor pentatonic chords (MP1). E MP4, for example, contains the tones of the minor pentatonic scale in A:

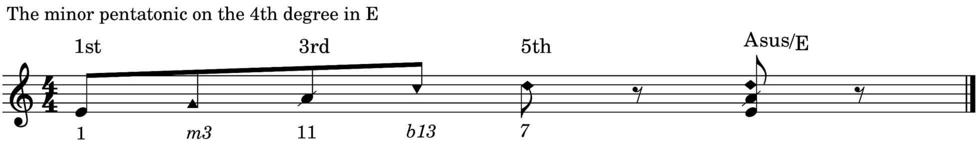


Figure 169 - The minor pentatonic on the 4th degree (MP4) in E

The chords of the minor pentatonic in A are underlaid with the scale´s fourth note - E - as a bass note:

[126]

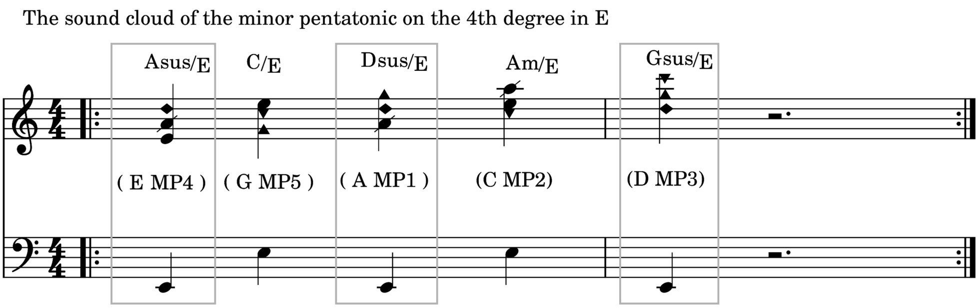


Figure 170 - The sound cloud of the minor pentatonic on the 4th degree (MP4) in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. In the minor pentatonic scale on the 4th degree in E, the triad formed from the 1st, 3rd and 5th notes corresponds to a A^{sus}/E, i.e. the second inversion of the A^{sus} chord.

From the second note of the minor pentatonic MP4 - here in E, i.e. G MP5 - the triad formed from the 1st, 3rd and 5th tone results in a C/G, i.e. the 2nd inversion of the C chord. Since we have the bass note E under it, it is still designated as C/E.

From the third note of the minor pentatonic MP4 - here in E, i.e. A MP1 - the triad formed from the 1st, 3rd and 5th tone results in a D^{sus}/A, i.e. the second inversion of the D sus triad. Since we again have the bass note E under it, we designate the chord as D^{sus}/E i.e. D^{sus} over E in the bass.

From the fourth note of the minor pentatonic MP4 - here in E, i.e. C MP2 - the triad formed from the 1st, 3rd and 5th tone results in an Am/C, i.e. the first inversion of the Am triad. Since we again have the bass note E under it, we call the chord Am/E, i.e. A minor over E in the bass.

From the fifth note of the minor pentatonic MP4 - here in E, i.e. D MP3 - the triad formed from the 1st, 3rd and 5th tone results in a G^{sus}/D, i.e. the second inversion of the G^{sus} triad. Since we again have the bass note E under it, we call the chord G^{sus}/E, i.e. G sus triad over E in the bass.

For the sound cloud of the minor pentatonic on the 4th level (MP4) in E, the triads A^{sus} (E MP4), C (G MP5), D^{sus} (A MP1), Am (C MP2) and G^{sus} (D MP3) are underlaid with the bass note E, where (MP1) ... (MP5) means that the respective chord is based on the corresponding minor pentatonic on the respective level.

All combinations sound good here. The three Sus triads on the 1st, 3rd and 5th stages sound particularly interesting, here A^{sus}/E, D^{sus}/E and G^{sus}/E (A^{sus}, Dsus and G^{sus} triad over E in the bass).

13.9.5 The sound cloud of the minor pentatonic on the 5th degree (MP5)

The sound cloud of the minor pentatonic on the 5th degree (MP5) is obtained by underlaying the fifth tone as a pedal point or pedal tone to the chords of the minor pentatonic (MP1). E MP5, for example, contains the notes of the minor pentatonic scale in $F^{\#}$:

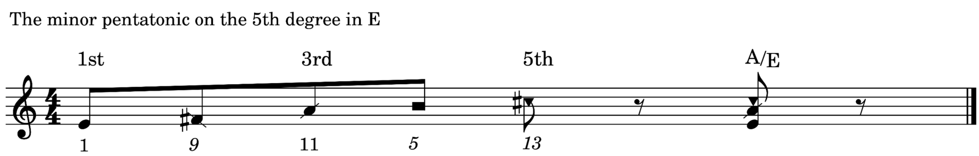


Figure 171 - The minor pentatonic on the 5th degree (MP5) in E

The chords of the minor pentatonic in $F^{\#}$ are underlaid with the scale´s fifth note - E - as a bass note:

[127]

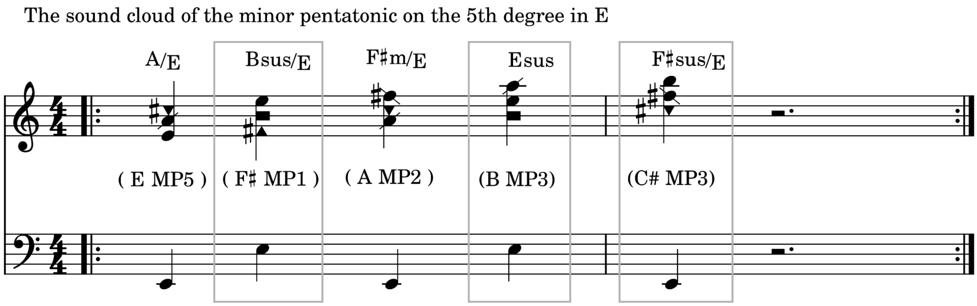


Figure 172 - The sound cloud of the minor pentatonic on the 5th degree (MP5) in E

For the sake of simplicity, we only consider the triads formed from the 1st, 3rd and 5th notes. In the minor pentatonic scale on the 5th degree in E, the triad formed from the 1st, 3rd and 5th notes corresponds to a A^{sus}/E, i.e. the second inversion of the A^{sus} chord.

From the second note of the minor pentatonic MP5 - here in E, i.e. $F^{\#}$ MP1 - the triad formed from the 1st, 3rd and 5th tone results in a B^{sus}/F#, i.e. the second inversion of the B sus triad. Since the bass note is E, we call the chord B^{sus}/E.

From the third note of the minor pentatonic MP5 - here in E, i.e. A MP2 - the triad formed from the 1st, 3rd and 5th tone results in an $F^{\#}$m/A, i.e. the first inversion of the $F^{\#}$m triad. Since we again have the bass note E under it, we designate the chord as $F^{\#}$m/E i.e. $F^{\#}$ minor over E in the bass.

From the fourth note of the minor pentatonic MP5 - here in E, i.e. B MP3 - the triad formed from the 1st, 3rd and 5th tone results in an E^{sus}/B, i.e. the second inversion of the E^{sus} triad. Since we again have the bass note E under it, we simply refer to the chord as E^{sus}.

From the fifth note of the minor pentatonic MP5 - here in E, i.e. $C^{\#}$ MP3 - the triad formed from the 1st, 3rd and 5th tone results in an $F^{\#sus}$/$C^{\#}$, i.e. the second inversion of the $F^{\#sus}$ triad. Since we again have the bass note E under it, we designate the chord as $F^{\#sus}$/E, i.e. $F^{\#}$ sus triad above E in the bass.

For the sound cloud of the minor pentatonic on the 5th level (MP5) in E, the triads A (E MP5), B^{sus} ($F^{\#}$ MP1), $F^{\#}$m (A MP2), E^{sus} (B MP3) and $F^{\#sus}$ ($C^{\#}$ MP3) are underlaid with the bass note E, where (MP1) ... (MP5) means that the respective chord is based on the corresponding minor pentatonic on the respective level.

All combinations sound good here. The three Sus triads on the 2nd, 4th and 5th levels sound particularly interesting, here B^{sus}/E, E^{sus} and $F^{\#sus}$/E (B^{sus}, E^{sus} and $F^{\#su}$s triad over E in the bass).

14 Cadences and Cadence variants

14.1 Definition Cadence

In music theory, the term Cadence [75] is generally understood to mean a sequence of chords that concludes a piece or a section.

Here we are not looking at the classical cadence and voice leading, but rather lean on the jazz harmony theory and understand the cadence as a sequence of chords with the following characteristics:

a) The root note goes up in fourths or down in fifths

b) The third (stays and) becomes the seventh of the following chord

c) The seventh resolves into the third of the following chord

d) All notes come from the same scale

As we will see, these four basic principles are gradually “softened” and this is how the numerous cadence variations arise.

14.2 The cadence of the Ionian major scale

14.2.1 The 2-5-1 major cadence

If we put the seven chords (Imaj7, IIm7, IIIm7, IVmaj7, V7, VIm7, VIIm7b5) of the Ionian major scale, see chapter 5.1 (The Ionian major scale and its Major^7 chord), in the following order, we get the classical major cadence, which satisfies all four conditions a) to d) mentioned above. In addition to the root note, we only consider the third and seventh:

[76]

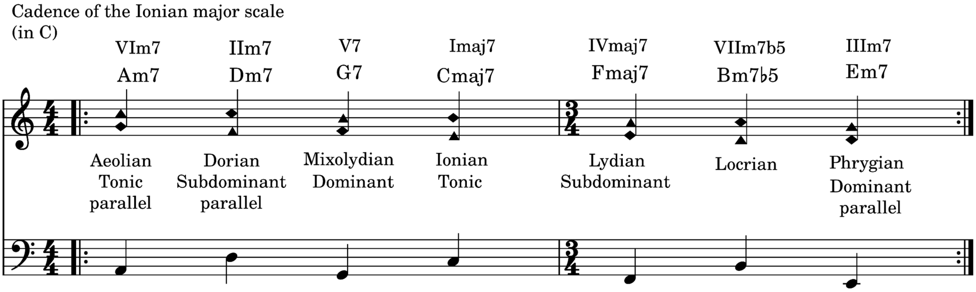


Figure 173 - The cadence of the Ionian major scale in C

The third and seventh, together with the root note, determine the cadence, while the fifth and tensions are to be regarded more as decorative accessories. The major cadence fulfills all four criteria of a cadence:

a) The root note goes up in fourths or down in fifths
b) The third (remains and) becomes the seventh of the following chord
c) The seventh falls by one scale tone and becomes the third of the following chord
d) All notes come from the same scale

The left part, the actual major cadence, is found throughout music in various variations and forms the basis for the analysis of almost every piece of music. This VI-II-V-I-IV cadence is often used in its entirety or in excerpts:

- $VIm^7 \rightarrow IIm^7 \rightarrow V^7 \rightarrow I^{maj7} \rightarrow IV^{maj7}$
- $VIm^7 \rightarrow IIm^7 \rightarrow V^7 \rightarrow I^{maj7}$
- $IIm^7 \rightarrow V^7 \rightarrow I^{maj7}$
- $V^7 \rightarrow I^{maj7}$ (Minimal form)

The $IIm^7 \rightarrow V^7 \rightarrow I^{maj7}$ cadence is the most common.

14.2.2 The 2-5-1 minor cadence

The minor cadence results solely from the functional reinterpretation of the chords of the Ionian major scale. Above, we assumed the major chord to be the first chord, the tonic. Now we consider the parallel VIm^7 minor chord as the tonic and the Im^7 chord:

[76]

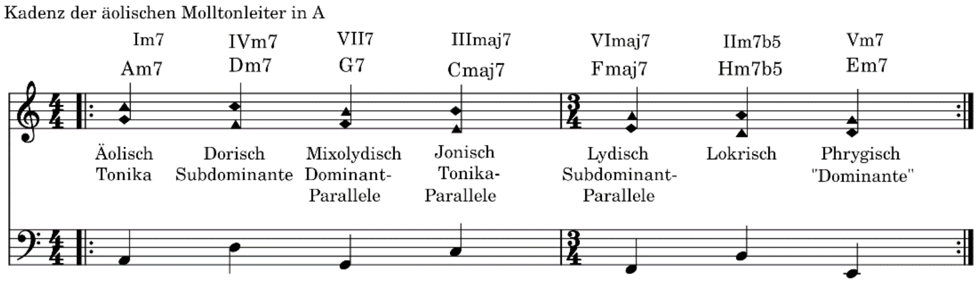


Figure 174 - Die Kadenz der äolischen Molltonleiter in A

Es handelt sich um eine reine funktionale Umdeutung der obigen Durkadenz. Die Akkorde bleiben unverändert.

Statt des Vm^7, hier des Em^7, erwartet man auf der 5. Stufe eine Dominante mit großer Terz. Die große Terz des V^7-Akkords "leiht" man sich von der HM5-Tonleiter**,** siehe Kapitel 8.5 (HM5: Die Harmonisch-Moll-Tonleiter auf der 5. Stufe und ihr Dominant-b9/b13-Septakkord), also Harmonisch-Moll auf der 5. Stufe, wodurch das oben aufgeführte vierte Kriterium einer Kadenz, dass alle Töne der selben Tonleiter entstammen, aufgeweicht wird:

[77]

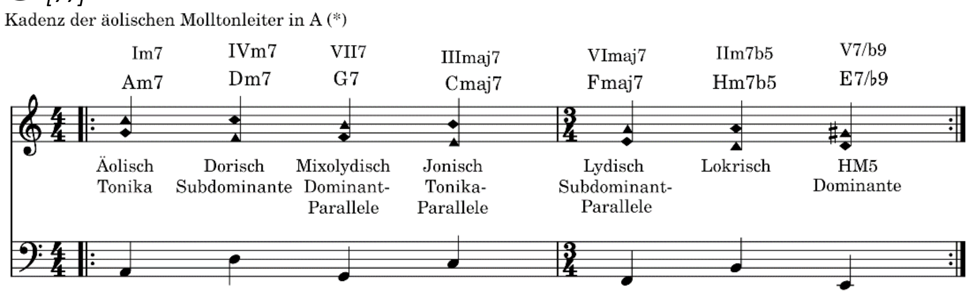


Figure 175 - Die Kadenz der äolischen Molltonleiter mit „Anleihe“ des Dominantseptakkords auf der 5. Stufe

*) Die Mollkadenz der äolischen Molltonleiter inklusive ihrer "Anleihe" des Dominantseptakkords auf der 5. Stufe von der Harmonisch-Molltonleiter.

Die 6-2-5-1-4-Mollkadenz wird oft komplett verwendet oder auch in Auszügen. Sie ist überall in der Musik in unterschiedlichen Varianten anzutreffen und bildet ebenfalls die Grundlage der Analyse fast jeden Musikstücks:

- $VI^{maj7} \rightarrow IIm^{7b5} \rightarrow V^7 \rightarrow Im^7 \rightarrow IVm^7$
- $VI^{maj7} \rightarrow IIm^{7b5} \rightarrow V^7 \rightarrow Im^7$
- $IIm^{7b5} \rightarrow V^7 \rightarrow Im^7$
- $V^7 \rightarrow Im^7$ (Minimalform)

Häufig anzutreffen ist auch der Weg nach dem VII^7 direkt zurück zur Tonika Im^7, also in diesem Fall $Am^7 \rightarrow Dm^7 \rightarrow G^7 \rightarrow Am^7$, oder allgemein $Im^7 \rightarrow IVm^7 \rightarrow VII^7 \rightarrow Im^7$.

Weil die $IIm^{7b5} \rightarrow V^7 \rightarrow Im^7$ - Kadenz am häufigsten zu finden ist, spricht man in der Regel statt von der 6-2-5-1-4 von der 2-5-1-Mollkadenz.

14.2.3 Zusammenfassung: Die 2-5-1-Dur- und Mollkadenz der ionischen Tonleiter

In der Regel werden die funktionalen Bezeichnungen mit Fokus auf die jeweilige II-V-I-Verbindung gemischt:

[77]

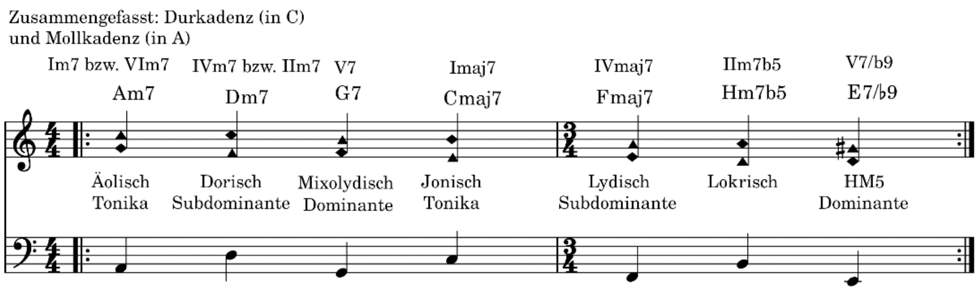


Figure 176 - Zusammengefasst: Durkadenz in C und Mollkadenz in A

Es handelt sich nach wie vor um eine reine funktionale Umdeutung der obigen Kadenz der ionischen Dur- bzw. äolischen Molltonleiter inklusive der „Anleihe" des V^7 von der Harmonisch-Molltonleiter auf der 5. Stufe (HM5). Die Akkorde sind dieselben.

14.3 Die Mollkadenz der Harmonisch-Molltonleiter

Wenn man die sieben Akkorde der Harmonisch-Molltonleiter, siehe Kapitel 8 (Die Harmonisch-Moll-Tonleiter und ihre Skalen und Akkorde) - hier in C - in die folgende Reihenfolge bringt und die funktionalen Bezeichnungen wie oben wieder mit Fokus auf die jeweilige 2-5-1-Verbindung festlegt, ergibt sich wieder eine Kadenzfolge:

[78]

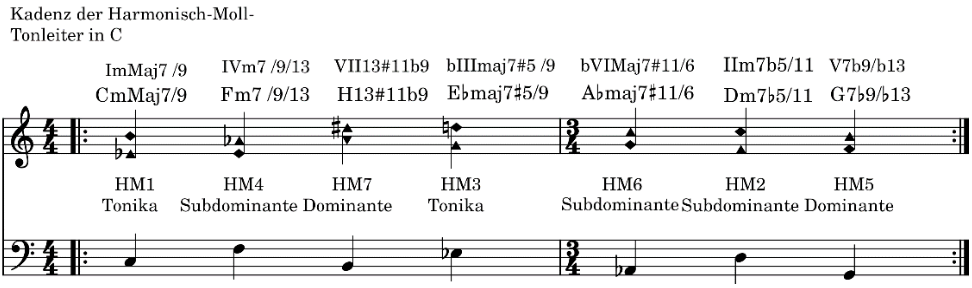


Figure 177 - Die Kadenz der Harmonisch-Molltonleiter in C

Auch die Mollkadenz der Harmonisch-Molltonleiter erfüllt alle vier Kriterien einer Kadenz:

a) Der Grundton geht in Fourthn aufwärts bzw. in Fifthn abwärts
b) Die Terz (bleibt stehen und) wird zur Septime des folgenden Akkords
c) Die Septime löst sich in die Terz des folgenden Akkords auf
d) Alle Töne entstammen derselben Tonleiter

Strenggenommen stimmt das nicht ganz: Bei HM7 wird die Terz, hier das D$^{\#}$ vom H^{13}, in die Septime D des nachfolgenden Major-Akkords, hier E^{bmaj7}, aufgelöst, bleibt also nicht stehen.

Die hintere 2-5-1-Mollkadenz der Harmonisch-Molltonleiter ist häufig in der Musik in unterschiedlichen Varianten anzutreffen:

- VI^{maj7} → IIm^{7b5} → $^{V7b9/b13}$ → Im^{maj7} → IV^{m7}
- VI^{maj7} → IIm^{7b5} → V7$^{b9/b13}$ → Im^{maj7}
- IIm^{7b5} → V$^{7b9/b13}$ → Im^{maj7}
- V$^{7b9/b13}$ → Im^{maj7} (Minimalform)

14.4 Die Mollkadenz der Melodisch-Molltonleiter

Wenn man alle sieben Akkorde der Melodisch-Molltonleiter, siehe Kapitel 7 (Die Melodisch-Moll-Tonleiter und ihre Skalen und Akkorde) in die folgende Reihenfolge bringt, ergibt sich wieder eine Kadenzfolge:

[79]

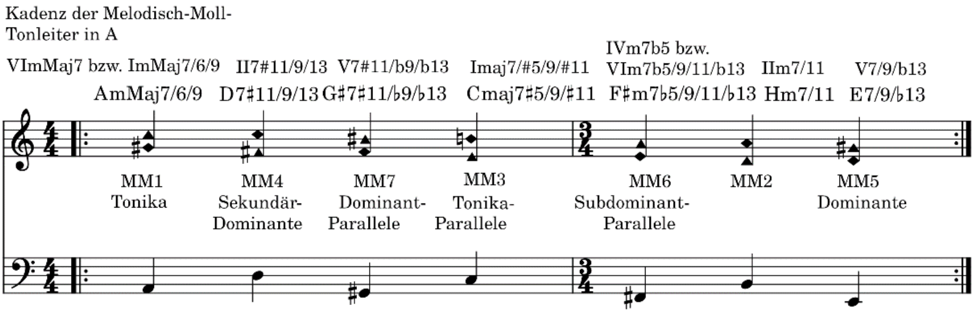


Figure 178 - Die Kadenz der Melodisch-Molltonleiter in A

Auch die Mollkadenz der Melodisch-Molltonleiter erfüllt alle vier Kriterien einer Kadenz:

a) Der Grundton geht in Fourthn aufwärts bzw. in Fifthn abwärts
b) Die Terz (bleibt stehen und) wird zur Septime des folgenden Akkords
c) Die Septime löst sich in die Terz des folgenden Akkords auf
d) Alle Töne entstammen derselben Tonleiter

Strenggenommen stimmt das - wie bei der Mollkadenz der Harmonisch-Molltonleiter - wieder nicht ganz: Bei MM7 wird die Terz, hier das $H^{\#}$ oder klingend C vom $G^{\#7\#11}$, in die Septime H des nachfolgenden Major-Akkords, hier C^{maj7}, aufgelöst, bleibt also nicht stehen.

Die Melodisch-Molltonleiter enthält als Besonderheit drei Dominantseptakkorde auf der 4., 5. und 7. Stufe. Vor allem das Dominantpaar $II^{7\#11}$ - $V^{7\#11}$ ist im Jazz äußerst beliebt, wobei der I^{maj7} eher wieder aus dem ionischen Tonraum übernommen wird, weil die übermäßige Fifth (#5) im Major-Akkord für eine Tonikaparallele zu unruhig klingt. Die hintere II-V-Verbindung entspricht wieder der II-V-Verbindung der ionischen Tonleiter, wobei MM5 in der Kombination mit der großen None (9) und kleinen Tredezime (b13) eher selten verwendet wird. Auch sehr beliebt ist die Auflösung des Dominantpaars $II^{7\#11}$ - $V^{7\#11}$ in einen Moll-Major-Tonikaakkord (MM1) wobei dann natürlich der Tonraum verlassen wird und ein neuer um den neuen Tonikaakkord (MM1) aufgespannt wird.

Zusammenfassend kann man sagen, dass die Melodisch-Molltonleiter nicht zum Aufspannen eines Kadenztonraums verwendet wird, sondern eher berühmt ist für ihr Dominantpaar $II^{7\#11}$ (MM4) - $V^{7\#11}$ (MM7) und die Auflösung in einen Tonikaakkord (MM1), der aber einen eigenen, neuen Tonraum aufspannt. Auch MM6 wird gerne als Alternative für die lokrische Tonleiter verwendet und wird daher auch als Lokrisch9 bezeichnet. Die Tonikaparallele (MM3) wird aufgrund ihrer dissonant klingenden #5 eher selten verwendet. Ebenso die Dominante (MM5) mit der Kombination ihrer Optionstöne 9 und b13 ist eher unüblich, genauso wie Tonleiter MM2, die aufgrund ihrer dissonant klingenden b9 eher selten verwendet wird.

14.5 Alterierte Dominanten

In der Jazzmusik verwendet man häufig alterierte Dominanten (also mit #11, b9 und/oder b13) auf der 5. Stufe, die sich sowohl nach Moll als auch nach Dur auflösen lassen:

[80]

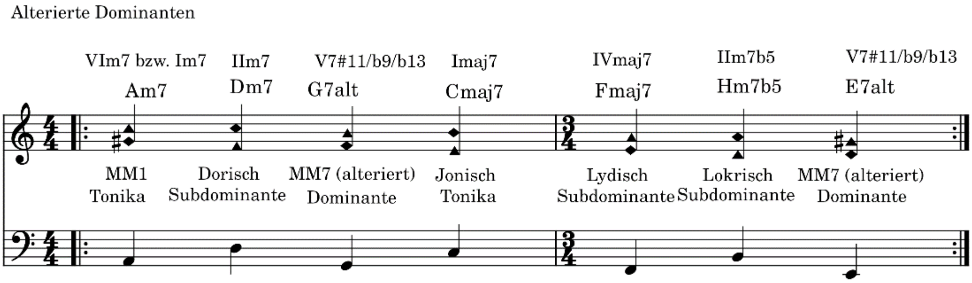


Figure 179 - Alterierte Dominanten auf der 5. Stufe

Da der alterierte Akkord sowohl nach Dur als auch nach Moll aufgelöst werden kann, spricht man auch von einer Tongeschlechtskreuzung.

Es gelten immer noch die Bedingungen a) bis c) der oben genannten Kadenzdefinition. Über die alterierten Dominanten wird die alterierte Tonleiter (MM7) gespielt.

Im Jazz wird über den Tonikaakkord in der Regel Melodisch-Moll (MM1), in der Unterhaltungsmusik eher äolisch oder auch Harmonisch-Moll (HM1) gespielt.

14.6 Ersatz der alterierten Dominante durch ihre Sekundärdominante

Wie wir oben im Kapitel 14.4 (Die Mollkadenz der Melodisch-Molltonleiter) gesehen haben, enthält die Melodisch-Molltonleiter drei Dominantseptakkorde, wobei die auf der 4. (MM4) und 7. Stufe (MM7) die interessanten sind: Die beiden zugehörigen Dominantseptakkorde, im oberen Beispiel $D^{7\#11/9/13}$ (MM4) und $G^{\#7\#11/b9/b13}$ (MM7), stehen im Abstand eines Tritone zueinander und enthalten die selben Töne, da sie ja beide aus der selben Melodisch-Molltonleiter stammen:

Funktion:			**Funktion:**	
$V^{7\#11/b9/b13}$ Dominante			$bII^{7\#11/9/13}$ Sekundärdominante	
Tonleiter:			**Tonleiter:**	
MM7 (alteriert)			MM4 (Mixo#11, Lydianb7)	
Beispiel:			**Beispiel:**	
$G^{\#7\#11/b9/b13}$			$D^{7\#11/9/13}$	
Funktion:	Töne:		Töne:	Funktion:
7	F#	=	F#	M3
b13	E	=	E	9
#11	C##	=	D	1
M3	H#	=	C	7
#9	A##	=	H	13
b9	A	=	A	5
1	G#	=	G#	#11

Table65 - Gegenüberstellung: Dominante auf der 5. Stufe mit MM7-Tonleiter (alteriert) und Sekundärdominante auf der Stufe IIb mit MM4-Tonleiter

Die übermäßige Undezime (#11) der alterierten Dominante wird dabei zum Grundton, die übermäßige None (#9) zur Tredezime (13), die kleine None (b9) zur reinen Fifth (5), die kleine Tredezime (b13) zur großen None (9), der Grundton (1) zur übermäßigen Undezime (#11) und das Tritonepärchen große Terz (M3) / kleine Septime (7) wird zum Tritonepärchen kleine Septime (7) / große Terz (M3) der Sekundärdominante.

Fazit

Man kann jeden alterierten Dominantseptakkord mit der Tonleiter MM7 (alteriert, Lydianb7) ersetzen durch seine Sekundärdominante bII7#11/9/13 im Tritoneabstand mit der Tonleiter MM4 (Mixo#11, Lydian b7).

Das gilt natürlich auch umgekehrt: Man kann jede Sekundärdominante mit einer alterierten Dominante im Tritoneabstand ersetzen.

[84]

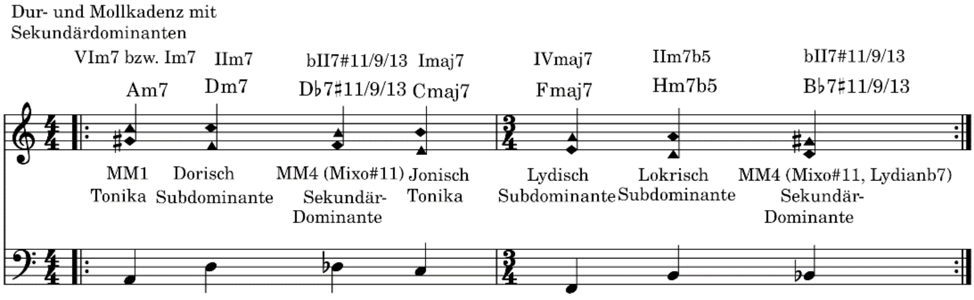


Figure 180 - Ersatz der alterierten Dominanten durch Sekundärdominanten auf der Stufe II^{b}

Die Definitionen zu Dominante und Sekundärdominante gehen in der Literatur auseinander. Hier schließe ich mich der logischen Definition von Axel Jungbluths [2] Jazz Harmonielehre an:

Merke

Eine alterierte Dominante steht immer auf der 5. Stufe und hat die Tonleiter MM7 (alteriert). Eine Sekundärdominante steht niemals auf der 5. Stufe und hat immer die Tonleiter MM4 (Mixo#11, Lydianb7).

Da auch die Sekundärdominanten sowohl nach Dur als auch nach Moll aufgelöst werden können, spricht man auch hier von einer Tongeschlechtskreuzung.

Der Basston geht in diesen II-bII-I-Kadenzen chromatisch abwärts. Aus diesem Grund werden diese Kadenzvarianten auch als Chromatic Approach [85] bezeichnet. Sie sind besonders häufig im Jazz und insbesondere im Latin-Jazz anzutreffen.

14.7 Verminderte Akkorde als Zwischendominante

Häufig wird vor dem dorischen Mollakkord auf der 2. Stufe der Kadenz eine sogenannte Zwischendominante V^{7b9} eingefügt:

[86]

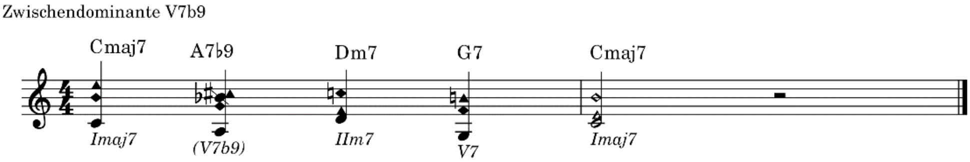


Figure 181 - Zwischendominante zur Einleitung einer II-V-I-Kadenz

Wie wir im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Die Halbton-Ganztonleiter und ihre verminderten Septakkorde) gesehen haben, kann man jeden V^{7b9}-Akkord, hier zum Beispiel den A^{7b9}, ersetzen durch einen verminderten Akkord auf der Stufe b9, M3, 5 oder 7, in diesem Beispiel also: $B^{b\circ}$, $C^{\#\circ}$, E°oder G°. Der verminderte Akkord startend von der M3, in diesem Fall der $C^{\#\circ}$ wird sehr häufig verwendet, um einen chromatischen Aufgang zur folgenden II-V-I-Kadenz zu erzeugen:

[87]

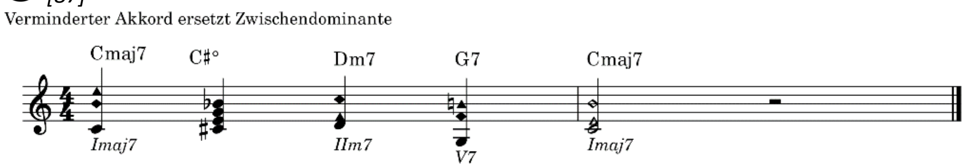


Figure 182 - Ersatz der Zwischendominante durch einen verminderten Akkord

Fazit

Der $C^{\#\circ}$ ersetzt also die Zwischendominante $A^{7b9.}$ Über den verminderten Akkord wird dabei die Ganzton-Halbtonleiter gespielt.

Entsprechend kann man über den V7b9 (hier A^{7b9}) neben HM5 oder alteriert auch die Halbton-Ganztonleiter spielen.

15 Slash chords and inversions

15.1 Definition Slash-Akkord und Umkehrung

Definition Slash-Akkord:

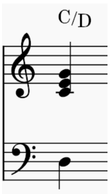


Figure 183 - Der Slash-Akkord C/D

Slash-Akkorde [69] sind Drei- oder Mehrklänge, denen einer der 12 möglichen Basstöne unterlegt wird. Der Basston wird dabei hinter dem Schrägstrich angezeigt. C/D bedeutet zum Beispiel C-Dur mit einem D im Bass.

Definition Umkehrung:

Figure 184 - 1. und 2. Umkehrung des Durakkords in C

Umkehrungen sind Slash-Akkorde, bei denen der Basston einem Akkordton entspricht. C/E bezeichnet z.B. die 1. und C/G die 2. Umkehrung des C-Dur-Akkords.

Das Interessante an den Slash-Akkorden ist, dass sich - wie wir sehen werden - durch die Variation des Basstons die Funktion des Akkords im Musik-Stück ändert. Das macht sie für Komponisten und Singer-/Songwriter so interessant, weil sich dadurch viel mehr Möglichkeiten und Varianten zum Beispiel für die weiter oben beschriebenen Kadenzen eröffnen.

15.2 Slash-Akkord-Tool

Mit Hilfe des Slash-Akkorde-Tools [89] kann der Grundakkord, z.B. der C-Durdreiklang, eingestellt werden und ein beliebiger Basston ausgewählt und unterlegt werden. Es werden dann alle im Rahmen dieser Harmonielehre näher vorgestellten Tonleitern angezeigt, die in das so erzeugte Muster oder English: *Pattern* passen. Es wird auch der zur jeweiligen Tonleiter passende Akkord angezeigt. Die zu vermeidenden Töne sind entsprechend markiert und entweder in Klammern oder durchgestrichen dargestellt. Durchgestrichen sind sie, wenn sie aufgrund von Dissonanzen zu vermeiden sind, eingeklammert sind sie, wenn sie den Charakter des Akkords verändern, innerhalb einer Kadenzfolge Terz oder Septime des Folgeakkords vorwegnehmen, oder aufgrund eines anderen nebenliegenden Akkordtons zu dissonant klingen. Wichtigen Töne des Akkords, zum Beispiel Terz und Septime, fehlen oft bei den Slash-Akkorden und können durch den Komponisten zum Beispiel in der Melodie ergänzt werden.

Slash-Akkord auswählen: ◉ **Funktionen** ○ **Noten**

C [Dur-Dreiklang (1-M3-5)] / D

C/D	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 b7	7	maj7 b15
Dorisch	Dm7/9/11	1		9	**m3**		11		5		(13)	**7**	
Mixolydisch	D7/9	1		9		**M3**	(sus4)		5		13	**7**	
Äolisch	Dm7/9/11	1		9	**m3**		11		5	~~b13~~		**7**	
MM5	D7/9	1		9		**M3**	(sus4)		5	b13		**7**	
MM6 (Lokrisch9)	Dm7b5/9/11	1		9	**m3**		11	**b5**		b13		**7**	

Figure 185 - Das Slash-Akkorde-Tool [89] auf der e-reuter.com-Webseite

Im folgenden Kapitel 13.3 (Slash-Akkorde: Hintergrund und Erklärung) wird erklärt, wie man zu dem Ergebnis kommt und wie sich die durch den Grundakkord gegebenen Pattern in Abhängigkeit vom Basston verschieben.

15.3 Slash-Akkorde: Hintergrund und Erklärung

Zur systematischen Analyse listen wir zunächst die für den Grundakkord in Frage kommenden verschiedenen Akkordtypen auf. Den Durdreiklang mit seinen Erweiterungen Major^{7} und Dominant^{7} sowie den übermäßigen Dreiklang mit seinen Erweiterungen Major$^{7\#5}$ und Dominant^{7b13} (siehe Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** Durakkorde), den Molldreiklang mit seinen Erweiterungen Moll^{7} und Moll-Major^{7} sowie den verminderten Dreiklang mit seinen Erweiterungen Moll^{7b5} und vermindert (siehe Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** Mollakkorde) und schließlich den Sus4-Dreiklang mit seiner Erweiterung Dominant^{7sus4} (siehe Kapitel 4.2.3 Akkorde mit Sus4-Dreiklang). Sie geben sozusagen das Muster oder Englisch Pattern vor:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
Major^{7}-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
Dominantsept-Vierklang	1, M3, 5, 7	C^{7}	1				M3			5			7	
Übermäßiger Dreiklang	1, M3, b13	C^{aug}	1				M3				b13			
Major$^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
Dominantsept/b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
Molldreiklang	1, m3, 5	Cm	1			m3				5				
Mollseptvierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
Verminderter Dreiklang	1, m3, b5	(Drei-klang) C°	1			m3			b5					
Halbverminderter Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
Dominantsept/sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	

Table66 - Die Grunddreiklänge und ihre Vierklangerweiterungen geben das Muster oder Englisch Pattern vor

Jetzt unterlegen wir den Grundakkord mit dem Basston, der hinter dem Schrägstrich angegeben wird. Der Basston als tiefster Ton bildet dabei immer den 1. Ton oder die Eins. Wenn der Basston dem Grundton des Akkords entspricht, ändert sich das oben dargestellte Pattern nicht. Wird der Basston aber zum Beispiel nach links verschoben, im folgenden Beispiel von C nach H, verschiebt sich das Pattern entsprechend nach rechts, in diesem Beispiel um einen Halbton.

15.3.1 Der C/H - Slash-Akkord

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Durdreiklang	1, M3, 5		1				M3			5				
		C/H	→	b9			→	11 sus4		→	b13 #5			

Table67 - Verschiebt sich der Basston um einen Ton nach links von C nach H, verschiebt sich das Pattern entsprechend um eine Position nach rechts

Aus dem 1-M3-5 Pattern wird also ein b9-11 (oder sus4)-b13 (oder #5)-Pattern. Jetzt fügen wir noch den Basston, in diesem Fall das H, als Eins hinzu und erhalten damit ein 1-b9-11 (oder sus4)-b13 (oder #5)-Pattern:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
C-Durdreiklang/H	1, b9, 11, b13	C/H	1	b9				11 sus4			b13 #5			

Table68 - Die 1 als Basston ist per Definition gesetzt, so dass sich ein 1-b9-11 (oder sus4)-b13 (oder #5)-Pattern ergibt

C/H ergibt also ein 1-b9-11 (oder sus4)-b13 (oder #5)-Pattern. Um zu beurteilen, wie der Slash-Akkord, in diesem Beispiel C/H harmonisch einzuordnen ist, schaut man, welche Tonleitern in das entsprechende C/H-Pattern passen. Wir betrachten dabei aber nicht alle 2048 theoretisch möglichen Tonleitern [23], sondern nur die im Rahmen dieser Harmonielehre näher betrachteten Tonleitern:

Tonleiter		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Ionisch		H^{maj7}	1		9		M3	~~11~~		5		6		maj7
Dorisch		Hm^{7}	1		9	m3		11		5		(13)	7	
Phrygisch		$Hm^{7/11}$	1	~~b9~~		m3		11		5	(b13)		7	
Lydisch		$H^{maj7\#11}$	1		9		M3		#11	(5)		6		maj7
Mixolydisch		H^{7}	1		9		(M3)	sus4		5		13	7	
Äolisch		Hm^{7}	1		9	m3		11		5	(b13)		7	
Lokrisch		$Hm^{7b5/11/b13}$	1	~~b9~~		m3		11	b5		b13		7	
Harmonisch-Moll HM1		Hm^{maj7}	1		9	m3		~~11~~		5	(b13)			maj7
HM2		Hm^{7b5}	1	~~b9~~		m3		11	b5			13	7	
HM3		$H^{maj7\#5}$	1		9		M3	~~11~~			#5	(6)		maj7
HM4		Hm^{7}	1		9	m3			(#11)	5		13	7	
HM5		$H^{7/b9/b13}$	1	b9			(M3)	sus4		5	b13		7	
HM6		$H^{maj7\#11}$	1			~~#9~~	M3		#11	(5)		6		maj7
HM7		H^{13}	1	b9		#9	M3		#11		(b13)	b7		
Melodisch-Moll MM1		Hm^{maj7}	1		9	m3		~~11~~		5		6		maj7
MM2		Hm^{7}	1	~~b9~~		m3		11		5		(13)	7	
MM3		$H^{maj7\#5}$	1		9		M3		#11		#5	(6)		maj7
MM4 (Mixo#11)		$H^{7\#11/9/13}$	1		9		M3		#11	5		13	7	
MM5		$H^{7/9/b13}$	1		9		(M3)	sus4		5	b13		7	
MM6 (Lokrisch9)		H^{m7b5}	1		9	m3		11	b5		b13		7	
MM7 (Alteriert)		$H^{7\#11/b9/b13}$	1	b9		#9	M3		#11		b13		7	
Halbton-Ganzton HTGT		$H^{7/b9/13}$	1	b9		#9	M3		#11	5		13	7	
Ganzton-Halbton GTHT		H°	1		9	m3		~~11~~	b5		b13	b7		b15
Ganzton GT		$H^{7\#11/9/b13}$	1		9		M3		#11		b13		7	
Mollpentatonik		Hm^{7}	1			m3		11		5			7	
Mollpentatonik+Blue-Note		Hm^{7}	1			m3		11	#11	5			7	

Table69 - Das 1-b9-11 (oder sus4)-b13 (oder #5)-Pattern wird über die zu betrachtenden Tonleitern gelegt.

Es gibt drei Treffer. Das C/H-Pattern passt offensichtlich zu den Tonleitern Phrygisch, Lokrisch und HM5, das heißt jedes farbig markierte Feld des Patterns trifft auf einen Ton der entsprechenden Tonleiter:

Tonleiter		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Phrygisch		$Hm^{7/11}$	1	~~b9~~		m3		11		5	(b13)		7	
Lokrisch	C/H	$Hm^{7b5/11/b13}$	1	~~b9~~		m3		11	b5		b13		7	
HM5		$H^{7/b9/b13}$	1	b9			(M3)	sus4		5	b13		7	

Table70 - Das 1-b9-11 (oder sus4)-b13 (oder #5)-Pattern trifft bei den drei Tonleitern Phrygisch, Lokrisch und HM5

Phrygisch enthält einen Mollseptakkord mit der reinen Undezime (11) als Option. Die kleine None (b9) und kleine Tredezime (b13) sind zu vermeidende Töne. Die kleine None (b9) klingt dissonant zum Grundton und die kleine Tredezime (b13) zur Fifth (5). Alternativ kann man auf die Fifth (5) verzichten und die kleine Tredezime (b13) verwenden. Als Option passt die reine Undezime (11), so dass der passende Akkord hier der $Hm^{7/11}$ ist. Minor third (m3) und kleine Septime (7) sollten ergänzt und die kleine None (b9) vermieden werden.

Zu Lokrisch gehört ein $Moll^{7b5}$-Akkord, hier also Hm^{7b5} mit den Optionen 11 und b13. Die kleine None (b9) wird bei allen Akkordtypen außer den Dominanten als zu dissonant zum Grundton empfunden. Dieser zu vermeidende Ton sollte in die Terz oder den Grundton aufgelöst werden. Die fehlende Minor third (m3) und kleine Septime (7) sowie die verminderte Fifth (b5) sollten hinzugefügt werden.

Die 3. Tonleiter HM5 enthält den Akkord $H^{7/b9/b13}$. Die kleine None (b9) ist hier ein erlaubter und gewünschter Ton, um der Dominante noch mehr Spannung zu geben. Die große Terz (M3) und kleine Septime (7) sollten ergänzt werden. Die reine Undezime (11) macht den Akkord zum Sus4-Akkord. Alternativ löst man die reine Undezime (11) in die große Terz (M3) auf und bekommt dann den beschriebenen Dominantseptakkord $H^{7/b9/b13}$. Reine Undezime (11) und große Terz (M3) sollten nicht gleichzeitig in einem Akkord verwendet werden.

Merke

Bei Slash-Akkorden fehlen häufig die wichtigen Töne, in der Regel die Terz und Septime, so dass sie durch den Komponisten ergänzt werden können, um die Tonart zu verdeutlichen. Die Kunst besteht darin, die zu vermeidenden Töne in die wichtigen Töne, in der Regel Terz und Septime aufzulösen, und die passenden Optionen gegebenenfalls hinzuzufügen.

15.4 Slash-Akkorde über Dur

15.4.1 C/D^b

Verschiebt sich der Basston um eine Position nach rechts, hier um einen Step von C nach D^b, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^7-Vierklang und dem Dominantseptvierklang, entsprechend um einen Step nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
						I↙			I↙					I↙
		C/D^b	1 *)			m3 #9			#11 b5					maj7 b15
Major^7-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
						I↙			I↙				I↙	I↙
		C^{maj7}/D^b	1 *)			m3 #9			#11 b5				7	maj7 b15
Dominantsept- vierklang	1, M3, 5, 7	C^7	1				M3			5			7	
						I↙			I↙			I↙		I↙
		C^7/D^b	1 *)			m3 #9			#11 b5			13 6		maj7 b15

Table71 - Patterns, die sich bei den Slash-Akkorden C/D^b, C^{maj7}/D^b und C^7/D^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter			**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM6	C/D^b	C^7/D^b	D^{bmaj7}	1			~~#9~~	M3		#11	(5)		6		maj7
Ganzton-Halbton			D$^{b°}$	1		9	m3		11	b5		b13	b7		b15

Table72 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/D^b und C^7/D. Zum C^{maj7}/D^b passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Bei beiden Tonleitern sind aber zu vermeidende Töne enthalten. Die bei HM6 zu vermeidende übermäßige None (#9) kann in die große Terz (M3) aufgelöst werden und es entsteht ein lydischer Major7#11-Akkord. Die b15 als klingende Major seventh (maj7) klingt im verminderten Akkord recht unpassend und sollte in die verminderte Septime (b7) aufgelöst werden, so dass ein kompletter verminderter Akkord entsteht.

Wenn man den Grunddreiklang, hier den C-Durdreiklang, um die kleine oder Major seventh erweitert, sieht man, dass die Erweiterung des Grundakkords um die Major seventh (maj7) in diesem Beispiel zum C^{maj7}/D^b keine passende Tonleiter findet. Die Erweiterung des Grundakkords um die kleine Septime (7) in diesem Beispiel zum C^7/D^b

passt zu beiden Tonleitern HM6 und Ganzton-Halbton. Die kleine Septime wird zur großen Sexte (6) bzw. verminderten Septime (b7) im Slash-Akkord.

15.4.2 C/D

Verschiebt sich der Basston um zwei Positionen nach rechts, hier um zwei Stepe von C nach D, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^{7}-Vierklang und dem Dominantseptvierklang, entsprechend um zwei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
					⇤	↙		⇤	↙				⇤	↙
		C/D	1 *)		9			11 sus4					7	
Major^{7}-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
					⇤	↙		⇤	↙			⇤	↙	↙
		C^{maj7}/D	1 *)		9			11 sus4				13 6	7	
Dominantsept-vierklang	1, M3, 5, 7	C^{7}	1				M3			5			7	
					⇤	↙		⇤	↙		⇤	↙	⇤	↙
		C^{7}/D	1 *)		9			11 sus4			b13 #5		7	

Table73 - Patterns, die sich bei den Slash-Akkorden C/D, C^{maj7}/D und C^{7}/D ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Dorisch	C/D	C^{maj7}/D	$Dm^{7/9/11}$	1		9	m3		11		5		(13)	7	
Mixolydisch			D7/9	1		9		(M3)	sus4		5		13	7	
Äolisch		C^{7}/D	$Dm^{7/9/11}$	1		9	m3		11		5	(b13)		7	
MM5			$D^{7/9}$	1		9		(M3)	sus4		5	b13		7	
MM6 (Lokrisch9)			$Dm^{7b5/9/11}$	1		9	m3		11	b5		b13		7	

Table74 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/D, C^{maj7}/D und C^{7}/D

Der Grund-Slash-Akkord C/D ergibt einen vollständigen dominanten Sus4-Akkord mit mixolydischer oder MM5-Tonleiter. Er kann aber auch als Moll11-Akkord mit dorischer oder äolischer Tonleiter und fehlender kleiner Terz interpretiert werden. Auch als halbverminderter Akkord lässt sich dieser Slash-Akkord interpretieren, wobei neben der kleinen Terz (m3) auch die verminderte Fifth (b5) fehlt. Unter mixolydischer Verwendung des C/D-Slash-Akkords kann der Slash-Akkord direkt in einer V-I-Verbindung nach G^{maj7} aufgelöst werden:

C/D→G^{maj7}.

Wenn man den Grunddreiklang, hier den C-Durdreiklang, um die kleine oder Major seventh erweitert, teilt sich die Ergebnismenge entsprechend auf. Die Major seventh (maj7) wird zur großen Tredezime (13) und die kleine Septime (7) zur kleinen Tredezime (b13) im Slash-Akkord.

Die Erweiterung des Grundakkords um die Major seventh (maj7) in diesem Beispiel zum C^{maj7}/D passt zur dorischen und mixolydischen Tonleiter, während die Erweiterung des Grundakkords um die kleine Septime (7) in diesem Beispiel zum C^{7}/D zu den Tonleitern Äolisch, MM5 und MM6 (Lokrisch9) passt.

15.4.3 C/E^{b}

Verschiebt sich der Basston um drei Positionen nach rechts, hier um drei Stepe von C nach E^{b}, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^{7}-Vierklang und dem Dominantseptvierklang, entsprechend um drei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
				⇤	←	↙	⇤	←	↙			⇤	←	↙
		C/E^{b}	1 *)	b9			M3					13 6		
Major^{7}-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
				⇤	←	↙	⇤	←	↙		⇤	← ⇤	↙ ←	↙
		C^{maj7}/E^{b}	1 *)	b9			M3				b13 #5	13 6		
Dominantsept-vierklang	1, M3, 5, 7	C^{7}	1				M3			5			7	
				⇤	←	↙	⇤	←	↙	⇤	←	↙ ⇤	←	↙
		C^{7}/E^{b}	1 *)	b9			M3			5		13 6		

Table75 - Patterns, die sich bei den Slash-Akkorden C/E^{b}, C^{maj7}/E^{b} und C^{7}/E^{b} ergeben

**) Die 1 als Basston ist per Definition immer gesetzt*

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM7	C/E^b	C^{maj7}/E^b	$E^{b13/b9}$	1	b9		#9	M3		#11		(b13)	b7		
HTGT		C^7/E^b	$E^{b7/b9/13}$	1	b9		#9	M3		#11	5		13	7	

Table76 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/E^b, C^{maj7}/E^b und C^7/E^b

Den C/E^b-Slash-Akkord könnte man am ehesten als $E^{b7\#11/b9/13}$ mit Halbton-Ganztonleiter und fehlender übermäßiger Undezime (#11) und kleiner Septime (7) interpretieren. Den C/E^b-Slash-Akkord kann man unter Verwendung der HTGT-Tonleiter folgendermaßen auflösen:

$C/E^b \rightarrow Ab^{maj7}$ bzw. $C/E^b \rightarrow Abm^{maj7}$.

Die Erweiterung des Durdreiklangs zu einem $Major^7$- oder Dominantseptakkord, in diesem Fall C^{maj7}/E^b oder C^7/E^b, führt zu keiner Klärung der Tonart, weil im Fall des $Major^7$-Akkords die Major seventh (maj7) zur zu vermeidenden kleinen Tredezime (b13) und die kleine Septime (7) zur Fifth (5) im Slash-Akkord werden.

15.4.4 C/E

Dieser Slash-Akkord entspricht der 1. Umkehrung des C-Akkords, weil das E im Bass einem Akkordton, in diesem Fall der Terz, entspricht. Verschiebt sich der Basston um vier Positionen nach rechts, hier um vier Stepe von C nach E, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem $Major^7$-Vierklang und dem Dominantseptvierklang, entsprechend um vier Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/E	|←	←	←	↙ |←	←	←	↙		|←	←	←	↙
			1*)			m3 #9					b13 #5			
Major^7-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/E	|←	←	←	↙ |←	←	←	↙	|←	← |←	← ←	↙ ←	↙
			1*)			m3 b9				5	b13 #5			
Dominantsept- vierklang	1, M3, 5, 7	C^7	1				M3			5			7	
		C^7/E	|←	←	←	↙ |←	←	←	↙ |←	↙	← |←	↙ ←	←	↙
			1*)			m3 b9			#11 b5		b13 #5			

Table77 - Patterns, die sich bei den Slash-Akkorden C/E, C^{maj7}/E und C^7/E ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Phrygisch	C/E	C^{maj7}/E	Em^7	1	~~b9~~		m3		11		5	(b13)		7	
Äolisch	C/E	C^{maj7}/E	Em^7	1		9	m3		11		5	(b13)		7	
Harmonisch-Moll HM1	C/E	C^{maj7}/E	Em^{maj7}	1		9	m3		~~11~~		5	(b13)			maj7
Lokrisch	C/E	C^7/E	Em$^{7b5/b13}$	1	~~b9~~		m3		11	b5		b13		7	
HM7	C/E	C^7/E	E°$^{13/\#9}$	1	b9		#9	M3		#11		(b13)	b7		
MM6 (Lokrisch9)	C/E	C^7/E	Em$^{7b5/b13}$	1		9	m3		11	b5		b13		7	
MM7 (Alteriert)	C/E	C^7/E	E$^{7/\#9/b13}$	1	b9		#9	M3		#11		b13		7	
Ganzton-Halbton	C/E	C^7/E	E°$^{/b13}$	1		9	m3		11	b5		b13	b7		b15

Table78 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/E, C^{maj7}/E und C^7/E

Den C/E-Slash-Akkord könnte man auf der einen Seite durch Hinzufügen der verminderten Fifth (b5) und der kleinen Septime (7) zu einem halbverminderten Akkord mit lokrischer oder lokrisch9-Tonleiter ausbauen und als Beginn einer IIm^{7b5}-V^{7b9}-Im-Mollkadenz interpretieren, also:

C/E→A^{7b9}→Dm^7.

Auf der anderen Seite kann man ihn aber durch Hinzufügen der großen Terz (M3), kleinen Septime (7) und/oder der übermäßigen Undezime (#11) zu einem alterierten Akkord auf der 5. Stufe machen:

C/E→A^{maj7} oder C/E→Am^{maj7}.

Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^{7}/E wird die kleine Septime (7) bereits zur übermäßigen Undezime (#11) bzw. verminderten Fifth (b5), so dass in den oben genannten Beispielen nur noch die kleine Septime (7) hinzugefügt werden müsste.

Bei der Erweiterung mit der großen Septime, hier C^{maj7}/E wird die Major seventh (maj7) zur Fifth (5) im Slash-Akkord. Der entstehende Mollakkord beinhaltet aber die kleine Tredezime (b13), die als zu vermeidender Ton gilt und nur als Durchgangsnote verwendet werden sollte, siehe dazu die Anmerkung 6 im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

15.4.5 C/F

Verschiebt sich der Basston um fünf Positionen nach rechts, hier um fünf Stepe von C nach F, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^{7}-Vierklang und dem Dominantseptvierklang, entsprechend um fünf Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/F	←	←	← |←	↙ ←	←	←	↙	|←	←	←	←	↙ |←
			1*)		9					5				maj7 b15
Major^{7} -vierklang	1, M3, 5, maj7	C^{maj7}	1				M 3			5				maj7
		C^{maj7}/F	←	←	← |←	↙ ←	←	←	|← ↙	← |←	← ←	← ←	↙ ←	↙ |←
			1*)		9				#11 b5	5				maj7 b15
Dominantsept- vierklang	1, M3, 5, 7	C^{7}	1				M 3			5			7	
		C^{7}/F	←	←	← |←	↙ ←	←	|← ←	← ↙	← |←	← ←	↙ ←	←	↙ |←
			1*)		9			11 sus4		5				maj7 b15

Table79 - Patterns, die sich bei den Slash-Akkorden C/F, C^{maj7}/F und C^{7}/F ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Lydisch	C/F	C^{maj7}/F	$F^{maj7/9}$	1		9		M3		#11	(5)		6		maj7
Ionisch	C/F	C^7/F	$F^{maj7/9}$	1		9		M3	~~11~~		5		6		maj7
Harmonisch-Moll HM1	C/F	C^7/F	$Fm^{maj7/9}$	1		9	m3		~~11~~		5	(b13)			maj7
Melodisch-Moll MM1	C/F	C^7/F	$Fm^{maj7/9}$	1		9	m3		~~11~~		5		6		maj7

Table80 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/F, C^{maj7}/F und C^7/F

Der C/F-Slash-Akkord ergibt ein Pattern, dass zu den Tonikaakkorden passt. Durch Hinzufügen der großen Terz (M3) erhalten wir einen ionischen oder lydischen $Major^7$-Akkord, durch Hinzufügen der kleinen Terz (m3) einen Moll-$Major^7$-Akkord mit Harmonisch- oder Melodisch-Molltonleiter.

Bei der Erweiterung des Slash-Akkords zum $Major^7$-Vierklang, in diesem Beispiel C^{maj7}/F, wird die Major seventh (maj7) zur übermäßigen Undezime (#11) im Slash-Akkord, wodurch der lydische Charakter hervorgehoben wird.

Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^7/F, wird die Septime (7) zur Undezime (11) im Slash-Akkord, die als zu vermeidender Ton bei den Tonikatypen gilt, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

15.4.6 C/F#

Verschiebt sich der Basston um sechs Positionen, also einen Tritone nach rechts (oder links, was bei sechs Halbtönen auf das Selbe heraus kommt), hier um sechs Stepe von C nach F#, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem $Major^7$-Vierklang und dem Dominantseptvierklang, entsprechend um sechs Stepe nach links (oder rechts), so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/F#	←	← |←	← ←	↙ ←	←	←	↙ |←	←	←	←	← |←	↙ ←
			1*)	b9					#11 b5				7	maj7 b15
Major^{7}-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/F#	←	← |←	← ←	↙ ←	←	← |←	↙ ← |←	← ←	← ←	← ←	↙ ← |←	↙ ←
			1*)	b9				11 sus4	#11 b5				7	maj7 b15
Dominantsept- vierklang	1, M3, 5, 7	C^{7}	1				M3			5			7	
		C^{7}/F#	←	← |←	← ←	↙ ←	← |←	← ←	↙ ← |←	← ←	← ←	↙ ←	← |←	↙ ←
			1*)	b9			M3		#11 b5				7	maj7 b15

Table81 - Patterns, die sich bei den Slash-Akkorden C/F#, C^{maj7}/F# und C^{7}/F# ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj 7 b15
Lokrisch	C/F#	C^{maj7}/F#	F#m7b5	1	~~b9~~		m3		11	b5		b13		7	
HM2			F#m7b5	1	~~b9~~		m3		11	b5			13	7	
MM7 (Alteriert)		C^{7}/F#	F#7/b9/#11	1	b9		#9	M3		#11		b13		7	
Halbton-Ganzton			F#7/b9/#11	1	b9		#9	M3		#11	5		13	7	

Table82 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/F#, C^{maj7}/F# und C^{7}/F#

Den C/F#-Slash-Akkord kann man durch Hinzufügen der großen Terz (M3) zu einem alterierten Akkord auf der 5. Stufe machen, den man nach Major^{7} oder Moll-Major^{7} auflösen kann:

C/F#→H^{maj7} oder C/F#→Hm^{maj7}.

Bei der Interpretation als Lokrisch oder HM2 stört die kleine None (b9) als ein zu vermeidender Ton, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^{7}/F#, wird die kleine Septime (7) zur großen Terz (M3) im Slash-Akkord, wodurch der C^{7}/F#-Slash-Akkord einen vollständigen alterierten Akkord ($F^{\# alt}$) ergibt. Dieser kann nach Dur oder Moll aufgelöst werden:

$C^7/F^\#$ → H^{maj7} oder $C^7/F^\#$ → Hm^{maj7}.

Bei der Erweiterung des Slash-Akkords zum Major^7-Vierklang, in diesem Beispiel $C^{maj7}/F^\#$, wird die Major seventh (maj7) zur reinen Undezime (11) im resultierenden Mollakkord. Es stört aber weiterhin die b9 als zu vermeidender Ton bei Mollakkorden.

15.4.7 C/G

Dieser Slash-Akkord entspricht der 2. Umkehrung des C-Akkords, weil das G im Bass einem Akkordton, in diesem Fall der Fifth, entspricht. Verschiebt sich der Basston um sieben Positionen nach rechts, oder besser um fünf Positionen nach links, hier um fünf Stepe von C nach G, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^7-Vierklang und dem Dominantseptvierklang, entsprechend um fünf Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/G	→|	↘	→	→	→	↘ →|	→	→	↘ →	→ →|	→	→
			1*)					11 sus4				13 6		
Major^7-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/G	↘ →|	↘ →	→ →	→ →	→ →|	↘ →|	→	→	↘ →	→ →|	→	→
			1*)				M3	11 sus4				13 6		
Dominantsept- vierklang	1, M3, 5, 7	C^7	1				M3			5			7	
		C^7/G	→ →|	→ ↘	→ →	→| →	→	↘ →|	→	→	↘ →	→ →|	→	↘ →
			1*)			m3 #9		11 sus4				13 6		

Table83 - Patterns, die sich bei den Slash-Akkorden C/G, C^{maj7}/G und C^7/G ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Ionisch	C/G	C^{maj7}/G	G^{maj6}	1		9		M3	~~11~~		5		6		maj7
Mixolydisch			$G^{7/13}$	1		9		M3	sus4		5		13	7	
HM3			Gmaj7#5	1		9		M3	~~11~~			#5	(6)		maj7
Dorisch		C^7/G	$Gm^{7/11}$	1		9	m3		11		5		(13)	7	
HM2			$Gm^{7b5/11/13}$	1	~~b9~~		m3		11	b5			13	7	
Melodisch-Moll MM1			Gm^{maj7}	1		9	m3		~~11~~		5		6		maj7
MM2			$Gm^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	
Ganzton-Halbton			$G^{\circ/11}$	1		9	m3		11	b5		b13	b7		b15

Table84 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/G, C^{maj7}/G und C^7/G

Den C/G-Slash-Akkord als 2. Umkehrung des C-Akkords könnte man aufgrund der fehlenden Terz sowohl als Sus4-Akkord mit fehlender Septime (7) und mixolydischer Tonleiter, als auch als Moll11-Akkord mit den möglichen Tonleitern Dorisch, HM2 oder MM2 ansehen.

Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^7/G, wird die kleine Septime (7) zur kleinen Terz (m3) und bestätigt den $Moll^{11}$-Akkord. Der Slash-Akkord könnte am Anfang einer 2-5-1-Kadenz unter Verwendung der dorischen Tonleiter stehen, zum Beispiel:

$C^7/G \rightarrow C^7 \rightarrow F^{maj7}$.

Bei der Erweiterung des Slash-Akkords zum $Major^7$-Akkord, in diesem Beispiel C^{maj7}/G, wird die Major seventh (maj7) zur großen Terz (M3). Diese reibt sich an der Sus4. Auch bei der Interpretation als $Major^7$-Akkord stört die reine Undezime (11) als zu vermeidender Ton, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

15.4.8 C/A^b

Verschiebt sich der Basston um vier Positionen, also eine große Terz nach links, hier um vier Stepe von C nach A^b, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem $Major^7$-Vierklang und dem Dominantseptvierklang, entsprechend um vier Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/A^b		↘	→	→	→|	↘	→	→	↘ →|	→	→	→|
			1 *)				M3				b13 #5			maj7 b15
Major⁷-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/A^b	↘	↘ →	→ →	→ →|	→|	↘	→	→	↘ →|	→	→	→|
			1 *)			m3 #9	M3				b13 #5			maj7 b15
Dominantsept-vierklang	1, M3, 5, 7	C^7	1				M3			5			7	
		C^7/A^b	→	→ ↘	→| →	→	→|	↘	→	→	↘ →|	→	→	↘ →|
			1 *)		9		M3				b13 #5			maj7 b15

Table85 - Patterns, die sich bei den Slash-Akkorden C/A^b, C^{maj7}/A^b und C^7/A^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM3	C/A^b	C^7/A^b	$A^{bmaj7\#5}$	1		9		M3	~~11~~			#5	(6)		maj7
MM3			$A^{bmaj7\#5}$	1		9		M3		#11		#5	(6)		maj7

Table86 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/A^b und C^7/A^b. Zum C^{maj7}/A^b passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Dieser Slash-Akkord C/A^b ergibt einen $A^{bmaj7\#5}$-Akkord mit den beiden möglichen Tonleitern HM3 und MM3.

Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^7/A^b, wird die kleine Septime (7) zur None (9) im Slash-Akkord. Die Major seventh (maj7) wird zur kleinen Terz (m3) im Slash-Akkord, für die es keine Entsprechung in diesem Fall gibt.

15.4.9 C/A

Verschiebt sich der Basston um drei Positionen, also eine Minor third nach links, hier um drei Stepe von C nach A, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major⁷-Vierklang und dem Dominantseptvierklang, entsprechend um drei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/A		↘	→	→|		↘	→	→|	↘	→	→|	
			1 *)			m3 #9				5			7	
Major^{7}-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/A	↘	↘ →	→ →|	→|		↘	→	→|	↘	→	→|	
			1 *)		9	m3 #9				5			7	
Dominantsept-vierklang	1, M3, 5, 7	C^{7}	1				M3			5			7	
		C^{7}/A	→	↘ →|	→	→|		↘	→	→|	↘	→	→|	↘
			1 *)	b9		m3 #9				5			7	

Table87 - Patterns, die sich bei den Slash-Akkorden C/A, C^{maj7}/A und C^{7}/A ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Äolisch	C/A	C^{maj7}/A	Am^{7}	1		9	m3		11		5	(b13)		7	
HM4			Am^{7}	1		9	m3			(#11)	5		13	7	
Dorisch			Am^{7}	1		9	m3		11		5		(13)	7	
Phrygisch		C^{7}/A	Am^{7}	1	~~b9~~		m3		11		5	(b13)		7	
MM2			Am^{7}	1	~~b9~~		m3		11		5		(13)	7	
Halbton-Ganzton			$A^{7\#9}$	1	b9		#9	M3		#11	5		13	7	
Mollpentatonik			Am^{7}	1			m3		11		5			7	
Mollpentatonik+Blue-Note			Am^{7}	1			m3		11	#11	5			7	

Table88 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/A, C^{maj7}/A und C^{7}/A

Dieser Slash-Akkord C/A ergibt die Mollparallele Am, auf den entsprechend die aufgeführten Molltonleitern und die Mollpentatonik passen. Der Slash-Akkord kann am Anfang einer 2-5-1-Kadenz unter Verwendung der dorischen Tonleiter stehen, zum Beispiel:

C/A→D^{7}→G^{maj7}.

Strenggenommen passt auch die Halbton-Ganztonleiter mit ihrem Dominantakkord, hier $H^{7\#9/13}$. Hier sollte der Komponist aber die große Terz (M3) ergänzen, um vom Moll- zum Dominantcharakter zu wechseln.

Bei der Erweiterung des Slash-Akkords zum Major^{7}-Akkord, in diesem Beispiel C^{maj7}/A, wird die Major seventh (maj7) zur großen None (9) und und erweitert den Mollseptakkord entsprechend. Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^{7}/A wird die kleine Septime (7) zur kleinen None (b9), die bei Mollakkorden ein zu vermeidender Ton ist, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

15.4.10 C/B^{b}

Verschiebt sich der Basston um zwei Positionen, also eine Major second nach links, hier um zwei Stepe von C nach B^{b}, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^{7}-Vierklang und dem Dominantseptvierklang, entsprechend um zwei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/B^{b}		↘	→|			↘	→|		↘	→|		
			1*)		9				#11 b5			13 6		
Major^{7}-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/B^{b}	↘	↘ →|	→|			↘	→|		↘	→|		
			1 *)	b9	9				#11 b5			13 6		
Dominantsept-vierklang	1, M3, 5, 7	C^{7}	1				M3			5			7	
		C^{7}/B^{b}	→|	↘	→|			↘	→|		↘	→|		↘
			1*)		9				#11 b5			13 6		

Table89 - Patterns, die sich bei den Slash-Akkorden C/B^{b}, C^{maj7}/B^{b} und C^{7}/B^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkord**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Lydisch			B^{b}maj6/#11/9	1		9		M3		#11	(5)		6		maj7
HM4			B^{b}m7/9/13	1		9	m3			(#11)	5		13	7	
MM3	C/B^{b}	C^{7}/B^{b}	B^{b}maj7#5/9/#11	1		9		M3		#11		#5	(6)		maj7
MM4 (Mixo#11)			B^{b}7#11/9/#11/13	1		9		M3		#11	5		13	7	
Ganzton-Halbton			B^{b}°/9	1		9	m3		11	b5		b13	b7		b15

Table90 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/B^{b} und C^{7}/B^{b}. Zum C^{maj7}/B^{b} passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Diesem Slash-Akkord C/B^b fehlen sowohl Terz als auch Septime. Der Komponist kann z.B. durch Hinzufügen der großen Terz (M3) und großen Septime (maj7) einen lydischen Major$^{7\#11}$-Akkord erzeugen, oder durch Hinzufügen der großen Terz (M3) und kleinen Septime (7) eine alterierte Sekundärdominante mit MM4-Tonleiter auf der Stufe II^b, die dann in eine Dur- oder Moll-Tonika aufgelöst werden kann:

C/B^b→A^{maj7} oder C/B^b→Am^{maj7}.

Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^7/B^b, wird die kleine Septime (7) zum bereits vorhandenen Grundton (1) und fügt somit keinen neuen Ton hinzu. Erweitert man den C/B^b-Slash-Akkord durch die Major seventh (maj7) auf den C^{maj7}/B^b, wird die Major seventh zur kleinen None (b9), so dass es keine passende Tonleiter gibt.

15.4.11 C/H

Verschiebt sich der Basston um eine Position, also eine Minor second nach links, hier um einen Step von C nach H, verschiebt sich das Pattern, hier das Durdreiklangpattern mit seinen zwei Erweiterungen, dem Major^7-Vierklang und dem Dominantseptvierklang, entsprechend um einen Step nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Durdreiklang	1, M3, 5	C	1				M3			5				
		C/H		↘|				↘|			↘|			
			1*)	b9				11 sus4			b13 #5			
Major^7-Vierklang	1, M3, 5, maj7	C^{maj7}	1				M3			5				maj7
		C^{maj7}/H	↘|	↘|				↘|			↘|			
			1*)	b9				11 sus4			b13 #5			
Dominantsept-vierklang	1, M3, 5, 7	C^7	1				M3			5			7	
		C^7/H		↘|				↘|			↘|			↘|
			1*)	b9				11 sus4			b13 #5			maj7 b15

Table91 - Patterns, die sich bei den Slash-Akkorden C/H, C^{maj7}/H und C^7/H ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Phrygisch	C/H	Cmaj7/H	Hm7/11	1	~~b9~~		m3		11		5	(b13)		7	
Lokrisch			Hm7b5/11/b13	1	~~b9~~		m3		11	b5		b13		7	
HM5			H7/b9/b13	1	b9			(M3)	sus4		5	b13		7	

Table92 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C/H und C^{maj7}/H. Zum C^{7}/H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Dieses Pattern wurde bereits im Kapitel 15.3.1 (Der C/H - Slash-Akkord) näher erläutert. Bei der Erweiterung des Slash-Akkords zum Dominantseptvierklang, in diesem Beispiel C^{7}/H, wird die kleine Septime (7) zur großen Septime (maj7), so dass es keine passende Tonleiter gibt. Erweitert man den C/H-Slash-Akkord durch die Major seventh (maj7) auf den C^{maj7}/H, wird die Major seventh (maj7) zum bereits vorhandenen Grundton (1) und fügt somit keinen neuen Ton hinzu.

15.5 Slash-Akkorde über Moll

15.5.1 Cm/D^{b}

Verschiebt sich der Basston um eine Position nach rechts, hier um einen Step von C nach D^{b}, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um einen Step nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Molldreiklang	1, m3, 5	Cm	1			m3				5				
					I↙				I↙					I↙
		Cm/D^{b}	1 *)		9				#11 b5					maj7 b15
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
					I↙				I↙				I↙	I↙
		Cm^{maj7}/D^{b}	1 *)		9				#11 b5				7	maj7 b15
Mollsept-vierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
					I↙				I↙			I↙		I↙
		Cm^{7}/D^{b}	1 *)		9				#11 b5			13 6		maj7 b15

Table93 - Patterns, die sich bei den Slash-Akkorden Cm/D^{b}, Cm^{maj7}/D^{b} und Cm^{7}/D^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Lydisch	Cm/D^b	Cm^7/D^b	D$^{bmaj7/9/\#11}$	1		9		M3		#11	(5)		6		maj7
MM3			D$^{bmaj7\#5/9/\#11}$	1		9		M3		#11		#5	(6)		maj7
Ganzton-Halbton			D$^{b°/9}$	1 *)		9	m3		11	b5		b13	b7		b15

Table94 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/D^b und Cm^7/D^b. Zum Cm^{maj7}/D^b H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Es entsteht ein lydischer Major^7-Akkord mit übermäßiger Undezime (#11), bei dem jedoch die große Terz (M3) fehlt und durch den Komponisten ergänzt werden sollte.

Erweitert man den Cm/D^b-Slash-Akkord durch die kleine Septime (7) auf den Cm^7/D^b, wird die kleine Septime (7) zur großen Sexte (6) bzw. verminderten Septime (b7) und ergänzt den resultierenden Slash-Akkord entsprechend. Bei der Erweiterung des Cm/D^b-Slash-Akkord durch die Major seventh (maj7) auf den Cm^{maj7}/D^b wird die Major seventh (maj7) zur kleinen Septime (7), für die es hier keine entsprechende Tonleiter gibt.

15.5.2 Cm/D

Verschiebt sich der Basston um zwei Positionen nach rechts, hier um zwei Stepe von C nach D, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^7-Vierklang entsprechend um zwei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/D		⇤	↙			⇤	↙				⇤	↙
			1 *)	b9				11 sus4					7	
Moll-Major^7-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/D		⇤	↙			⇤	↙			⇤	↙ ⇤	↙
			1 *)	b9				11 sus4				13 6	7	
Mollsept-vierklang	1, m3, 5, 7	Cm^7	1			m3				5			7	
		Cm^7/D		⇤	↙			⇤	↙		⇤	↙	⇤	↙
			1 *)	b9				11 sus4			b13 #5		7	

Table95 - Patterns, die sich bei den Slash-Akkorden Cm/D, Cm^{maj7}/D und Cm^7/D ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM2	Cm/D	Cm^{maj7}/D	$Dm^{7b5/11}$	1	~~b9~~		m3		11	b5			13	7	
MM2			$Dm^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	
Phrygisch		Cm^7/D	Dm^7	1	~~b9~~		m3		11		5	(b13)		7	
Lokrisch			Dm^{7b5}	1	~~b9~~		m3		11	b5		b13		7	
HM5			$D^{7/b9/b13}$	1	b9			(M3)	sus4		5	b13		7	

Table96 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/D, Cm^{maj7}/D und Cm^7/D

Die kleine None (b9) ist in den Molltonleitern ein zu vermeidender Ton. Bei HM5 passt das Pattern aber sehr gut, wobei die Fourth (sus4) in die große Terz (M3) überführt werden sollte, um den Dominantcharakter zu unterstreichen. Dieser Slash-Akkord kann dann gut als V→Im-Mollkadenz aufgelöst werden, in diesem Fall nach Gm:

Cm/D→Gm.

Erweitert man den Cm/D-Slash-Akkord durch die kleine Septime (7) auf den Cm^7/D, oder durch die Major seventh (maj7) auf den Cm^{maj7}/D, wird die kleine Septime (7) zur kleinen Tredezime (b13) im Slash-Akkord und passt gut zur oben genannten Interpretation als Dominantseptakkord mit HM5-Tonleiter:

Cm^7/D→Gm7,

wobei die sus4 in die M3 überführt werden sollte. Die Major seventh (maj7) wird zur großen Tredezime (13) im Slash-Akkord, so dass nur noch die Tonleitern HM2 und MM2 passen.

15.5.3 Cm/E^b

Dieser Slash-Akkord entspricht der 1. Umkehrung des Cm-Akkords, weil das E^b im Bass einem Akkordton, in diesem Fall der Terz, entspricht. Verschiebt sich der Basston um drei Positionen nach rechts, hier um drei Stepe von C nach E^b, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-$Major^7$-Vierklang entsprechend um drei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/E^b	⇤	←	↙		⇤	←	↙			⇤	←	↙
			1 *)				M3			5		13 6		
Moll-Major⁷-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/E^b	⇤	←	↙		⇤	←	↙		⇤	← ⇤	↙ ←	↙
			1 *)				M3			5	b13 #5	13 6		
Mollsept-vierklang	1, m3, 5, 7	Cm^7	1			m3				5			7	
		Cm^7/E^b	⇤	←	↙		⇤	←	↙	⇤	←	↙ ⇤	←	↙
			1 *)				M3			5		13 6		

Table97 - Patterns, die sich bei den Slash-Akkorden Cm/E^b, Cm^{maj7}/E^b und Cm^7/E^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM3	Cm/E^b	Cm^{maj7}/E^b	E^bmaj6	1		9		M3	~~11~~			#5	(6)		maj7
HM7			E^b13	1	b9		#9	M3		#11		(b13)	b7		
MM3			E^bmaj6	1		9		M3		#11		#5	(6)		maj7
Ionisch		Cm^7/E^b	E^bmaj6	1		9		M3	~~11~~		5		6		maj7
Lydisch			E^bmaj6	1		9		M3		#11	(5)		6		maj7
Mixolydisch			E^b7/13	1		9		M3	(sus4)		5		13	7	
MM4 (Mixo#11)			E^b7/13	1		9		M3		#11	5		13	7	
HM6			E^bmaj6	1			~~#9~~	M3		#11	(5)		6		maj7
Halbton-Ganzton			E^b7/13	1	b9		#9	M3		#11	5		13	7	

Table98 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/E^b, Cm^{maj7}/E^b und Cm^7/E^b

Dieser Slash-Akkord entspricht einem $Major^6$-Tonikaakkord, kann aber auch als Dominantseptakkord mit fehlender kleiner Septime (7) angesehen werden und nach Dur oder $Moll\text{-}Major^7$ aufgelöst werden:

$Cm/E^b \rightarrow A^{bmaj7}$ (mixolydische Verwendung), oder

$Cm/E^b \rightarrow D^{maj7}$ oder Dm^{maj7} (Verwendung als Sekundärdominante mit MM4-Tonleiter).

Erweitert man den Cm/E^b-Slash-Akkord durch die kleine Septime (7) auf den Cm^7/E^b, oder durch die Major seventh (maj7) auf den Cm^{maj7}/E^b, wird die kleine Septime (7) zur Fifth (5) im Slash-Akkord, während die Major seventh (maj7) zur übermäßigen Fifth (#5) bzw. kleinen Tredezime (b13) wird.

15.5.4 Cm/E

Verschiebt sich der Basston um vier Positionen nach rechts, hier um vier Stepe von C nach E, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um vier Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/E	←	←	↙	|←	←	←	↙		|←	←	←	↙ |←
			1 *)			m3 #9					b13 #5			maj7 b15
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/E	←	←	↙	|←	←	←	↙	|←	← |←	← ←	↙ ←	↙ |←
			1 *)			m3 #9				5	b13 #5			maj7 b15
Mollsept-vierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
		Cm^{7}/E	←	←	↙	|←	←	←	↙ |←	←	← |←	↙ ←	←	↙ |←
			1 *)			m3 #9			#11 b5		b13 #5			maj7 b15

Table99 - Patterns, die sich bei den Slash-Akkorden Cm/E, Cm^{maj7}/E und Cm^{7}/E ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkord**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Harmonisch-Moll HM1	Cm/E	Cm^{maj7}/E	Em^{maj7}	1		9	m3		~~11~~		5	(b13)			maj7
Ganzton-Halbton		Cm^{7}/E	E°/b13	1		9	m3		11	b5		b13	b7		b15

Table100 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/E, Cm^{maj7}/E und Cm^{7}/E

Dieser Cm/E Slash-Akkord mit der großen Terz im Bass passt zur Harmonisch-Molltonleiter HM1 und der Ganzton-Halbtonleiter, wobei in beiden Fällen zu vermeidende Töne enthalten sind. Bei der HM1-Tonleiter sollte die kleine Tredezime (b13) zum Beispiel in die Fifth (5) überführt werden.

Erweitert man den Cm/E-Slash-Akkord durch die kleine Septime (7) auf den Cm^7/E, oder durch die Major seventh (maj7) auf den Cm^{maj7}/E, wird die kleine Septime (7) zur verminderten Fifth (b5) im Slash-Akkord, während die Major seventh (maj7) zur reinen Fifth (5) wird.

15.5.5 Cm/F

Verschiebt sich der Basston um fünf Positionen nach rechts, hier um fünf Stepe von C nach F, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-$Major^7$-Vierklang entsprechend um fünf Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b1 3 #5**	**13 6**	**7**	**maj7 b15**
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/F	←	←	↙ |←	←	←	←	↙	|←	←	←	← |←	↙ ←
			1 *)		9					5			7	
Moll-$Major^7$- Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/F	←	←	↙ |←	←	←	←	↙ |←	← |←	← ←	← ←	↙ ← |←	↙ ←
			1 *)		9				#11 b5	5			7	
Mollsept- vierklang	1, m3, 5, 7	Cm^7	1			m3				5			7	
		Cm^7/F	←	←	↙ |←	←	←	← |←	↙ ←	← |←	← ←	↙ ←	← |←	↙ ←
			1 *)		9			11 sus4		5			7	

Table101 - Patterns, die sich bei den Slash-Akkorden Cm/F, Cm^{maj7}/F und Cm^7/F ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj 7 b15
HM4	Cm/F	Cm^{maj7}/F	Fm$^{7/9}$	1		9	m3			(#11)	5		13	7	
MM4 (Mixo#11)			F$^{7/9/\#11}$	1		9		M3		#11	5		13	7	
Dorisch		Cm^{7}/F	Fm$^{7/9/11}$	1		9	m3		11		5		(13)	7	
Mixolydisch			F$^{7sus4/9}$	1		9		(M3)	sus4		5		13	7	
Äolisch			Fm$^{7/9/11}$	1		9	m3		11		5	(b13)		7	
MM5			F$^{7sus4/9}$	1		9		(M3)	sus4		5	b13		7	

Table102 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/F, Cm^{maj7}/F und Cm^{7}/F

Dieser Slash-Akkord passt sowohl zu einem Mollseptakkord mit großer None (9) und fehlender kleiner Terz (m3), als auch zu einem Dominantseptakkord mit großer None (9) und fehlender großer Terz (M3). In beiden Fällen kann der Komponist die fehlende Terz ergänzen, um die Tonart festzulegen.

Erweitert man den Cm/F-Slash-Akkord durch die kleine Septime (7) auf den Cm^{7}/F, oder durch die Major seventh (maj7) auf den Cm^{maj7}/F, wird die kleine Septime (7) zur reinen Undezime (11) bzw. Fourth (sus4) im Slash-Akkord, während die Major seventh (maj7) zur übermäßigen Undezime (#11) wird.

Bei der Interpretation als Dominante wäre zum Beispiel die Kadenz

Cm7/F → B^{bmaj7} (bei mixolydischer Interpretation), oder

Cm^{maj}/F → Em^{maj7} bzw. Cm^{maj7}/F → E^{maj7} (bei Interpretation als Sekundärdominante mit MM4-Tonleiter)

sinnvoll.

15.5.6 Cm/F$^{\#}$

Verschiebt sich der Basston um sechs Positionen, also einen Tritone nach rechts, hier um sechs Stepe von C nach F$^{\#}$, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um sechs Stepe nach links, so dass sich folgendes Pattern ergibt:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/F#	←	← ⇤	↙ ←	←	←	←	↙ ⇤	←	←	← ⇤	← ←	↙ ←
			1 *)	b9					#11 b5			13 6		
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		$Cm^{maj7}/F^{\#}$	←	← ⇤	↙ ←	←	←	← ⇤	↙ ← ⇤	← ←	← ←	← ← ⇤	↙ ← ←	↙ ←
			1 *)	b9				11 sus4	#11 b5			13 6		
Mollsept-vierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
		$Cm^{7}/F^{\#}$	←	← ⇤	↙ ←	←	← ⇤	← ←	↙ ← ⇤	← ←	← ←	↙ ← ⇤	← ←	↙ ←
			1 *)	b9			M3		#11 b5			13 6		

Table103 - Patterns, die sich bei den Slash-Akkorden $Cm/F^{\#}$, $Cm^{maj7}/F^{\#}$ und $Cm^{7}/F^{\#}$ ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM2	Cm/F#	$Cm^{maj7}/F^{\#}$	$F\#m^{7b5/13}$	1	~~b9~~		m3		11	b5			13	7	
HM7		$Cm^{7}/F^{\#}$	$F\#^{13/b9}$	1	b9		#9	M3		#11		(b13)	b7		
Halbton-Ganzton HTGT			$F\#^{7/b9/13}$	1	b9		#9	M3		#11	5		13	7	

Table104 - Passende Tonleitern und Akkorde zu den Slash-Akkorden $Cm/F^{\#}$, $Cm^{maj7}/F^{\#}$ und $Cm^{7}/F^{\#}$

Diesen Slash-Akkord kann man durch Hinzufügen der großen Terz (M3) zu einem Dominantakkord auf der 5. Stufe machen und unter Verwendung der Halbton-Ganztonleiter (HTGT) zum Beispiel folgendermaßen auflösen:

$Cm/F^{\#} \rightarrow H^{maj7}$ oder $Cm/F^{\#} \rightarrow Hm^{Maj7}$.

Erweitert man den $Cm/F^{\#}$-Slash-Akkord durch die kleine Septime (7) auf den $Cm^{7}/F^{\#}$, oder durch die Major seventh (maj7) auf den $Cm^{maj7}/F^{\#}$, wird die kleine Septime (7) zur großen Terz (M3) im Slash-Akkord und bestätigt den Dominantcharakter. Die Major seventh (maj7) wird zur reinen Undezime (11) im Slash-Akkord und unterstreicht die Verwendung als Mollakkord mit HM2-Tonleiter, wobei die Minor third (m3) fehlt und die kleine None (b9) als zu vermeidender Ton gilt, siehe dazu die Anmerkungen im Kapitel **Fehler!**

Verweisquelle konnte nicht gefunden werden. (Intervallbezeichnungen innerhalb der Akkorde).

15.5.7 Cm/G

Dieser Slash-Akkord entspricht der 2. Umkehrung des Cm-Akkords, weil das G im Bass einem Akkordton, in diesem Fall der Fifth, entspricht. Verschiebt sich der Basston um sieben Positionen nach rechts, oder besser um fünf Positionen nach links, hier um fünf Stepe von C nach G, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um fünf Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b 9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/G	→|	↘	→	→	↘ →	→ →|	→	→	↘ →|	→	→	→
			1*)					11 sus4			b13 #5			
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/G	↘ →|	→ ↘	→ →	→ →	↘ →| →	→ →|	→	→	↘ →|	→	→	→
			1*)				M3	11 sus4			b13 #5			
Mollsept-vierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
		Cm^{7}/G	→ →|	→ ↘	→ →	→| →	↘ →	→ →|	→	→	↘ →|	→	→	↘ →
			1*)			m3		11 sus4			b13 #5			

Table105 - Patterns, die sich bei den Slash-Akkorden Cm/G, Cm^{maj7}/G und Cm^{7}/G ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkord**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM3	Cm/G	Cm^{maj7}/G	G$^{maj7\#5}$	1		9		M3	~~11~~			#5	(6)		maj7
HM5			G$^{7/b13}$	1	b9			(M3)	sus4		5	b13		7	
MM5			G$^{7/b13}$	1		9		(M3)	sus4		5	b13		7	
Phrygisch		Cm^{7}/G	Gm$^{7/11}$	1	~~b9~~		m3		11		5	(b13)		7	
Äolisch			Gm$^{7/11}$	1		9	m3		11		5	(b13)		7	
Lokrisch			Gm$^{7b5/b13}$	1	~~b9~~		m3		11	b5		b13		7	
Harmonisch-Moll HM1			Gm^{maj7}	1		9	m3		~~11~~		5	(b13)			maj7
MM6 (Lokrisch9)			Gm^{7b5}	1		9	m3		11	b5		b13		7	

Ganzton-Halbton GTHT			G°/b13	1		9	m3		~~11~~	b5		b13	b7		b15

Table106 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/G, Cm^{maj7}/G und Cm^{7}/G

Da in dem Cm/G-Slash-Akkord sowohl die kleine als auch die große Terz fehlen, passen sowohl die Molltonleitern Phrygisch, Äolisch, Lokrisch, HM1, MM6 und GTHT, als auch die Durtonleitern HM3, HM5 und MM5. Die kleine Tredezime (b13) gilt bei den Molltonleitern Phrygisch, Äolisch und HM1 als zu vermeidender Ton, ebenso die reine Undezime (11) in den Tonleitern HM1, HM3 und GTHT, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Bevorzugt bleiben daher die lokrische und MM6-Verwendung bei der Interpretation des Slash-Akkords als Mollakkord und die Verwendung als Sus4-Akkord mit den Tonleitern HM5 und MM5 bei der Interpretation als Durakkord.

Erweitert man den Cm/G-Slash-Akkord durch die kleine Septime (7) auf den Cm^{7}/G, oder durch die Major seventh (maj7) auf den Cm^{maj7}/G, wird die kleine Septime (7) zur kleinen Terz (m3) im Slash-Akkord und bestätigt den Mollcharakter und die Tonleitern Phrygisch, Äolisch, Lokrisch, HM1, MM6 und GTHT. Die Major seventh (maj7) wird zur großen Terz (M3) im Slash-Akkord und bestätigt die Verwendung als Durakkord mit den Tonleitern HM3, HM5 und MM5, wobei jetzt die sus4 als zu vermeidender Ton gilt, da die große Terz (M3) und die reine Fourth (sus4) nicht gleichzeitig verwendet werden können.

15.5.8 Cm/A^{b}

Verschiebt sich der Basston um vier Positionen, also eine große Terz nach links, hier um vier Stepe von C nach A^{b}, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um vier Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/A^b		↘	→	→	↘ →|	→	→	→|	↘	→	→	→|
			1*)				M3			5				maj7 b15
Moll-Major^7-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/A^b	↘	↘ →	→ →	→ →|	↘ →|	→	→	→|	↘	→	→	→|
			1*)			m3 #9	M3			5				maj7 b15
Mollsept-vierklang	1, m3, 5, 7	Cm^7	1			m3				5			7	
		Cm^7/ A^b	→	↘ →	→ →|	→	↘ →|	→	→	→|	↘	→	→	↘ →|
			1*)		9		M3			5				maj7 b15

Table107 - Patterns, die sich bei den Slash-Akkorden Cm/A^b, Cm^{maj7}/A^b und Cm^7/A^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM6	Cm/A^b	Cm^{maj7}/A^b	A^{bmaj7}	1			~~#9~~	M3		#11	(5)		6		maj7
Ionisch		Cm^7/A^b	A$^{bmaj7/9}$	1		9		M3	~~11~~		5		6		maj7
Lydisch			A$^{bmaj7/9}$	1		9		M3		#11	(5)		6		maj7

Table108 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/A^b, Cm^{maj7}/A^b und Cm^7/A^b

Dieser Slash-Akkord Cm/A^b ergibt die Durparallele A^{bmaj7}, auf den entsprechend die angezeigten Tonika-Durtonleitern Ionisch, Lydisch und HM6 passen.

Erweitert man den Cm/A^b-Slash-Akkord durch die kleine Septime (7) auf den Cm^7/A^b, oder durch die Major seventh (maj7) auf den Cm^{maj7}/A^b, wird die kleine Septime (7) zur großen None (9) im Slash-Akkord und erweitert den Major^7-Akkord zum Major$^{7/9}$-Akkord. Die Major seventh (maj7) wird zur übermäßigen None (#9), also zur klingenden kleinen Terz (m3) und gilt im Major-Akkord als zu vermeidender Ton, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

15.5.9 Cm/A

Verschiebt sich der Basston um drei Positionen, also eine Minor third nach links, hier um drei Stepe von C nach A, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um drei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/A		↘	→	→|	↘	→	→|		↘	→	→|	
			1 *)			m3 #9			#11 b5				7	
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/A	↘	↘ →	→ →|	→|	↘	→	→|		↘	→	→|	
			1 *)		9	m3 #9			#11 b5				7	
Mollsept-vierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
		Cm^{7}/A	→	↘ →|	→	→|	↘	→	→|		↘	→	→|	↘
			1 *)	b9		m3 #9			#11 b5				7	

Table109 - Patterns, die sich bei den Slash-Akkorden Cm/A, Cm^{maj7}/A und Cm^{7}/A ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM4	Cm/A	Cm^{maj7}/A	Am^{7}	1		9	m3			(#11)	5		13	7	
MM6 (Lokrisch9)			Am$^{7b5/9}$	1		9	m3		11	b5		b13		7	
Lokrisch		Cm^{7}/A	Am^{7b5}	1	~~b9~~		m3		11	b5		b13		7	
HM2			Am^{7b5}	1	~~b9~~		m3		11	b5			13	7	
MM7 (Alteriert)			A$^{7\#9/\#11}$	1	b9		#9	M3		#11		b13		7	
Halbton-Ganzton			A$^{7\#9/\#11}$	1	b9		#9	M3		#11	5		13	7	
Mollpentatonik +Blue-Note			Am^{7}	1			m3		11	#11	5			7	

Table110 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/A, Cm^{maj7}/A und Cm^{7}/A

Dieser Slash-Akkord Cm/A ergibt einen vollständigen halbverminderten Mollseptakkord mit den passenden Tonleitern Lokrisch, HM2 und MM6. Er kann daher am Anfang einer Mollkadenz stehen, zum Beispiel:

Cm/A→D$^{7/b9}$→Gm^{7}.

Wenn der Komponist die große Terz (M3) hinzufügt, ergibt sich ein alterierter Dominantseptakkord mit den passenden Tonleitern MM7 und HTGT. Auch die Mollpentatonik mit Blue-Note passt, die übermäßige Undezime (#11) entspricht dann der Blue-Note.

Erweitert man den Cm/A-Slash-Akkord durch die kleine Septime (7) auf den Cm^7/A, oder durch die Major seventh (maj7) auf den Cm^{maj7}/A, wird die kleine Septime (7) zur kleinen None (b9) im Slash-Akkord und unterstreicht die Verwendung als alterierten Akkord, wenn man die große Terz (M3) hinzufügt. Im halbverminderten Mollseptakkord gilt die kleine None (b9) als ein zu vermeidender Ton, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Die Major seventh (maj7) wird zur None (9) und unterstreicht die Verwendung als halbverminderten Mollseptakkord mit MM6 (Lokrisch9)-Tonleiter.

15.5.10 Cm/B^b

Verschiebt sich der Basston um zwei Positionen, also eine Major second nach links, hier um zwei Stepe von C nach B^b, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^7-Vierklang entsprechend um zwei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/B^b		↘	→|		↘	→|			↘	→|		
			1*)		9			11 sus4				13 6		
Moll-Major^7-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/B^b	↘	↘ →|	→|		↘	→|			↘	→|		
			1*)	b9	9			11 sus4				13 6		
Mollsept-vierklang	1, m3, 5, 7	Cm^7	1			m3				5			7	
		Cm^7/B^b	→|	↘	→|		↘	→|			↘	→|		↘
			1 *)		9			11 sus4				13 6		

Table111 - Patterns, die sich bei den Slash-Akkorden Cm/B^b, Cm^{maj7}/B^b und Cm^7/B^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15

Ionisch			$B^{b}maj^{7/9/6}$	1		9		M3	~~11~~		5		6		maj7
Dorisch			$B^{b}m^{7/9/11}$	1		9	m3		11		5		(13)	7	
Mixolydisch			$B^{b7/9/13}$	1		9		(M3)	sus4		5		13	7	
HM3	Cm/B^{b}	Cm^{7}/B^{b}	$B^{b}maj^{7\#5/9}$	1		9		M3	~~11~~			#5	(6)		maj7
Melodisch-Moll MM1			$B^{b}m^{maj7/9}$	1		9	m3		~~11~~		5		6		maj7
Ganzton-Halbton			$B^{b\circ/9}$	1		9	m3		~~11~~	b5		b13	b7		b15

Table112 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/B^{b} und Cm^{7}/B^{b}. Zum Cm^{maj7}/B^{b} H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Diesem Slash-Akkord Cm/B^{b} fehlen sowohl Terz als auch Septime. Der Komponist kann z.B. durch Hinzufügen der großen Terz (M3) und kleinen Septime (7) einen mixolydischen Sus4-Akkord, oder durch Hinzufügen der kleinen Terz (m3) und kleinen Septime (7) einen dorischen Moll11-Akkord erzeugen. Als Tonika-Major- oder Moll-Major-Akkord bietet sich dieses Pattern nicht an, da die reine Undezime (11) dort ein zu vermeidender Ton ist, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Erweitert man den Cm/B^{b}-Slash-Akkord durch die kleine Septime (7) auf den Cm^{7}/B^{b}, oder durch die Major seventh (maj7) auf den Cm^{maj7}/B^{b}, wird die kleine Septime (7) zum Grundton (1) im Slash-Akkord und ergibt damit keine Erweiterung. Die Major seventh (maj7) wird zur kleinen None (b9), für die es keine Entsprechung in den hier vorgestellten Tonleitern gibt.

15.5.11 Cm/H

Verschiebt sich der Basston um eine Position, also eine Minor second nach links, hier um einen Step von C nach H, verschiebt sich das Pattern, hier das Molldreiklangpattern mit seinen zwei Erweiterungen, dem Mollseptvierklang und dem Moll-Major^{7}-Vierklang entsprechend um einen Step nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Molldreiklang	1, m3, 5	Cm	1			m3				5				
		Cm/H		↘|			↘|				↘|			
			1*)	b9			M3				b13 #5			
Moll-Major^{7}-Vierklang	1, m3, 5, maj7	Cm^{maj7}	1			m3				5				maj7
		Cm^{maj7}/H	↘|	↘|			↘|				↘|			
			1*)	b9			M3				b13 #5			
Mollsept-vierklang	1, m3, 5, 7	Cm^{7}	1			m3				5			7	
		Cm^{7}/H		↘|			↘|				↘|			↘|
			1*)	b9			M3				b13 #5			maj7 b15

Table113 - Patterns, die sich bei den Slash-Akkorden Cm/H, Cm^{maj7}/H und Cm^{7}/H ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM5			$H^{7/b9/b13}$	1	b9			M3	(sus4)		5	b13		7	
HM7	Cm/H	Cm^{maj7}/H	$H^{13/b9}$	1	b9		#9	M3		#11		(b13)	b7		
MM7 (Alteriert)			$H^{7/b9/b13}$	1	b9		#9	M3		#11		b13		7	

Table114 - Passende Tonleitern und Akkorde zu den Slash-Akkorden Cm/H und Cm^{maj7}/H. Zum Cm^{7}/H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Durch die Kombination der kleinen None (b9) und kleinen Tredezime (b13) mit der großen Terz (M3) passen die Dominant-Tonleitern HM5, HM7 und MM7. Zur Verdeutlichung kann die kleine Septime (7) durch den Komponisten hinzugefügt werden. Folgende Kadenzen können erzeugt werden:

Cm/H→Em^{7} (HM5-Verwendung), oder

Cm/H→Em^{maj7} bzw. Cm/H→E^{maj7} (alterierte Verwendung).

Erweitert man den Cm/H-Slash-Akkord durch die kleine Septime (7) auf den Cm^{7}/H, oder durch die Major seventh (maj7) auf den Cm^{maj7}/H, wird die Major seventh (maj7) zum Grundton (1) im Slash-Akkord und ergibt damit keine Erweiterung. Die kleine Septime (7) wird zur großen Septime (maj7), für die es keine Entsprechung in den hier vorgestellten Tonleitern gibt.

15.6 Slash-Akkorde über „Vermindert“

15.6.1 C°/D^{b}

Verschiebt sich der Basston um eine Position nach rechts, hier um einen Step von C nach D^{b}, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um einen Step nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
					I↙			I↙						I↙
		(Dreiklang) C°/D^{b}	1 *)		9			11 sus4						maj7 b15
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
					I↙			I↙			I↙			I↙
		C°/D^{b}	1 *)		9			11 sus4			b13 #5			maj7 b15
Halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
					I↙			I↙				I↙		I↙
		Cm^{7b5}/D^{b}	1 *)		9			11 sus4				13 6 b7		maj7 b15

Table115 - Patterns, die sich bei den Slash-Akkorden C°/D^{b} und Cm^{7b5}/D^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde			Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Harmonisch-Moll HM1	(Dreiklang) C°/Db	C°/Db		D^{b}maj7	1		9	m3		~~11~~		5	(b13)			maj7
HM3			Cm7b5/Db	D^{b}maj7#11	1		9		M3	~~11~~			#5	(6)		maj7
Ganzton-Halbton (GTHT)				D^{b}°	1		9	m3		~~11~~	b5		b13	b7		b15
Ionisch				D^{b}maj7	1		9		M3	~~11~~		5		6		maj7
Melodisch-Moll MM1				D^{b}mmaj7	1		9	m3		~~11~~		5		6		maj7

Table116 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/D^{b} und Cm^{7b5}/D^{b}

Es sind allesamt Tonika-Akkorde, wobei bei allen die reine Undezime (11) als zu vermeidender Ton gilt, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/D^{b}, also dem verminderten Vierklang in C über D^{b} im Bass, wird die verminderte Septime (b7) zur kleinen Tredezime (b13) im C°/D^b-Slash-Akkord. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur großen Sexte (6) bzw. verminderten Septime (b7) im Cm^{7b5}/D^b - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum (Vierklang) C°/D^b, als auch zum Cm^{7b5}/D^b passen die Tonleitern HM3 und Ganzton-Halbton (GTHT).

15.6.2 C°/D

Verschiebt sich der Basston um zwei Positionen nach rechts, hier um zwei Stepe von C nach D, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um zwei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
				|←	↙		|←	↙					|←	↙
		(Dreiklang) C°/D	1 *)	b9			M3						7	
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
				|←	↙		|←	↙		|←	↙		|←	↙
		C°/D	1 *)	b9			M3			5			7	
Halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
				|←	↙		|←	↙			|←	↙	|←	↙
		Cm^{7b5}/D	1 *)	b9			M3				b13 #5		7	

Table117 - Patterns, die sich bei den Slash-Akkorden C°/D und Cm^{7b5}/D ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**			**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Halbton-Ganzton	(Dreiklang) C°/D	C°/D		D$^{7/b9}$	1	b9		#9	M3		#11	5		13	7	
HM5	(Dreiklang) C°/D	C°/D	Cm^{7b5}/D	D$^{7/b9}$	1	b9			M3	(sus4)		5	b13		7	
MM7 (Alteriert)	(Dreiklang) C°/D		Cm^{7b5}/D	D7/b9	1	b9		#9	M3		#11		b13		7	

Table118 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/D und Cm^{7b5}/D

Es passen die Tonleitern HM5, MM7 (alteriert) und Halbton-Ganzton (HTGT), so dass der Slash-Akkord folgendermaßen aufgelöst werden kann:

(Dreiklang) C°/D→Gm^{7} (HM5-Verwendung), oder

(Dreiklang) C°/D→G^{maj7} bzw. C°/D→Gm^{maj7} (MM7- oder HTGT-Verwendung).

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7), in diesem Beispiel zum C°/D, also dem verminderten Vierklang in C über D im Bass, wird die verminderte Septime (b7) zur Fifth (5) im C°/D-Slash-Akkord. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur kleinen Tredezime (b13) im Cm^{7b5}/D - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum Cm^{7b5}/D, als auch zum (Vierklang) C°/D passt die Tonleiter HM5. Die Slash-Akkorde können folgendermaßen aufgelöst werden:

Cm^{7b5}/D→G^{maj7} bzw. Cm^{7b5}/D→Gm^{maj7} (MM7-Verwendung), oder

Cm^{7b5}/D→Gm^{7} (HM5-Verwendung), dann

(Vierklang) C°/D→Gm^{7} (HM5-Verwendung) und

(Vierklang) C°/D→C$^{\#maj7}$ bzw. C°/D→C$^{\#}$m^{maj7} unter Verwendung der Halbton-Ganzton-Tonleiter.

15.6.3 C°/E^{b}

Dieser Slash-Akkord entspricht der 1. Umkehrung des C°-Akkords, weil das E^{b} im Bass einem Akkordton, in diesem Fall der Terz, entspricht. Verschiebt sich der Basston um drei Positionen nach rechts, hier um drei Stepe von C nach E^{b}, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um drei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
		(Dreiklang) C°/E^{b}	|←	←	↙	|←	←	↙				|←	←	↙
			1 *)			m3 #9						13 6		
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
		C°/E^{b}	|←	←	↙	|←	←	↙	|←	←	↙	|←	←	↙
			1 *)			m3 #9			#11 b5			13 6		
Halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
		Cm^{7b5}/ E^{b}	|←	←	↙	|←	←	↙		|←	←	↙ |←	←	↙
			1 *)			m3 #9				5		13 6		

Table119 - Patterns, die sich bei den Slash-Akkorden C°/E^{b} und Cm^{7b5}/E^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde			Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Dorisch	(Dreiklang) $C°/E^b$		Cm^{7b5}/E^b	E^bm^7	1		9	m3		11		5		(13)	7	
Melodisch-Moll MM1				E^bm^{maj7}	1		9	m3		~~11~~		5		6		maj7
MM2				E^bm^7	1	~~b9~~		m3		11		5		(13)	7	
HM4		$C°/E^b$		$E^bm^{7/13}$	1		9	m3			(#11)	5		13	7	
HM6				$E^{bmaj7/6}$	1			~~#9~~	M3		#11	(5)		6		maj7
Halbton-Ganzton HTGT				$E^{b7/\#9/13}$	1	b9		#9	M3		#11	5		13	7	
HM2				$E^bm^{7b5/13}$	1	~~b9~~		m3		11	b5			13	7	
HM7				$E^{b13/\#9}$	1	b9		#9	M3		#11		(b13)	b7		
Ganzton-Halbton				$E^{b°}$	1		9	m3		~~11~~	b5		b13	b7		b15

Table120 - Passende Tonleitern und Akkorde zu den Slash-Akkorden $C°/E^b$ und Cm^{7b5}/E^b

Der Slash-Akkord entspricht am ehesten einem Mollsextakkord mit den Tonleitern Dorisch, MM2, HM4, HM2 und Ganzton-Halbton. Auch die Interpretation als Moll-Major6-Akkord mit MM1-Tonleiter passt gut. Für die Interpretation als Dominante mit HTGT-Tonleiter fehlen die große Terz (M3) und kleine Septime (7), die durch den Komponisten ergänzt werden sollten.

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum $C°/E^b$, also dem verminderten Vierklang in C über E^b im Bass, wird die verminderte Septime (b7) zur verminderten Fifth (b5) bzw. übermäßigen Undezime (#11) im $C°/E^b$-Slash-Akkord. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur Fifth (5) im Cm^{7b5}/E^b - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum $C°/E^b$, als auch zum Cm^{7b5}/E^b passen die Tonleitern HM4, HM6 und HTGT. Die Slash-Akkorde können bei der Interpretation als Dominante mit HTGT-Tonleiter folgendermaßen aufgelöst werden:

(Vierklang) $C°/E^b \rightarrow A^{bmaj7}$ bzw. $C°/E^b \rightarrow A^bm^{maj7}$

aber auch

$Cm^{7b5}/E^b \rightarrow A^{bmaj7}$ bzw. $Cm^{7b5}/E^b \rightarrow A^bm^{maj7}$.

Dazu sollte aber zumindest die große Terz (M3) durch den Komponisten ergänzt werden, um den Dominantcharakter zu verdeutlichen. Der Vierklang $C°/E^b$ ergibt den vollständigen verminderten Vierklang E° mit der Ganzton-Halbonleiter (GTHT) als passendste Tonleiter.

15.6.4 C°/E

Verschiebt sich der Basston um vier Positionen nach rechts, hier um vier Stepe von C nach E, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um vier Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
		(Dreiklang) C°/E	←	←	↙ |←	←	←	↙			|←	←	←	↙ |←
			1 *)		9						b13 #5			maj7 b15
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
		C°/E	←	←	↙ |←	←	←	↙ |←	←	←	↙ |←	←	←	↙ |←
			1 *)		9			11 sus4			b13 #5			maj7 b15
Halbverminderter $Moll^{7b5}$-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
		Cm^{7b5}/E	←	←	↙ |←	←	←	↙	|←	←	← |←	↙ ←	←	↙ |←
			1 *)		9				#11 b5		b13 #5			maj7 b15

Table121 - Patterns, die sich bei den Slash-Akkorden C°/E und Cm^{7b5}/E ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde			Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Harmonisch-Moll HM1	(Dreiklang) C°/E	C°/E		$Em^{maj7/9}$	1		9	m3		~~11~~		5	(b13)			maj7
HM3	(Dreiklang) C°/E	C°/E		$E^{maj7\#5/9}$	1		9		M3	~~11~~			#5	(6)		maj7
Ganzton-Halbton GTHT	(Dreiklang) C°/E	C°/E	Cm^{7b5}/E	E°/9/b13	1		9	m3		~~11~~	b5		b13	b7		b15
MM3	(Dreiklang) C°/E		Cm^{7b5}/E	$E^{maj7\#5/9}$	1		9		M3		#11		#5	(6)		maj7

Table122 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/E und Cm^{7b5}/E

In diesem Slash-Akkord fehlt die Terz. Er passt zu den Tonleitern HM1, HM3, MM3 und GTHT.

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7), in diesem Beispiel zum C°/E, also dem verminderten Vierklang in C über E im Bass, wird die verminderte Septime (b7) zur reinen Undezime (11) im C°/E-Slash-Akkord, die aber in den Tonikaakkorden mit HM1, HM3-Tonleiter als zu vermeidender Ton gilt, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine

Septime (7) zur verminderten Fifth (b5) bzw. übermäßigen Undezime (#11) im Cm^{7b5}/E - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum (Vierklang) C°/E, als auch zum Cm^{7b5}/E passt die Tonleiter GTHT.

15.6.5 C°/F

Verschiebt sich der Basston um fünf Positionen nach rechts, hier um fünf Stepe von C nach F, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um fünf Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
			←	← |←	↙ ←	←	←	↙		|←	←	←	← |←	↙ ←
		(Dreiklang) C°/F	1 *)	b9						5			7	
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
			←	← |←	↙ ←	←	← |←	↙ ←	←	← |←	↙ ←	←	← |←	↙ ←
		C°/F	1 *)	b9			M3			5			7	
Halbverminderter $Moll^{7b5}$-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
			←	← |←	↙ ←	←	←	↙ |←	←	← |←	← ←	↙ ←	← |←	↙ ←
		Cm^{7b5}/F	1 *)	b9				11 sus4		5			7	

Table123 - Patterns, die sich bei den Slash-Akkorden C°/F und Cm^{7b5}/F ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Phrygisch	(Dreiklang) C°/F, Cm7b5/F	Fm^7	1	~~b9~~		m3		11		5	(b13)		7	
MM2	(Dreiklang) C°/F, Cm7b5/F	Fm^7	1	~~b9~~		m3		11		5		(13)	7	
HM5	(Dreiklang) C°/F, C°/F, Cm7b5/F	$F^{7/b9}$	1	b9			M3	sus4		5	b13		7	
Halbton-Ganzton HTGT	(Dreiklang) C°/F, C°/F	$F^{7/b9}$	1	b9		#9	M3		#11	5		13	7	

Table124 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/F und Cm^{7b5}/F

In diesem (Dreiklang) C°/F-Slash-Akkord fehlt die Terz. Er passt zu den Tonleitern Phrygisch, HM5, MM2 und HTGT. Man kann den C°/F-Slash-Akkord folgendermaßen auflösen:

(Dreiklang) C°/F→Bbm^{7} (HM5-Verwendung),

oder als Dominante mit HTGT-Tonleiter:

(Dreiklang) C°/F→B^{bmaj7} bzw. C°/F→B^{b}m$^{maj7.}$

Erweitert man den verminderten C°-Dreiklang um die verminderte Septime (b7), in diesem Beispiel zum C°/F, also dem verminderten Vierklang in C über F im Bass, wird die verminderte Septime (b7) zur großen Terz (M3) im C°/F-Slash-Akkord. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur reinen Undezime (11) im Cm^{7b5}/F - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum (Vierklang) C°/F, als auch zum Cm^{7b5}/F passt die Tonleiter HM5. Den (Vierklang) C°/F-Slash-Akkord kann man folgendermaßen auflösen:

(Vierklang) C°/F→Bbm^{7} (HM5-Verwendung),

oder als Dominante mit HTGT-Tonleiter:

(Vierklang) C°/F→B^{bmaj7} bzw. C°/F→B^{b}m$^{maj7.}$

15.6.6 C°/G^{b}

Dieser Slash-Akkord entspricht der 2. Umkehrung des C°-Akkords, weil das G^{b} im Bass dem 2. Akkordton (von unten), in diesem Fall der Fifth, entspricht. Verschiebt sich der Basston um sechs Positionen nach rechts, hier um sechs Stepe von C nach G^{b}, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um sechs Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
		(Dreiklang) C°/Gb	← |←	← ←	↙ ←	←	←	↙	|←	←	←	← |←	← ←	↙ ←
			1 *)						#11 b5			11 6		
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
		C°/Gb	← |←	← ←	↙ ←	← |←	← ←	↙ ←	← |←	← ←	↙ ←	← |←	← ←	↙ ←
			1 *)			m3 #9			#11 b5			11 6		
Halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
		Cm^{7b5}/Gb	← |←	← ←	↙ ←	←	← |←	↙ ←	← |←	← ←	← ←	↙ ← |←	← ←	↙ ←
			1 *)				M3		#11 b5			11 6		

Table125 - Patterns, die sich bei den Slash-Akkorden C°/G^b und Cm^{7b5}/G^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Lydisch		Gbmaj7#11/6	1		9		M3		#11	(5)		6		maj7
MM3		Gbmaj7#11	1		9		M3		#11		#5	(6)		maj7
MM4 (Mixo#11)	Cm7b5/Gb	Gb7#11/13	1		9		M3		#11	5		13	7	
HM6		Gbmaj7/6	1			~~#9~~	M3		#11	(5)		6		maj7
HM7	(Dreiklang) C°/Gb	Gb13	1	b9		#9	M3		#11		(b13)	b7		
Halbton-Ganzton HTGT		Gb7#11/13	1	b9		#9	M3		#11	5		13	7	
HM2	C°/Gb	Gbm7b5/13	1	~~b9~~		m3		11	b5			13	7	
HM4		Gbm7/13	1		9	m3			(#11)	5		13	7	
Ganzton-Halbton GTHT		Gb°	1		9	m3		~~11~~	b5		b13	b7		b15

Table126 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/G^b und Cm^{7b5}/G^b

Diesem (Dreiklang) C°/G^b-Slash-Akkord fehlt neben der Septime auch die Terz, so dass er sowohl zu den Durtonleitern Lydisch, MM3, MM4, HM6, HM7 und HTGT, als auch Molltonleitern HM2, HM4 und GTHT passt. Wenn der Komponist die große Terz (M3) und Major seventh (maj7) hinzufügt, wird der (Dreiklang) C°/G^b-Slash-Akkord zu einem lydischen Major^7-Akkord mit den Tonleitern Lydisch oder MM3 oder HM6. Fügt man die große Terz (M3) und kleine Septime (7) hinzu, passen die Tonleitern MM4 und HTGT. Den Slash-Akkord kann man folgendermaßen auflösen:

(Dreiklang) C°/G^b→F^{maj7} bzw. C°/G^b→Fm^{maj7} (MM4-Verwendung), oder

(Dreiklang) C°/G^b→C^{bmaj7} bzw. C°/G^b→$C^b m^{maj7}$ (HTGT-Verwendung).

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/G^b, also dem verminderten Vierklang in C über G^b im Bass, wird die verminderte Septime (b7) zur kleinen Terz (m3) bzw. übermäßigen None (#9) im C°/G^b-Slash-Akkord. Es ergibt sich der vollständige verminderte $G^{b°}$-Akkord mit der Ganzton-Halbtonleiter (GTHT) als passendste Tonleiter. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur großen Terz (M3) im Cm^{7b5}/G^b - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum (Vierklang) C°/G^b, als auch zum Cm^{7b5}/G^b passen die Tonleitern HM6, HM7 und HTGT. Zum Cm^{7b5}/G^b-Slash-Akkord passen die Tonleitern MM4 und HTGT, so dass man ihn direkt folgendermaßen auflösen kann:

Cm^{7b5}/G^b→F^{maj7} bzw. Cm^{7b5}/G^b→Fm^{maj7} (MM4-Verwendung), oder

Cm^{7b5}/G^b→C^{bmaj7} bzw. Cm^{7b5}/G^b→$C^b m^{maj7}$ (HTGT-Verwendung).

Der Komponist kann zur Verdeutlichung noch die fehlende kleine Septime (7) hinzufügen.

15.6.7 C°/G

Verschiebt sich der Basston um fünf Positionen nach links, hier um fünf Stepe von C nach G, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um fünf Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
		(Dreiklang) C°/G		↘	→	→	↘ →	→ →|	→	↘ →	→ →|	→	→	→|
			1 *)					11 sus4			b13 #5			maj7 b15
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
		C°/G	→	↘ →	→ →|	→	↘ →	→ →|	→	↘ →	→ →|	→	↘ →	→ →|
			1 *)		9			11 sus4			b13 #5			maj7 b15
Halbverminderter $Moll^{7b5}$-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
		Cm^{7b5}/G	→	↘ →	→ →	→ →|	↘ →	→ →|	→	↘ →	→ →|	→	→	↘ →|
			1 *)			m3		11 sus4			b13 #5			maj7 b15

Table127 - Patterns, die sich bei den Slash-Akkorden C°/G und Cm^{7b5}/G ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

<table>
<tr><th>Tonleiter</th><th colspan="3">Slash-Akkorde</th><th>Beispiel</th><th>1</th><th>b9</th><th>9</th><th>m3 #9</th><th>M3</th><th>11 sus4</th><th>#11 b5</th><th>5</th><th>b13 #5</th><th>13 6</th><th>7</th><th>maj7 b15</th></tr>
<tr><td>Harmonisch-Moll HM1</td><td rowspan="3">(Dreiklang) C°/G</td><td rowspan="3">C°/G</td><td rowspan="2">Cm7b5/G</td><td>Gm^{maj7}</td><td>1</td><td></td><td>9</td><td>m3</td><td></td><td><s>11</s></td><td></td><td>5</td><td>(b13)</td><td></td><td></td><td>maj7</td></tr>
<tr><td>Ganzton-Halbton GTHT</td><td>G°/b13</td><td>1</td><td></td><td>9</td><td>m3</td><td></td><td><s>11</s></td><td>b5</td><td></td><td>b13</td><td>b7</td><td></td><td>b15</td></tr>
<tr><td>HM3</td><td></td><td>Gmaj7#5</td><td>1</td><td></td><td>9</td><td></td><td>M3</td><td><s>11</s></td><td></td><td></td><td>#5</td><td>(6)</td><td></td><td>maj7</td></tr>
</table>

Table128 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/G und Cm^{7b5}/G

In diesem (Dreiklang) C°/G-Slash-Akkord fehlt die Terz. Er passt zu den Tonleitern HM1, HM3 und GTHT. In allen drei Tonleitern ist die reine Undezime (11) ein zu vermeidender Ton, weshalb dieser Slash-Akkord insgesamt als zu vermeiden gilt, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/G, also dem verminderten Vierklang in C über G im Bass, wird die verminderte Septime (b7) zur großen None (9) im C°/G-Slash-Akkord. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur kleinen Terz (m3) im Cm^{7b5}/G - Slash-Akkord. Es gibt hier eine Schnittmenge: Sowohl zum Cm^{7b5}/G, als auch zum C°/G passen die Tonleitern

HM1 und GTHT. Nach wie vor stört die in allen Tonika-Tonleitern zu vermeidende reine Undezime (11).

15.6.8 C°/A^b

Verschiebt sich der Basston um vier Positionen nach links, hier um vier Stepe von C nach A^b, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um vier Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m 3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m 3			b5					
		(Dreiklang) C°/Ab		↘	→	→	↘ →|	→	→	↘ →|	→	→	→|	
			1 *)				M3			5			7	
Verminderter Vierklang	1, m3, b5, b7	C°	1			m 3			b5			b7		
		C°/ Ab	→	↘ →|	→	→	↘ →|	→	→	↘ →|	→	→	↘ →|	→
			1 *)	b9			M3			5			7	
Halbverminderter Moll7b5-Vierklang	1, m3, b5, 7	Cm7b5	1			m 3			b5				7	
		Cm7b5/Ab	→	↘ →	→ →|	→	↘ →|	→	→	↘ →|	→	→	→|	↘
			1 *)		9		M3			5			7	

Table129 - Patterns, die sich bei den Slash-Akkorden C°/A^b und Cm^{7b5}/A^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde			Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Mixolydisch	(Dreiklang) C°/Ab		Cm7b5/Ab	$A^{b7/9}$	1		9		M3	(sus4)		5		13	7	
MM4 (Mixo#11)	(Dreiklang) C°/Ab		Cm7b5/Ab	$A^{b7/9}$	1		9		M3		#11	5		13	7	
MM5	(Dreiklang) C°/Ab		Cm7b5/Ab	$A^{b7/9}$	1		9		M3	(sus4)		5	b13		7	
HM5	(Dreiklang) C°/Ab	C°/Ab		$A^{b7/b9}$	1	b9			M3	(sus4)		5	b13		7	
Halbton-Ganzton HTGT	(Dreiklang) C°/Ab	C°/Ab		$A^{b7/b9}$	1	b9		#9	M3		#11	5		13	7	

Table130 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/A^b und Cm^{7b5}/A^b

Dieser Slash-Akkord ist ein vollständiger Dominantseptakkord. Entsprechend passen alle Dominant-Tonleitern Mixolydisch, MM4, MM5, HM5 und HTGT. Er kann sowohl direkt nach Moll aufgelöst werde, zum Beispiel

(Dreiklang) C°/A^b→D^bm^7 (HM5),

als auch nach Dur, zum Beispiel

(Dreiklang) C°/A^b→D^{bmaj7} (mixolydische Verwendung),

oder nach Moll-Major^7, zum Beispiel

(Dreiklang) C°/A^b→Dbm^{maj7} (MM5-Verwendung).

Auch die folgenden Auflösungen sind möglich, zum Beispiel

(Dreiklang) C°/A^b→D^{bmaj7} bzw. C°/A^b→D^bm^{maj7} (Dominante mit HTGT-Tonleiter), oder

(Dreiklang) C°/A^b→G^{maj7} bzw. C°/A^b→Gm^{maj7} (Sekundärdominante mit MM4-Tonleiter).

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/A^b, also dem verminderten Vierklang in C über A^b im Bass, wird die verminderte Septime (b7) zur kleinen None (b9) im C°/A^b-Slash-Akkord. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur None (9) im Cm^{7b5}/A^b - Slash-Akkord.

Der Cm^{7b5}/A^b unterstreicht die mixolydische Verwendung, zum Beispiel

Cm^{7b5}/A^b→D^{bmaj7}

aber auch die MM4-Verwendung, zum Beispiel

Cm^{7b5}/A^b→G^{maj7} bzw. Cm^{7b5}/A^b→Gm^{maj7}

sowie die MM5-Verwendung, zum Beispiel

Cm^{7b5}/A^b→D^bm^{maj7}.

Auf der anderen Seite kann der (Vierklang) C°/A^{b} unter HM5-Verwendung nach Moll aufgelöst werden, zum Beispiel

(Vierklang) C°/A^{b}→D^{b}m^{7} (HM5),

oder als Dominante mit HTGT-Tonleiter zum Beispiel folgendermaßen:

(Vierklang) C°/A^{b}→D^{bmaj7} bzw. C°/A^{b}→D^{b}m^{maj7}.

15.6.9 C°/A

Dieser Slash-Akkord entspricht der 3. Umkehrung des C°-Vierklangs, weil das A im Bass einem Akkordton, in diesem Fall der verminderten Septime (b7), entspricht. Verschiebt sich der Basston um drei Positionen nach links, hier um drei Stepe von C nach A, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um drei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
		(Dreiklang) C°/A		↘	→	→|	↘	→	→|	↘	→	→|		
			1 *)			m3 #9			#11 b5			13 6		
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
		C°/A	→|	↘	→	→|	↘	→	→|	↘	→	→|	↘	→
			1 *)			m3 #9			#11 b5			13 6		
Halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
		Cm^{7b5}/A	→	↘ →|	→	→|	↘	→	→|	↘	→	→|		↘
			1 *)	b9		m3 #9			#11 b5			13 6		

Table131 - Patterns, die sich bei den Slash-Akkorden C°/A und Cm^{7b5}/A ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**			**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM6	(Dreiklang) C°/A	C°/A		$A^{maj7/6}$	1			~~#9~~	M3		#11	(5)		6		maj7
HM4				$Am^{7/13}$	1		9	m3			(#11)	5		13	7	
Ganzton-Halbton GTHT				A°	1		9	m3		~~11~~	b5		b13	b7		b15
HM2 (Lokrisch13)			Cm7b5/A	$Am^{7b5/13}$	1	~~b9~~		m3		11	b5			13	7	
HM7				$A^{13/\#9}$	1	b9		#9	M3		#11		(b13)	b7		
Halbton-Ganzton HTGT				$A^{7/\#9/\#11/13}$	1	b9		#9	M3		#11	5		13	7	

Table132 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/A und Cm^{7b5}/A

Zu diesem Slash-Akkord passen die Tonleitern HM6, HM4, GTHT, HM2, HM7 und HTGT. Er ist wieder ein vollständiger verminderter Vierklang mit der Ganzton-Halbtonleiter (GTHT) als passendste Tonleiter.

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/A, also dem verminderten Vierklang in C über A im Bass, wird die verminderte Septime (b7) zum Grundton (1) im C°/A-Slash-Akkord und ergibt somit keinen weiteren neuen Ton. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur kleinen None (b9) im Cm^{7b5}/A - Slash-Akkord. Der Cm^{7b5}/A - Slash-Akkord passt jetzt eher zur HTGT- oder HM7-Tonleiter, wenn man die große Terz (M3) noch hinzufügt.

15.6.10 C°/B^b

Verschiebt sich der Basston um zwei Positionen nach links, hier um zwei Stepe von C nach B^b, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um zwei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b 9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
				↘	→|		↘	→|		↘	→|			
		(Dreiklang) C°/B^b	1*)		9			11 sus4			b13 #5			
Verminderter Vierklang	1, m3, b5, b7		1			m3			b5			b7		

		C°/B^b		↘	→|		↘	→|		↘	→|		↘	→|
			1*)		9			11 sus4			b13 #5			maj7 b15
Halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
		Cm^{7b5}/B^b	→|	↘	→|		↘	→|		↘	→|			↘
			1*)		9			11 sus4			b13 #5			

Table133 - Patterns, die sich bei den Slash-Akkorden C°/B^b und Cm^{7b5}/B^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Harmonisch-Moll HM1	(Dreiklang) C°/Bb; Cm7b5/Bb; C°/Bb	$B^bm^{maj7/9}$	1		9	m3		~~11~~		5	(b13)			maj7
HM3	(Dreiklang) C°/Bb; Cm7b5/Bb; C°/Bb	$B^{bmaj7\#5/9}$	1		9		M3	~~11~~			#5	(6)		maj7
Ganzton-Halbton GTHT	(Dreiklang) C°/Bb; Cm7b5/Bb; C°/Bb	$B^{b°/9/b13}$	1		9	m3		~~11~~	b5		b13	b7		b15
Äolisch	(Dreiklang) C°/Bb; Cm7b5/Bb	$B^bm^{7/9/11}$	1		9	m3		11		5	(b13)		7	
MM5	(Dreiklang) C°/Bb; Cm7b5/Bb	$B^{b7/9/b13}$	1		9		(M3)	sus4		5	b13		7	
MM6 (Lokrisch9)	(Dreiklang) C°/Bb; Cm7b5/Bb	$B^bm^{7b5/9/11/b13}$	1		9	m3		11	b5		b13		7	

Table134 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/B^b und Cm^{7b5}/B^b

Zu diesem Slash-Akkord passen die Tonleitern HM1, HM3, GTHT, Äolisch, MM5 und MM6. Am passendsten ist die Verwendung als MM5 oder MM6 (Lokrisch9). Bei MM5 sollte die fehlende kleine Septime (7) ergänzt werden, bei MM6 (Lokrisch9) die Minor third (m3) und kleine Septime (7).

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/B^b, also dem verminderten Vierklang in C über B^b im Bass, wird die verminderte Septime (b7) zur großen Septime (maj7) bzw. b15 im C°/B^b-Slash-Akkord und unterstreicht die Verwendung der HM1-, HM3- und GTHT-Tonleitern, wobei die reine Undezime (11) in allen Tonika-Akkorden ein zu vermeidender Ton ist, siehe dazu die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zum Grundton (1) und ergibt somit keinen neuen Ton.

15.6.11 C°/H

Verschiebt sich der Basston um eine Position nach links, hier um einen Step von C nach H, verschiebt sich das Pattern, hier das verminderte Dreiklangpattern mit seinen zwei Erweiterungen, dem verminderten Vierklang mit verminderter Septime (b7), und dem halbverminderten Moll7b5-Vierklang, entsprechend um einen Step nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Verminderter Dreiklang	1, m3, b5	(Dreiklang) C°	1			m3			b5					
				↘|			↘|			↘|				
		(Dreiklang) C°/H	1 *)	b9			M3			5				
Verminderter Vierklang	1, m3, b5, b7	C°	1			m3			b5			b7		
				↘|			↘|			↘|			↘|	
		C°/H	1 *)	b9			M3			5			7	
halbverminderter Moll^{7b5}-Vierklang	1, m3, b5, 7	Cm^{7b5}	1			m3			b5				7	
				↘|			↘|			↘|				↘|
		Cm^{7b5}/H	1 *)	b9			M3			5				maj7 b15

Table135 - Patterns, die sich bei den Slash-Akkorden C°/H und Cm^{7b5}/H ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkord**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM5	(Dreiklang) C°/H	C°/H	H$^{7/b9}$	1	b9			M3	(sus4)		5	b13		7	
Halbton-Ganzton HTGT			H$^{7/b9}$	1	b9		#9	M3		#11	5		13	7	

Table136 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C°/H. Zum Cm^{7b5}/H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Zu diesem Slash-Akkord passen die Tonleitern HM5 und HTGT. Er kann also zum Beispiel folgendermaßen aufgelöst werden:

(Dreiklang) C°/H→Em^{7} (HM5-Verwendung),

oder bei Verwendung als Dominante mit HTGT-Tonleiter:

(Dreiklang) C°/H→E^{maj7} bzw. C°/H→Em^{maj7}.

Bei der Erweiterung des Grundakkords um die verminderte Septime (b7) in diesem Beispiel zum C°/H, also dem verminderten Vierklang in C über H im Bass, wird die verminderte Septime (b7) zur kleinen Septime (7) im C°/H-Slash-Akkord und unterstreicht die oben beschriebene Verwendung der HM5- und HTGT-Tonleitern. Erweitert man den Grunddreiklang, hier den verminderten C°-Dreiklang, um die kleine Septime (7) zum Cm^{7b5}, wird die kleine Septime (7) zur großen Septime (maj7) im Slash-Akkord und ergibt keine Treffer bei den hier vorgestellten Tonleitern.

15.7 Slash-Akkorde über „Übermäßig“

15.7.1 C^{+}/D^{b}

Verschiebt sich der Basston um eine Position nach rechts, hier um einen Step von C nach D^{b}, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um einen Step nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13# 5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C^{+}	1				M3				#5			
						I↙				I↙				I↙
		C^{+}/D^{b}	1 *)			m3 #9				5				maj7 b15
$Major^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj 7
						I↙				I↙			I↙	I↙
		$C^{maj7\#5}/D^{b}$	1 *)			m3 #9				5			7	maj7 b15
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
						I↙				I↙		I↙		I↙
		C^{7b13}/D^{b}	1 *)			m3 #9				5		13 6		maj7 b15

Table137 - Patterns, die sich bei den Slash-Akkorden C^{+}/D^{b}, $C^{maj7\#5}/D^{b}$ und C^{7b13}/D^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

<table>
<tr><th>Tonleiter</th><th colspan="2">Slash-Akkorde</th><th>Beispiel</th><th>1</th><th>b9</th><th>9</th><th>m3
#9</th><th>M3</th><th>11
sus4</th><th>#11
b5</th><th>5</th><th>b13
#5</th><th>13
6</th><th>7</th><th>maj7
b15</th></tr>
<tr><td>Harmonisch-Moll HM1</td><td rowspan="3">C^+/D^b</td><td></td><td>$D^b m^{maj7}$</td><td>1</td><td></td><td>9</td><td>m3</td><td></td><td>~~11~~</td><td></td><td>5</td><td>(b13)</td><td></td><td></td><td>maj7</td></tr>
<tr><td>HM6</td><td rowspan="2">C^{7b13}/D^b</td><td>D^{bmaj7}</td><td>1</td><td></td><td></td><td>~~#9~~</td><td>M3</td><td></td><td>#11</td><td>(5)</td><td></td><td>6</td><td></td><td>maj7</td></tr>
<tr><td>Melodisch-Moll MM1</td><td>$D^b m^{maj7}$</td><td>1</td><td></td><td>9</td><td>m3</td><td></td><td>~~11~~</td><td></td><td>5</td><td></td><td>6</td><td></td><td>maj7</td></tr>
</table>

Table138 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^+/D^b und C^{7b13}/D^b. Zum $C^{maj7\#5}/D^b$ passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Der Grund-Slash-Akkord C^+/D^b ist ein Moll-Major^7-Akkord mit den passenden Tonleitern Harmonisch-Moll (HM1) und Melodisch-Moll (MM1). HM6 passt theoretisch auch, die übermäßige None (#9) ist hier aber ein zu vermeidender Ton, da HM6 einen Major^7-Akkord beschreibt.

Erweitert man den Grunddreiklang, hier den übermäßigen C^+-Dreiklang, um die große Septime (maj7) zum C^{maj7+5}-Akkord, wird die Major seventh (maj7) zur kleinen Septime (7) im Slash-Akkord. Zu diesem Slash-Akkord gibt es keine passenden im Rahmen dieser Harmonielehre näher betrachteten Tonleitern, da der Slash-Akkord gleichzeitig eine kleine und Major seventh beinhaltet. Erweitert man den C^+/D^b-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/D^b, wird die kleine Septime (7) im C^{7b13}-Akkord zur großen Sexte (6) im C^{7b13}/D^b-Slash-Akkord, es ergibt sich also ein Moll-Major6-Akkord.

15.7.2 C^+/D

Verschiebt sich der Basston um zwei Positionen nach rechts, hier um zwei Stepe von C nach D, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem Major$^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um zwei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C⁺	1				M3				#5			
		C⁺/D			⇤	↙			⇤	↙			⇤	↙
			1 *)		9				#11 b5				7	
Major$^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
		$C^{maj7\#5}$/D			⇤	↙			⇤	↙		⇤	↙ ⇤	↙
			1 *)		9				#11 b5			13 6	7	
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
		C^{7b13}/D			⇤	↙			⇤	↙	⇤	↙	⇤	↙
			1 *)		9				#11 b5		b13 #5		7	

Table139 - Patterns, die sich bei den Slash-Akkorden C⁺/D, $C^{maj7\#5}$/D und C^{7b13}/D ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM4	C⁺/D	Cmaj7#5/D	$Dm^{7/9}$	1		9	m3			(#11)	5		13	7	
MM4 (Mixo#11)	C⁺/D	Cmaj7#5/D	$D^{7\#11/9}$	1		9		M3		#11	5		13	7	
MM6 (Lokrisch9)	C⁺/D	C7b13/D	$Dm^{7b5/9}$	1		9	m3		11	b5		b13		7	
Ganzton GT	C⁺/D	C7b13/D	$D^{7\#11/9}$	1		9		M3		#11		b13		7	

Table140 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C⁺/D, C^{7b13}/D und $C^{maj7\#5}$/D.

Aufgrund der fehlenden Terz kann der C⁺/D-Slash-Akkord sowohl unter Verwendung der MM4-Tonleiter als Sekundärdominante zum Beispiel folgendermaßen aufgelöst werden:

C+/D→$C^{\#}m^{maj7}$ bzw. C+/D→$C^{\#maj7}$

oder auch mit alteriert-dominanter Verwendung und GT-Tonleiter:

C+/D→Gm^{maj7} bzw. C+/D→G^{maj7}.

Darüber hinaus ist auch die Verwendung als halbverminderter Mollseptakkord mit HM4 oder MM6 (Lokrisch9)-Tonleiter möglich. In allen Fällen sollte der Komponist die fehlende Terz zur Verdeutlichung ergänzen.

Erweitert man den C⁺/D-Slash-Akkord um die Major seventh (maj7) zum $C^{maj7\#5}$/D, wird die Major seventh (maj7) im $C^{maj7\#5}$-Akkord zur großen Tredezime (13) im $C^{maj7\#5}$/D-Slash-

Akkord und unterstreicht die Verwendung der HM4- und MM4-Tonleitern. Die Interpretation als Sekundärdominante mit MM4-Tonleiter kann dann wieder zum Beispiel folgendermaßen aufgelöst werden:

$C^{maj7\#5}$/D→$C^{\#}m^{maj7}$ bzw. C $^{maj7\#5}$/D→$C^{\#maj7}$.

Erweitert man den C^{+}/D-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/D, wird die kleine Septime (7) im C^{7b13}-Akkord zur kleinen Tredezime (b13) im C^{7b13}/D-Slash-Akkord und unterstreicht die Verwendung der MM6 (Lokrisch9)-Tonleiter oder der Ganztonleiter (GT) mit folgender möglicher Auflösung:

C^{7b13}/D→Gm^{maj7} bzw. C^{7b13}/D→G^{maj7} (alteriert-dominante Verwendung).

In allen Fällen sollte der Komponist die fehlende Terz zur Verdeutlichung ergänzen.

15.7.3 C^{+}/E^{b}

Verschiebt sich der Basston um drei Positionen nach rechts, hier um drei Stepe von C nach E^{b}, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um drei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C+	1				M3				#5			
				|←	←	↙		|←	←	↙		|←	←	↙
		C+/Eb	1*)	b9				11 sus4				13 6		
Major7#5-Vierklang	1, M3, #5, maj7	Cmaj7#5	1				M3				#5			maj7
				|←	←	↙		|←	←	↙	|←	← |←	↙ ←	↙
		Cmaj7#5/Eb	1*)	b9				11 sus4			b13 #5	13 6		
Dominantsept /b13-Vierklang	1, M3, b13, 7	C7b13	1				M3				b13		7	
				|←	←	↙		|←	←	↙ |←	←	↙ |←	←	↙
		C7b13/Eb	1*)	b9				11 sus4		5		13 6		

Table141 - Patterns, die sich bei den Slash-Akkorden C^{+}/E^{b}, $C^{maj7\#5}/E^{b}$ und C^{7b13}/E^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM2	C^{+}/E^{b}		$E^{b}m^{7b5/11/13}$	1	~~b9~~		m3		11	b5			13	7	
MM2		C^{7b13}/E^{b}	$E^{b}m^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	

Table142 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{+}/E und C^{7b13}/E^{b}. Zum $C^{maj7\#5}/E^{b}$ H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Der C^{+}/E^{b}-Slash-Akkord passt zu den Tonleitern HM2 und MM2 wobei die kleine None (b9) in beiden Fällen ein zu vermeidender Ton ist, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Erweitert man den C^{+}/E^{b}-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/E^{b}, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}/E^{b}$, wird die kleine Septime (7) im C^{7b13}-Akkord zur reinen Fifth (5) im C^{7b13}/E^{b}-Slash-Akkord. Die Major seventh (maj7) wird zur kleinen Tredezime (b13) und findet keine Entsprechung in den hier vorgestellten Tonleitern.

15.7.4 C^{+}/E

Die Dieser Slash-Akkord entspricht der Umkehrung des C^{+}-Akkords, weil das E im Bass einem Akkordton, in diesem Fall der Terz, entspricht. Verschiebt sich der Basston um vier Positionen nach rechts, hier um drei Stepe von C nach E, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um vier Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C^{+}	1				M3				#5			
			|←	←	←	↙	|←	←	←	↙	|←	←	←	↙
		C^{+}/E	1*)				M3				b13 #5			
$Major^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
			|←	←	←	↙	|←	←	←	↙ |←	← |←	← ←	↙ ←	↙
		$C^{maj7\#5}/E$	1*)				M3			5	b13 #5			
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
			|←	←	←	↙	|←	←	← |←	↙ ←	← |←	↙ ←	←	↙
		C^{7b13}/E	1*)				M3		#11 b5		b13 #5			

Table143 - Patterns, die sich bei den Slash-Akkorden C^{+}/E, $C^{maj7\#5}/E$ und C^{7b13}/E ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM3	C^{+}/E		$E^{maj7\#5}$	1		9		M3	~~11~~			#5	(6)		maj7
HM5		$C^{maj7\#5}/E$	$E^{7/b13}$	1	b9			M3	(sus4)		5	b13		7	
MM5			$E^{7/b13}$	1		9		M3	(sus4)		5	b13		7	
HM7		C^{7b13}/E	E^{13}	1	b9		#9	M3		#11		(b13)	b7		
MM3			$E^{maj7\#5}$	1		9		M3		#11		#5	(6)		maj7
MM7 (Alteriert)			$E^{7/b13}$	1	b9		#9	M3		#11		b13		7	
Ganzton GT			$E^{7/b13}$	1		9		M3		#11		b13		7	

Table144 Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{+}/E, C^{7b13}/E und $C^{maj7\#5}/E$.

Der C^{+}/E-Slash-Akkord ist die 1. Umkehrung des C^{+}-Akkords. Es passen auch hier die Tonleitern HM3, HM5, HM7, MM3, MM5, MM7 und GT. Er kann nach Moll aufgelöst werden, hier

$C^{+}/E \rightarrow Am7$ (HM5-Verwendung), oder auch

$C^{+}/E \rightarrow Am^{maj7}$ bzw. $C^{+}/E \rightarrow A^{maj7}$ (MM7-Verwendung).

Erweitert man den C^{+}/E-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/E, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}/E$, wird die kleine Septime (7) im C^{7b13}-Akkord zur übermäßigen Undezime (#11) im C^{7b13}/E-Slash-Akkord. Er kann nach

$C^{7b13}/E \rightarrow Am^{maj7}$ bzw. $C^{7b13}/E \rightarrow A^{maj7}$ (MM7-Verwendung)

aufgelöst werden. Die Major seventh (maj7) im $C^{maj7\#5}$-Akkord wird zur Fifth (5) im $C^{maj7\#5}/E$-Slash-Akkord. Er kann unter HM5-Verwendung nach Moll aufgelöst werden, hier

$C^{maj7\#5}/E \rightarrow Am7$.

15.7.5 C^{+}/F

Verschiebt sich der Basston um fünf Positionen nach rechts, hier um fünf Stepe von C nach F, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um fünf Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C^{+}	1				M3				#5			
		C^{+}/F	←	←	←	↙ ⇤	←	←	←	↙ ⇤	←	←	←	↙ ⇤
			1*)			m3 #9				5				maj7 b15
Major$^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
		$C^{maj7\#5}$/F	←	←	←	↙ ⇤	←	←	← ⇤	↙ ← ⇤	← ←	← ←	↙ ←	↙ ⇤
			1*)			m3 #9			#11 b5	5				maj7 b15
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
		C^{7b13}/F	←	←	←	↙ ⇤	←	← ⇤	← ←	↙ ← ⇤	← ←	↙ ←	←	↙ ⇤
			1*)			m3 #9		11 sus4		5				maj7 b15

Table145 - Patterns, die sich bei den Slash-Akkorden C^{+}/F, $C^{maj7\#5}$/F und C^{7b13}/F ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM6	C^{+}/F	$C^{maj7\#5}$/F	F^{maj7}	1			~~#9~~	M3		#11	(5)		6		maj7
Harmonisch-Moll HM1		C^{7b13}/F	Fm^{maj7}	1		9	m3		~~11~~		5	(b13)			maj7
Melodisch-Moll MM1			Fm^{maj7}	1		9	m3		~~11~~		5		6		maj7

Table146 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{+}/F, C^{7b13}/F und $C^{maj7\#5}$/F

Der C^{+}/F-Slash-Akkord ist ein Moll-Major^{7}-Tonika-Akkord mit den passenden Tonleitern HM6, HM1 und MM1.

Erweitert man den C^{+}/F-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/F, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}$/F, wird die kleine Septime (7) im C^{7b13}-Akkord zur reinen Undezime (11) im C^{7b13}/F-Slash-Akkord und ergibt damit einen zu vermeidenden Ton, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Die Major seventh (maj7) wird zur übermäßigen Undezime (#11) und reibt sich an der reinen Fifth (5).

15.7.6 $C^{+}/F^{\#}$

Verschiebt sich der Basston um sechs Positionen nach rechts, hier um fünf Stepe von C nach $F^{\#}$, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um sechs Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C^{+}	1				M3				#5			
		$C^{+}/F^{\#}$	←	←	← |←	↙ ←	←	←	← |←	↙ ←	←	←	← |←	↙ ←
			1 *)		9				#11 b5				7	
$Major^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
		$C^{maj7\#5}/F^{\#}$	←	←	← |←	↙ ←	←	← |←	← ← |←	↙ ← ←	← ←	← ←	↙ ← |←	↙ ←
			1 *)		9			11 sus4	#11 b5				7	
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
		$C^{7b13}/F^{\#}$	←	←	← |←	↙ ←	← |←	← ←	← ← |←	↙ ← ←	← ←	↙ ←	← |←	↙ ←
			1 *)		9		M3		#11 b5				7	

Table147 - Patterns, die sich bei den Slash-Akkorden $C^{+}/F^{\#}$, $C^{maj7\#5}/F^{\#}$ und $C^{7b13}/F^{\#}$ ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM4	$C^{+}/F^{\#}$	$F^{\#}m^{7/9}$	1		9	m3			(#11)	5		13	7	
MM4 (Mixo#11)	$C^{7b13}/F^{\#}$	$F^{\#7/9/\#11}$	1		9		M3		#11	5		13	7	
Ganzton GT		$F^{\#7/9/\#11}$	1		9		M3		#11		b13		7	
MM6 (Lokrisch9)	$C^{maj7\#5}/F^{\#}$	$F^{\#}m^{7b5/9}$	1		9	m3		11	b5		b13		7	

Table148 - Passende Tonleitern und Akkorde zu den Slash-Akkorden $C^{+}/F^{\#}$, $C^{7b13}/F^{\#}$ und $C^{maj7\#5}/F^{\#}$

Dem $C^{+}/F^{\#}$-Slash-Akkord fehlt die Terz. Er passt zu den Tonleitern HM4, MM4, MM6 und Ganzton (GT). Wenn man die große Terz ergänzt, lässt sich der $C^{+}/F^{\#}$-Slash-Akkord zum Beispiel nach

$C^{+}/F^{\#} \rightarrow E^{\#}m^{maj7}$ bzw. $E^{\#maj7}$ auflösen (MM4-Verwendung), oder auch unter Verwendung der Ganztonleiter als Dominante nach

$C^+/F^\# \rightarrow Hm^{maj7}$ bzw. H^{maj7}.

Wenn man die Minor third (m3) hinzufügt, kann man den $C^+/F^\#$-Slash-Akkord unter Verwendung der MM6 (Lokrisch9) - Tonleiter auch als Anfang einer Mollkadenz interpretieren und ihn zum Beispiel folgendermaßen auflösen:

$C^+/F^\# \rightarrow H^{7b9} \rightarrow Em^7$.

Erweitert man den $C^+/F^\#$-Slash-Akkord um die kleine Septime (7) zum $C^{7b13}/F^\#$, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}/F^\#$, wird die kleine Septime (7) im C^{7b13}-Akkord zur großen Terz (M3) im $C^{7b13}/F^\#$-Slash-Akkord und unterstreicht die oben aufgeführte Verwendung der MM4- oder Ganztonleiter. Die Major seventh (maj7) wird zur reinen Undezime (11) im $C^{maj7\#5}/F^\#$-Slash-Akkord und unterstreicht die oben genannte Verwendung der MM6 (Lokrisch9)-Tonleiter. Auch hier sollte aber die Minor third (m3) noch ergänzt werden.

15.7.7 C^+/G

Verschiebt sich der Basston um fünf Positionen nach links, hier um fünf Stepe von C nach G, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um fünf Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Übermäßiger Dreiklang	1, M3, #5	C^+	1				M3				#5			
		C^+/G	→	↘ →|	→	→	→	↘ →|	→	→	→	↘ →|	→	→
			1 *)	b9				11 sus4				13 6		
$Major^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
		$C^{maj7\#5}/G$	↘ →	↘ → →|	→ →	→ →	→ →|	↘ →|	→	→	→	↘ →|	→	→
			1 *)	b9			M3	11 sus4				13 6		
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
		C^{7b13}/G	→ →	↘ → →|	→ →	→ →|	→	↘ →|	→	→	→	↘ →|	→	↘ →
			1 *)	b9		m3 #9		11 sus4				13 6		

Table149 - Patterns, die sich bei den Slash-Akkorden C^+/G, $C^{maj7\#5}/G$ und C^{7b13}/G ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM2	C^+/G	C^{7b13}/G	$Gm^{7b5/11/13}$	1	~~b9~~		m3		11	b5			13	7	
MM2			$Gm^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	

Table150 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^+/G und C^{7b13}/G. Zum $C^{maj7\#5}/G$ passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Der C^+/G-Slash-Akkord passt zu den Tonleitern HM2 und MM2, wobei jeweils Terz und Septime fehlen. Die kleine None (b9) ist in beiden Tonleitern ein zu vermeidender Ton, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Erweitert man den C^+/G-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/G, wird die kleine Septime (7) im C^{7b13}-Akkord zur kleinen Terz (m3) im C^{7b13}/G-Slash-Akkord. Die Major seventh (maj7) wird zur großen Terz (M3) im $C^{maj7\#5}$/G-Slash-Akkord, für die es keine Entsprechung in den hier vorgestellten Tonleitern gibt.

15.7.8 $C^+/G^\#$

Dieser Slash-Akkord entspricht der 1. Umkehrung des C^+-Akkords, weil das $G^\#$ im Bass einem Akkordton, in diesem Fall der übermäßigen Fifth (#5), entspricht. Verschiebt sich der Basston um vier Positionen nach links, hier um drei Stepe von C nach E, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um vier Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C^+	1				M3				#5			
			→|	↘	→	→	→|	↘	→	→	→|	↘	→	→
		$C^+/G^\#$	1*)				M3				b13 #5			
$Major^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
			↘ →|	↘ →	→ →	→ →|	→|	↘	→	→	→|	↘	→	→
		$C^{maj7\#5}/G^\#$	1*)			m3 #9	M3				b13 #5			
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
			→ →|	↘ →	→ →|	→	→|	↘	→	→	→|	↘	→	↘ →
		$C^{7b13}/G^\#$	1*)		9		M3				b13 #5			

Table151 - Patterns, die sich bei den Slash-Akkorden $C^+/G^\#$, $C^{maj7\#5}/G^\#$ und $C^{7b13}/G^\#$ ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM5			$G^{\#7/b13}$	1	b9			M3	(sus4)		5	b13		7	
HM3			$G^{\#maj7\#5}$	1		9		M3	~~11~~			#5	(6)		maj7
MM3		$C^{7b13}/G^{\#}$	$G^{\#maj7\#5}$	1		9		M3		#11		#5	(6)		maj7
MM5	$C^{+}/G^{\#}$		$G^{\#7/b13}$	1		9		M3	(sus4)		5	b13		7	
Ganzton GT			$G^{\#7/b13}$	1		9		M3		#11		b13		7	
HM7		$C^{maj7\#5}/G^{\#}$	$G^{\#13}$	1	b9		#9	M3		#11		(b13)	b7		
MM7 (Alteriert)			$G^{\#7/b13}$	1	b9		#9	M3		#11		b13		7	

Table152 - Passende Tonleitern und Akkorde zu den Slash-Akkorden $C^{+}/G^{\#}$, $C^{7b13}/G^{\#}$ und $C^{maj7\#5}/G^{\#}$.

Der $C^{+}/G^{\#}$-Slash-Akkord ist die 2. Umkehrung des C^{+}-Akkords. Es passen auch hier die Tonleitern HM3, HM5, HM7, MM3, MM5, MM7 und GT. Er kann nach Moll aufgelöst werden, hier C^{+}/G→Cm7 (HM5-Verwendung), oder auch $C^{+}/G \rightarrow Cm^{maj7}$ bzw. $C^{+}/G \rightarrow C^{maj7}$ (MM7-Verwendung).

Erweitert man den C^{+}/G-Slash-Akkord um die kleine Septime (7) zum $C^{7b13}/G^{\#}$, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}/G^{\#}$, wird die kleine Septime (7) im C^{7b13}-Akkord wird zur großen None (9) im $C^{7b13}/G^{\#}$-Slash-Akkord. Er kann unter Verwendung der Ganztonleiter (GT) nach

$C^{7b13}/G^{\#} \rightarrow C^{\#}m^{maj7}$ bzw. $C^{7b13}/G^{\#} \rightarrow C^{\#maj7}$

aufgelöst werden. Die Major seventh (maj7) im $C^{maj7\#5}$-Akkord wird zur übermäßigen None (#9) im $C^{maj7\#5}/G^{\#}$-Slash-Akkord. Er kann unter Verwendung der alterierten Tonleiter (MM7) nach Dur oder Moll aufgelöst werden, hier

$C^{maj7\#5}/G^{\#} \rightarrow C^{\#}m^{maj7}$ bzw. $C^{maj7\#5}/G^{\#} \rightarrow C^{\#maj7}$.

15.7.9 C^{+}/A

Verschiebt sich der Basston um drei Positionen nach links, hier um drei Stepe von C nach G, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $Major^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um drei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Übermäßiger Dreiklang	1, M3, #5	C^{+}	1				M3				#5			
		C^{+}/A		↘	→	→|		↘	→	→|		↘	→	→|
			1*)			m3 #9				5				maj7 b15
Major$^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
		$C^{maj7\#5}/A$	↘	↘ →	→ →|	→|		↘	→	→|		↘	→	→|
			1*)		9	m3 #9				5				maj7 b15
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
		C^{7b13}/A	→	↘ →|	→	→|		↘	→	→|		↘	→	↘ →|
			1 *)	b9		m3 #9				5				maj7 b15

Table153 - Patterns, die sich bei den Slash-Akkorden C^{+}/A, $C^{maj7\#5}/A$ und C^{7b13}/A ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM6	C^{+}/A		A^{maj7}	1			~~#9~~	M3		#11	(5)		6		maj7
Harmonisch-Moll HM1		$C^{maj7\#5}/A$	Am^{maj7}	1		9	m3		~~11~~		5	(b13)			maj7
Melodisch-Moll MM1			Am^{maj7}	1		9	m3		~~11~~		5		6		maj7

Table154 - Patterns, die sich bei den Slash-Akkorden C^{+}/A und $C^{maj7\#5}/A$ ergeben. Zum C^{7b13}/A passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Der C^{+}/A-Slash-Akkord ergibt einen vollständigen Moll-Major-Tonika-Akkord mit den passenden Tonleitern HM1 und MM1. Theoretisch passt auch HM6. HM6 beschreibt aber einen Major-Akkord mit großer Terz (M3), in dem ist die #9 als klingende Minor third (m3) ein zu vermeidender Ton, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Erweitert man den C^{+}/A-Slash-Akkord um die Major seventh (maj7) zum $C^{maj7\#5}/A$, wird die Major seventh (maj7) im C^{7b13}-Akkord zur großen None (9) im $C^{maj7\#5}/A$-Slash-Akkord. Die kleine Septime (7) wird zur kleinen None (b9) im C^{7b13}/A-Slash-Akkord, für die es keine Entsprechung in den hier vorgestellten Tonleitern gibt.

15.7.10 C$^+$/B^b

Verschiebt sich der Basston um zwei Positionen nach links, hier um zwei Stepe von C nach B^b, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem Major$^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um zwei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Übermäßiger Dreiklang	1, M3, #5	C$^+$	1				M3				#5			
				↘	→|			↘	→|			↘	→|	
		C$^+$/B^b	1*)		9				#11 b5				7	
Major$^{7\#5}$-Vierklang	1, M3, #5, maj7	C$^{maj7\#5}$	1				M3				#5			maj7
			↘	↘ →|	→|			↘	→|			↘	→|	
		C$^{maj7\#5}$/B^b	1 *)	b9	9				#11 b5				7	
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
			→|	↘	→|			↘	→|			↘	→|	↘
		C^{7b13}/B^b	1 *)		9				#11 b5				7	

Table155 - Patterns, die sich bei den Slash-Akkorden C$^+$/B^b, C$^{maj7\#5}$/B^b und C^{7b13}/B^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
HM4	C$^+$/B^b	C^{7b13}/B^b	B^{b}m$^{7/9}$	1		9	m3			(#11)	5		13	7	
MM4 (Mixo#11)			B$^{b7/9/\#11}$	1		9		M3		#11	5		13	7	
MM6 (Lokrisch9)			B^{b}m$^{7b5/9}$	1		9	m3		11	b5		b13		7	
Ganzton GT			B$^{b7/9/\#11}$	1		9		M3		#11		b13		7	

Table156 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C$^+$/B^b und C^{7b13}/B^b. Zum C$^{maj7\#5}$/B^b passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Der C$^+$/B^b-Slash-Akkord passt zu den Tonleitern HM4, MM4, MM6 (Lokrisch9) und Ganzton (GT). Aufgrund der fehlenden Terz kann der C$^+$/B^b-Slash-Akkord sowohl unter Verwendung der MM4-Tonleiter als Sekundärdominante zum Beispiel folgendermaßen aufgelöst werden:

C+/B^b→Am^{maj7} bzw. C+/B^b→A^{maj7}

oder auch mit alteriert-dominanter Verwendung und GT-Tonleiter:

$C+/B^b \rightarrow E^bm^{maj7}$ bzw. $C+/B^b \rightarrow E^{bmaj7}$.

Darüber hinaus ist auch die Verwendung als halbverminderter Mollseptakkord mit MM6 (Lokrisch9)-Tonleiter möglich. In allen Fällen sollte der Komponist die fehlende Terz zur Verdeutlichung ergänzen.

Erweitert man den C^+/B^b-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/B^b, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}/B^b$, wird die Major seventh (maj7) im C^{7b13}-Akkord zur kleinen None (b9) im $C^{maj7\#5}$/A-Slash-Akkord und findet keine Entsprechung in den hier vorgestellten Tonleitern. Die kleine Septime (7) wird zum Grundton (1) im C^{7b13}/B^b-Slash-Akkord und ergibt somit keinen weiteren neuen Ton.

15.7.11 C^+/H

Verschiebt sich der Basston um eine Position nach links, hier um einen Step von C nach H, verschiebt sich das Pattern, hier das übermäßige Dreiklangpattern mit seinen zwei Erweiterungen, dem $\text{Major}^{7\#5}$-Vierklang mit großer Septime (maj7) und dem Dominantsept/b13-Vierklang mit kleiner Septime (7), entsprechend um einen Step nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Übermäßiger Dreiklang	1, M3, #5	C^+	1				M3				#5			
				↘|				↘|				↘|		
		C^+/H	1*)	b9				11 sus4				13 6		
$\text{Major}^{7\#5}$-Vierklang	1, M3, #5, maj7	$C^{maj7\#5}$	1				M3				#5			maj7
			↘|	↘|				↘|				↘|		
		$C^{maj7\#5}$/H	1*)	b9				11 sus4				13 6		
Dominantsept /b13-Vierklang	1, M3, b13, 7	C^{7b13}	1				M3				b13		7	
				↘|				↘|				↘|		↘|
		C^{7b13}/H	1*)	b9				11 sus4				13 6		maj7 b15

Table157 - Patterns, die sich bei den Slash-Akkorden C^+/H, $C^{maj7\#5}$/H und C^{7b13}/H ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM2	C^+/H	$C^{maj7\#5}$/H	$Hm^{7b5/11/13}$	1	~~b9~~		m3		11	b5			13	7	
MM2	C^+/H	$C^{maj7\#5}$/H	$Hm^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	

Table158 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^+/H und $C^{maj7\#5}$/H. Zum C^{7b13}/D^b passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Der C^+/H-Slash-Akkord passt zu den Tonleitern HM2 und MM2. Sowohl Terz und Septime fehlen und in beiden Tonleitern ist die kleine None (b9) ein zu vermeidender Ton, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde).

Erweitert man den C^+/H-Slash-Akkord um die kleine Septime (7) zum C^{7b13}/H, oder durch die Major seventh (maj7) auf den $C^{maj7\#5}$/H, wird die Major seventh (maj7) im $C^{maj7\#5}$-Akkord zum Grundton (1) im $C^{maj7\#5}$/H-Slash-Akkord und ergibt somit keinen weiteren neuen Ton. Die kleine Septime (7) wird zur großen Septime (maj7) im C^{7b13}/H-Slash-Akkord und findet keine Entsprechung in den hier vorgestellten Tonleitern.

15.8 Slash-Akkorde über Sus4

15.8.1 C^{sus4}/D^{b}

Verschiebt sich der Basston um **eine** Position nach rechts, hier um einen Step von C nach D^{b}, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um einen Step nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
							I←		I←					I←
		C^{sus4}/D^{b}	1 *)				M3		#11 b5					maj7 b15
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
							I←		I←			I←		I←
		C^{7sus4}/D^{b}	1 *)				M3		#11 b5			13 6		maj7 b15

Table159 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/D^{b}, C^{7sus4}/D^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Lydisch	C^{sus4}/D^{b}	C^{7sus4}/D^{b}	$D^{b}maj7\#11$	1		9		M3		#11	(5)		6		maj7
HM6				1			~~#9~~	M3		#11	(5)		6		maj7
MM3				1		9		M3		#11		#5	(6)		maj7

Table160 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/D^{b} und C^{7sus4}/D^{b}

Der Grund-Slash-Akkord C^{sus4}/D^{b} ergibt einen vollständigen lydischen $Major^{7}$-Akkord mit übermäßiger Undezime (#11) und den passenden Tonleitern Lydisch, HM6 und MM3.

Erweitert man den C^{sus4}/D^{b}-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/D^{b}, wird die kleine Septime (7) im C^{7sus}-Akkord zur großen Sexte (6) im C^{7sus4}/D^{b}-Slash-Akkord.

15.8.2 C^{sus4}/D

Verschiebt sich der Basston um zwei Positionen nach rechts, hier um zwei Stepe von C nach D, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um zwei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
						|←	↙	|←	↙				|←	↙
		C^{sus4}/D	1 *)			m3 #9		11 sus4					7	
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
						|←	↙	|←	↙		|←	↙	|←	↙
		C^{7sus4}/D	1 *)			m3 #9		11 sus4			b13 #5		7	

Table161 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/D, C^{7sus4}/D ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde		Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Dorisch			$Dm^{7/11}$	1		9	m3		11		5		(13)	7	
HM2			$Dm^{7b5/11}$	1	~~b9~~		m3		11	b5			13	7	
MM2			$Dm^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	
Mollpentatonik			$Dm^{7/11}$	1			m3		11		5			7	
Mollpentatonik +Blue-Note	C^{sus4}/D		$Dm^{7/11}$	1			m3		11	#11	5			7	
Phrygisch		C^{7sus4}/D		1	~~b9~~		m3		11		5	(b13)		7	
Äolisch			$Dm^{7/11}$	1		9	m3		11		5	(b13)		7	
Lokrisch			$Dm^{7b5/11}$	1	~~b9~~		m3		11	b5		b13		7	
MM6 (Lokrisch9)			$Dm^{7b5/11}$	1		9	m3		11	b5		b13		7	

Table162 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/D und C^{7sus4}/D

Der Grund-Slash-Akkord C^{sus4}/D ergibt einen Moll11-Septakkord mit den passenden Tonleitern Dorisch, Phrygisch, Äolisch, Lokrisch, HM2, MM2, MM6 und der Mollpentatonik. Dieser Slash-Akkord könnte am Anfang einer Mollkadenz stehen, zum Beispiel unter Verwendung von Lokrisch oder Lokrisch9:

$C^{sus4}/D \rightarrow G^{7b9} \rightarrow Cm^{7}$, oder unter Verwendung der dorischen Tonleiter auch $C^{sus4}/D \rightarrow G^{7} \rightarrow C^{maj7}$.

Erweitert man den C^{sus4}/D-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/D, wird die kleine Septime (7) im C^{7sus4}-Akkord zur kleinen Tredezime (b13) im C^{7sus4}/D-Slash-Akkord. Es passen dann noch die Tonleitern Phrygisch, Äolisch, Lokrisch und MM6 (Lokrisch9). Dieser Slash-Akkord könnte also am Anfang einer Mollkadenz stehen, zum Beispiel unter Verwendung von Lokrisch oder Lokrisch9:

$C^{7sus4}/D \rightarrow G^{7b9} \rightarrow Cm^{7}$.

15.8.3 C^{sus4}/E^{b}

Verschiebt sich der Basston um drei Positionen nach rechts, hier um drei Stepe von C nach E^{b}, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um drei Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		C^{sus4}/E^{b}			|←	←	↙ |←	←	↙			|←	←	↙
			1 *)		9		M3					13 6		
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		C^{7sus4}/E^{b}			|←	←	↙ |←	←	↙	|←	←	↙ |←	←	↙
			1 *)		9		M3			5		13 6		

Table163 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/E^{b}, C^{7sus4}/E^{b} ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM3	C^{sus4}/E^{b}	E$^{bmaj7/\#5/9}$	1		9		M3	~~11~~			#5	(6)		maj7
MM3		E$^{bmaj7/\#5/9}$	1		9		M3		#11		#5	(6)		maj7
Ionisch		E$^{bmaj7/9/6}$	1		9		M3	~~11~~		5		6		maj7
Lydisch	C^{7sus4}/E^{b}	E$^{bmaj7/9/6}$	1		9		M3		#11	(5)		6		maj7
Mixolydisch		E$^{b7/9/13}$	1		9		M3	(sus4)		5		13	7	
MM4 (Mixo#11)		E$^{b7/9/13}$	1		9		M3		#11	5		13	7	

Table164 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/E^{b} und C^{7sus4}/E^{b}

Der Grund-Slash-Akkord C^{sus4}/E^{b} ergibt einen Dursextakkord mit den passenden Tonleitern Ionisch, Lydisch, Mixolydisch, HM3, MM3 und MM4. Man könnte ihn durch Hinzufügen der großen Septime (maj7) zu einem Tonika-Akkord mit ionischer oder lydischer Tonleiter, oder durch Hinzufügen der kleinen Septime (7) zu einem Dominantseptakkord mit mixolydischer oder MM4-Tonleiter. Bei HM3 und MM3 ist die Major sixth (6) aufgrund ihrer Nähe zur übermäßigen Fifth (#5) ein zu vermeidender Ton, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Den C^{sus4}/E^{b}-Slashakkord könnte man folgendermaßen auflösen:

C^{sus4}/E^{b}→A^{bmaj7} (mixolydische Verwendung), oder

C^{sus4}/E^{b}→Dm^{maj7} bzw. C^{sus4}/E^{b}→D^{maj7} (MM4-Verwendung).

Erweitert man den C^{sus4}/E^{b}-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/E^{b}, wird die kleine Septime (7) im C^{7sus4}-Akkord zur reinen Fifth (5) im C^{7sus4}/E^{b}-Slash-Akkord und bringt somit keine neue Option ins Spiel.

15.8.4 C^{sus4}/E

Verschiebt sich der Basston um vier Positionen nach rechts, hier um vier Stepe von C nach E, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um vier Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		C^{sus4}/E		|←	←	← |←	↙ ←	←	↙		|←	←	←	↙
			1 *)	b9		m3 #9					b13 #5			
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		C^{7sus4}/E		|←	←	← |←	↙ ←	←	↙ |←	←	← |←	↙ ←	←	↙
			*)	b9		m3 #9			#11 b5		b13 #5			

Table165 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/E, C^{7sus4}/E ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Phrygisch	C^{sus4}/E	Em^{7}	1	~~b9~~		m3		11		5	(b13)		7	
Lokrisch		$Em^{7b5/b13}$	1	~~b9~~		m3		11	b5		b13		7	
HM7	C^{7sus4}/E	$Em^{13/b9/b13}$	1	b9		#9	M3		#11		(b13)	b7		
MM7 (Alteriert)		$E^{7/b9/\#9/b13}$	1	b9		#9	M3		#11		b13		7	

Table166 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/E und C^{7sus4}/E

Der Grund-Slash-Akkord C^{sus4}/E passt zu den Tonleiter Phrygisch, Lokrisch, HM7 und MM7, wobei bei Phrygisch und Lokrisch die kleine None (b9) aufgrund ihrer Nähe zum Grundton ein zu vermeidender Ton ist, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Durch Hinzufügen der großen Terz (M3) und kleinen Septime (7) könnte man ihn zu einem alterierten Akkord ausbauen und nach Am^{maj7} bzw. A^{maj7} auflösen:

$C^{sus4}/E \rightarrow A^{maj7}$ bzw. $C^{sus4}/E \rightarrow Am^{maj7}$.

Erweitert man den C^{sus4}/E^{b}-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/E, wird die kleine Septime (7) im C^{7sus4}-Akkord zur übermäßigen Undezime (#11) im C^{7sus4}/E-Slash-

Akkord und unterstreicht die Verwendung als alterierten Akkord, wobei wie oben wieder große Terz(M3) und kleine Septime (7) hinzugefügt werden sollten.

15.8.5 C^{sus4}/F

Dieser Slash-Akkord entspricht der 1. Umkehrung des C^{sus4}-Akkords, weil das F im Bass einem Akkordton, in diesem Fall der sus4, entspricht. Verschiebt sich der Basston um fünf Positionen nach rechts, hier um fünf Stepe von C nach F, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um fünf Stepe nach links, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		C^{sus4}/F	|←	←	← |←	← ←	↙ ←	←	↙	|←	←	←	←	↙
			1 *)		9					5				
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		C^{7sus4}/F	|←	←	← |←	← ←	↙ ←	← |←	↙ ←	← |←	← ←	↙ ←	←	↙
			1 *)		9			11 sus4		5				

Table167 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/F, C^{7sus4}/F ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Lydisch	C^{sus4}/F	$F^{maj7/9}$	1		9		M3		#11	(5)		6		maj7
HM4		$Fm^{7/9}$	1		9	m3			(#11)	5		13	7	
MM4 (Mixo#11)		$F^{7/9}$	1		9		M3		#11	5		13	7	
Ionisch	C^{7sus4}/F	$F^{maj7/9}$	1		9		M3	~~11~~		5		6		maj7
Dorisch		$Fm^{7/9/11}$	1		9	m3		11		5		(13)	7	
Mixolydisch		$F^{7sus4/9}$	1		9		(M3)	sus4		5		13	7	
Äolisch		$Fm^{7/9/11}$	1		9	m3		11		5	(b13)		7	
Harmonisch-Moll HM1		$Fm^{maj7/9}$	1		9	m3		~~11~~		5	(b13)			maj7
Melodisch-Moll MM1		$Fm^{maj7/9}$	1		9	m3		~~11~~		5		6		maj7
MM5		$F^{7sus4/9}$	1		9		(M3)	sus4		5	b13		7	

Table168 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/F und C^{7sus4}/F

Da dem Slash-Akkord C^{sus4}/F sowohl Terz als auch Septime fehlen, passen sowohl die

Durtonleitern Ionisch, Lydisch, Mixolydisch, MM4 und MM5, als auch die Molltonleitern Dorisch, Äolisch, HM1, HM4 und MM1.

Erweitert man den C^{sus4}/F-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/F, wird die kleine Septime (7) im C^{7sus4}-Akkord zur reinen Undezime (11) im C^{7sus4}/F-Slash-Akkord. Es entsteht wieder ein Sus4-Dreiklang, aber mit großer None (9). Es bieten sich jetzt die Molltonleitern Dorisch oder Äolisch und die Durtonleitern Mixolydisch oder MM5 an, da bei den anderen Tonleitern die reine Undezime (11) als zu vermeidender Ton gilt, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Als Sus4-Akkord mit mixolydischer Tonleiter kann man ihn z. B. nach B^{bmaj7} auflösen:

C^{7sus4}/F→ B^{bmaj7}.

15.8.6 $C^{sus4}/F^{\#}$

Verschiebt sich der Basston um sechs Positionen nach rechts (oder links), hier um sechs Stepe von C nach F⁺, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um sechs Stepe nach links (rechts), so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		$C^{sus4}/F^{\#}$	←	← I←	← ←	← ←	↙ ←	←	↙ I←	←	←	←	←	↙ I←
			1 *)	b9					#11 b5					maj7 b15
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		$C^{7sus4}/F^{\#}$	←	← I←	← ←	← ←	↙ ← I←	← ←	↙ ← I←	← ←	← ←	↙ ←	←	↙ I←
			1 *)	b9			M3		#11 b5					maj7 b15

Table169 - Patterns, die sich bei den Slash-Akkorden $C^{sus4}/F^{\#}$, $C^{7sus4}/F^{\#}$ ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei keiner der im Rahmen dieser Harmonielehre eingeführten Tonleitern.

15.8.7 C^{sus4}/G

Dieser Slash-Akkord entspricht der 2. Umkehrung des C^{sus4}-Akkords, weil das G im Bass einem Akkordton, in diesem Fall der Fifth, entspricht. Verschiebt sich der Basston um fünf Positionen nach links, hier um fünf Stepe von C nach G, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner

Septime (7), entsprechend um fünf Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b 9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		C^{sus4}/G	→|	↘	→	→	→	→|	↘	→	↘ →	→ →	→ →|	→
			1*)					11 sus4					7	
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		C^{7sus4}/G	→ →|	↘ →	→ →	→ →|	→	→|	↘	→	↘ →	→ →	→ →|	↘ →
			1*)			m3 #9		11 sus4					7	

Table170 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/G, C^{7sus4}/G ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Mixolydisch	C^{sus4}/G	G^7	1		9		(M3)	sus4		5		13	7	
HM5		G^7	1	b9			(M3)	sus4		5	b13		7	
MM5		G^7	1		9		(M3)	sus4		5	b13		7	
Dorisch	C^{7sus4}/G	$Gm^{7/11}$	1		9	m3		11		5		(13)	7	
Phrygisch		$Gm^{7/11}$	1	~~b9~~		m3		11		5	(b13)		7	
Äolisch		$Gm^{7/11}$	1		9	m3		11		5	(b13)		7	
Lokrisch		$Gm^{7b5/11}$	1	~~b9~~		m3		11	b5		b13		7	
HM2		$Gm^{7b5/11}$	1	~~b9~~		m3		11	b5			13	7	
MM2		$Gm^{7/11}$	1	~~b9~~		m3		11		5		(13)	7	
MM6 (Lokrisch9)		$Gm^{7b5/11}$	1		9	m3		11	b5		b13		7	
Mollpentatonik		$Gm^{7/11}$	1			m3		11		5			7	
Mollpentatonik +Blue-Note		$Gm^{7/11}$	1			m3		11	#11	5			7	

Table171 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/G und C^{7sus4}/G

Da dem C^{sus4}/G-Slash-Akkord die Terz fehlt, passen sowohl die Durtonleitern Mixolydisch, HM5 und MM5, als auch die Molltonleitern Dorisch, Phrygisch, Äolisch, Lokrisch, HM2, MM2, MM6, die Mollpentatonik und die Mollpentatonik mit Blue-Note.

Erweitert man den C^{sus4}/G-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/G, wird die kleine Septime (7) im C^{7sus4}-Akkord zur kleinen Terz (m3) im C^{7sus4}/G-Slash-Akkord, so dass die Durtonleitern als passende Tonleitern herausfallen. Es ergibt sich ein vollständiger Moll11-Akkord.

15.8.8 $C^{sus4}/G^{\#}$

Verschiebt sich der Basston um vier Positionen nach links, hier um vier Stepe von C nach $G^{\#}$, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um vier Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b 9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		$C^{sus4}/G^{\#}$		↘	→	→	→|		↘	→	↘ →	→ →|	→	→|
			1*)				M3					13 6		maj7 b15
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		$C^{7sus4}/G^{\#}$	→	↘ →	→ →|	→	→|		↘	→	↘ →	→ →|	→	↘ →|
			1*)		9		M3					13 6		maj7 b15

Table172 - Patterns, die sich bei den Slash-Akkorden $C^{sus4}/G^{\#}$, $C^{7sus4}/G^{\#}$ ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkord	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
HM6	$C^{sus4}/G^{\#}$	G#maj7/6	1			~~#9~~	M3		#11	(5)		6		maj7
Ionisch	$C^{7sus4}/G^{\#}$	G#maj7/6/9	1		9		M3	~~11~~		5		6		maj7
Lydisch		G#maj7/6/9	1		9		M3		#11	(5)		6		maj7
HM3		G#maj7#5/9	1		9		M3	~~11~~			#5	(6)		maj7
MM3		G#maj7#5/9	1		9		M3		#11		#5	(6)		maj7

Table173 - Passende Tonleitern und Akkorde zu den Slash-Akkorden $C^{sus4}/G^{\#}$ und $C^{7sus4}/G^{\#}$

Der $C^{sus4}/G^{\#}$-Slash-Akkord ist ein $Major^{7}$-Tonika-Akkord mit großer Sexte (6) und passt daher zu den Tonleitern Ionisch, Lydisch, HM3, HM6 und MM3.

Erweitert man den $C^{sus4}/G^{\#}$-Slash-Akkord um die kleine Septime (7) zum $C^{7sus4}/G^{\#}$, wird die kleine Septime (7) im C^{7sus4}-Akkord zur großen None (9) im $C^{7sus4}/G^{\#}$-Slash-Akkord und ergänzt den Tonika-Akkord entsprechend.

15.8.9 C^{sus4}/A

Verschiebt sich der Basston um drei Positionen nach links, hier um drei Stepe von C nach A, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um drei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
		C^{sus4}/A		↘	→	→|			↘	→	↘ →|	→	→|	
			1 *)			m3 #9					b13 6		7	
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
		C^{7sus4}/A	→	↘ →|	→	→|			↘	→	↘ →|	→	→|	↘
			1 *)	b9		m3 #9					b13 6		7	

Table174 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/A, C^{7sus4}/A ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	**Slash-Akkorde**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Äolisch	C^{sus4}/A	Am^7	1		9	m3		11		5	(b13)		7	
MM6 (Lokrisch9)		$Am^{7b5/b13}$	1		9	m3		11	b5		b13		7	
Phrygisch	C^{7sus4}/A	Am^7	1	~~b9~~		m3		11		5	(b13)		7	
Lokrisch		$Am^{7b5/b13}$	1	~~b9~~		m3		11	b5		b13		7	
MM7 (Alteriert)		$A^{7b9/\#9/b13}$	1	b9		#9	M3		#11		b13		7	

Table175 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/A und C^{7sus4}/A

Der C^{sus4}/A-Slash-Akkord ist ein Mollseptakkord mit kleiner Tredezime (b13) und passt daher zu den Tonleitern Phrygisch, Äolisch, Lokrisch, MM6. Wenn man die große Terz (M3) ergänzt, passt er auch zur alterierten Tonleiter (MM7). Dann könnte man ihn zum Beispiel nach D^{maj7} oder Dm^{maj7} auflösen:

$C^{sus4}/A \rightarrow D^{maj7}$ bzw. $C^{sus4}/A \rightarrow Dm^{maj7}$.

Ansonsten passt die lokrische Tonleiter am besten, weil die kleine Tredezime (b13) bei Phrygisch und Äolisch ein zu vermeidender Ton ist, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Mit der lokrischen Interpretation könnte man den C^{sus4}/A-Slash-Akkord an den Anfang einer Mollkadenz stellen und zum Beispiel folgendermaßen auflösen:

$C^{sus4}/A \rightarrow D^{7/b9} \rightarrow Gm^7$, oder

$C^{sus4}/A \rightarrow D^{7\ alt} \rightarrow G^{maj7}$ bzw. $C^{sus4}/A \rightarrow D^{7\ alt} \rightarrow Gm^{maj7}$.

Erweitert man den C^{sus4}/A-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/A, wird die kleine Septime (7) im C^{7sus4}-Akkord zur kleinen None (b9) im C^{7sus4}/A-Slash-Akkord. Da die kleine None (b9) in Phrygisch und Lokrisch ein zu vermeidender Ton ist, ist die Interpretation als alterierter Akkord mit MM7-Tonleiter am sinnvollsten, wenn man die fehlende große Terz (M3) noch ergänzt. Dann könnte man ihn wie oben zum Beispiel nach Dmaj7 oder Dmmaj7 auflösen:

C7sus4/A → D^{maj7} bzw. C7sus4/A → Dm^{maj7}.

15.8.10 C^{sus4}/B^b

Verschiebt sich der Basston um zwei Positionen nach links, hier um zwei Stepe von C nach B^b, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um zwei Stepe nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	Pattern	Beispiel	1	b9	9	m 3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Sus4-Dreiklang	1, sus4, 5	Csus4	1					sus4		5				
				↘	→|				↘	→|	↘	→|		
		Csus4/Bb	1*)		9					5		13 6		
7sus4-Vierklang	1, sus4, 5, 7	C7sus4	1					sus4		5			7	
			→|	↘	→|				↘	→|	↘	→|		↘
		C7sus4/Bb	1*)		9					5		13 6		

Table176 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/B^b, C^{7sus4}/B^b ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter	Slash-Akkorde	Beispiel	1	b9	9	m3 #9	M3	11 sus4	#11 b5	5	b13 #5	13 6	7	maj7 b15
Ionisch		Bbmaj7/9/6	1		9		M3	~~11~~		5		6		maj7
Dorisch		Bbm7/9	1		9	m3		11		5		(13)	7	
Lydisch	Csus4/Bb	Bbmaj7/9/6	1		9		M3		#11	(5)		6		maj7
Mixolydisch	=	Bb7/9/13	1		9		M3	(sus4)		5		13	7	
HM4	C7sus4/Bb	Bbm7/9/13	1		9	m3			(#11)	5		13	7	
Melodisch-Moll MM1		Bbmmaj7/9	1		9	m3		~~11~~		5		6		maj7
MM4 (Mixo#11)		Bb7/9/13	1		9		M3		#11	5		13	7	

Table177 - Passende Tonleitern und Akkorde zu den Slash-Akkorden C^{sus4}/B^b und C^{7sus4}/B^b

Dem C^{sus4}/B^{b}-Slash-Akkord fehlt neben der Septime auch die Terz, so dass er sowohl zu den Molltonleitern Dorisch, HM4 und MM1, als auch zu den Durtonleitern Ionisch, Lydisch, Mixolydisch und MM4 passt. Wenn man Terz und Septime hinzufügt, kann man ihn zu einem Tonika-Akkord mit ionischer, lydischer oder MM1-Tonleiter ausbauen, oder aber auch als Dominante mit mixolydischer, oder Sekundärdominante mit MM4-Tonleiter. Als Dominante wären dann zum Beispiel folgende Weiterführungen sinnvoll:

$C^{sus4}/B^{b} \rightarrow E^{bmaj7}$ (mixolydische Verwendung), oder

$C^{sus4}/B^{b} \rightarrow A^{maj7}$ bzw. $C^{sus4}/B^{b} \rightarrow Am^{maj7}$ (MM4-Verwendung).

Erweitert man den C^{sus4}/B^{b}-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/B^{b}, wird die kleine Septime (7) im C^{7sus4}-Akkord zum Grundton (1) im C^{7sus4}/B^{b}-Slash-Akkord und ergibt daher keinen weiteren Ton.

15.8.11 C^{sus4}/H

Verschiebt sich der Basston um eine Position nach links, hier um einen Step von C nach H, verschiebt sich das Pattern, hier das Sus4-Dreiklangpattern mit seiner Erweiterung, dem 7sus4-Vierklang mit kleiner Septime (7), entsprechend um einen Step nach rechts, so dass sich folgende Patterns ergeben:

Akkordtyp	**Pattern**	**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Sus4-Dreiklang	1, sus4, 5	C^{sus4}	1					sus4		5				
				↘|					↘|		↘|			
		C^{sus4}/H	1*)	b9					#11 b5		b13 #5			
7sus4-Vierklang	1, sus4, 5, 7	C^{7sus4}	1					sus4		5			7	
				↘|					↘|		↘|			↘|
		C^{7sus4}/H	1*)	b9					#11 b5		b13 #5			maj7 b15

Table178 - Patterns, die sich bei den Slash-Akkorden C^{sus4}/H, C^{7sus4}/H ergeben

*) Die 1 als Basston ist per Definition immer gesetzt

Die Patterns treffen bei den folgenden Tonleitern:

Tonleiter		**Beispiel**	**1**	**b9**	**9**	**m3 #9**	**M3**	**11 sus4**	**#11 b5**	**5**	**b13 #5**	**13 6**	**7**	**maj7 b15**
Lokrisch	C^{sus4}/H	$Hm^{7b5/b13}$	1	~~b9~~		m3		11	b5		b13		7	
HM7		$H^{13/b9}$	1	b9		#9	M3		#11		(b13)	b7		
MM7 (Alteriert)		$H^{7/b9/\#11/b13}$	1	b9		#9	M3		#11		b13		7	

Table179 - Passende Tonleitern und Akkorde zum Slash-Akkord C^{sus4}/H. Zum C^{7sus4}/H passt keine der im Rahmen dieser Harmonielehre näher betrachteten Tonleitern.

Dem C^{sus4}/H-Slash-Akkord fehlt neben der Septime auch die Terz, so dass er sowohl zur halbverminderten lokrischen Tonleiter als auch zu HM7 und MM7 (alteriert) passt. Es bietet sich die Verwendung der alterierten Tonleiter an, da die beiden anderen jeweils zu vermeidende Töne enthalten, siehe dazu auch die Anmerkungen im Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** (Intervallbezeichnungen innerhalb der Akkorde). Folgende Weiterführung wäre daher zum Beispiel sinnvoll:

C^{sus4}/H → E^{maj7} bzw. C^{sus4}/H → Em^{maj7} (alterierte Verwendung).

Große Terz (M3) und kleine Septime (7) sollten aber hinzugefügt werden.

Erweitert man den C^{sus4}/H-Slash-Akkord um die kleine Septime (7) zum C^{7sus4}/H, wird die kleine Septime (7) zur großen Septime (maj7) im Skash-Akkord und passt daher nicht mehr zu einer der im Rahmen dieser Harmonielehre näher beschriebenen Tonleitern.

16 Cross-references to websites

No.	QR code	Description	Link
1		Berklee College of Music	https://www.berklee.edu/
2		Axel Jungbluth	https://de.wikipedia.org/wiki/Axel_Jungbluth
3		Wikipedia: Transverse wave	https://en.wikipedia.org/wiki/Transverse_wave
4		Wikipedia: Longitudinal wave	https://en.wikipedia.org/wiki/Longitudinal_wave
5		Wikipedia: Sound waves	https://en.wikipedia.org/wiki/Sound
5a		Wikipedia: Resonance	https://en.wikipedia.org/wiki/Resonance
6		Audio: Flageolet tones on the guitar	https://www.e-reuter.com/mp3/harmony/harmonics.mp3
7		Wikipedia: Partials, overtones	https://en.wikipedia.org/wiki/Harmonic_series_(music)#Partial
8		Wikipedia: Flageolet tones (string harmonic)	https://en.wikipedia.org/wiki/String_harmonic
9		Youtube: Anne-Maria Hefele	https://www.youtube.com/watch?v=vC9Qh709gas

10		Wikipedia: Musical tunings	https://en.wikipedia.org/wiki/Musical_tuning
10a		Wikipedia: Just intonation tuning	https://en.wikipedia.org/wiki/Just_intonation
10b		Wikipedia: Well temperament tuning	https://en.wikipedia.org/wiki/Well_temperament
10c		Wikipedia: Meantone temperament	https://en.wikipedia.org/wiki/Meantone_temperament
10d		Wikipedia: The unit cent	https://en.wikipedia.org/wiki/cent_(music)
10e		Equal temperament tone systems	https://e-reuter.com/index.php?location=harmony/why_our_tonal_system_consist_of_12_tones/equal_temperament_tonal_systems&language=en-US
11		Wikipedia: Pythagorean comma	https://en.wikipedia.org/wiki/Pythagorean_comma
12		Wikipedia: Indische Musik	https://en.wikipedia.org/wiki/Music_of_India
13		Wikipedia: Shruti	https://en.wikipedia.org/wiki/Shruti_(music)
14		Wikipedia: Solmization	https://en.wikipedia.org/wiki/Solmization
15		Wikipedia: Pythagorean tuning	https://en.wikipedia.org/wiki/Pythagorean_tuning

16		Wikipedia: Equal temperament tuning	https://en.wikipedia.org/wiki/Equal_temperament
17		Wikipedia: Fibonacci sequence	https://en.wikipedia.org/wiki/Fibonacci_sequence
18		Wikipedia: Golden ratio	https://en.wikipedia.org/wiki/Golden_ratio
19		Wikipedia: Interval	https://en.wikipedia.org/wiki/Interval_(music)
20		Wikipedia: Combinatorics	https://en.wikipedia.org/wiki/Combinatorics
20a		Wikipedia: Binomial coefficient	https://en.wikipedia.org/wiki/Binomial_coefficient
21		Audio: Three-note chords (triads)	https://e-reuter.com/mp3/harmony/triads.mp3
22		Wikipedia: Three-note chords (triads)	https://en.wikipedia.org/wiki/Triad_(music)
23		All 2048 theoretically possible scales	https://e-reuter.com/index.php?location=harmony/scales/all_scales&language=en-US
24		Audio: C major scale	https://e-reuter.com/mp3/harmony/c_major.mp3

25		Wikipedia: Scale (music)	https://en.wikipedia.org/wiki/Scale_(music)
26		Wikipedia: Diatonic scales	https://en.wikipedia.org/wiki/Diatonic_scale
27		Wikipedia: Tonality	https://en.wikipedia.org/wiki/Tonality
28		Wikipedia: Mode (music)	https://en.wikipedia.org/wiki/Mode_(music)
29		Audio: Dorian minor scale in D	https://e-reuter.com/mp3/harmony/dorian_scale.mp3
30		Audio: Phrygian minor scale in E	https://e-reuter.com/mp3/harmony/phrygian_scale.mp3
31		Audio: Lydian major scale in F	https://e-reuter.com/mp3/harmony/lydian_scale.mp3
32		Audio: Mixolydian major scale in G	https://e-reuter.com/mp3/harmony/mixolydian_scale.mp3
33		Audio: Aeolian minor scale in A	https://e-reuter.com/mp3/harmony/aeolian_scale.mp3
34		Audio: Locrian minor scale in B	https://e-reuter.com/mp3/harmony/locrian_scale.mp3

35		Audio: Chords of the ionian major scale	https://e-reuter.com/mp3/harmony/major_harmony.mp3
36		Wikipedia: Chromatic scale	https://en.wikipedia.org/wiki/Chromatic_scale
37		Wikipedia: Twelve-tone technique	https://en.wikipedia.org/wiki/Twelve-tone_technique
38		Audio: The chromatic scale	https://e-reuter.com/mp3/harmony/chromatic_scale.mp3
39		Audio: The melodic minor scale (MM1)	https://e-reuter.com/mp3/harmony/melodic_minor.mp3
40		Audio: The melodic minor scale on the 2nd degree (MM2)	https://e-reuter.com/mp3/harmony/melodic_minor2nd.mp3
41		Audio: The melodic minor scale on the 3rd degree (MM3)	https://e-reuter.com/mp3/harmony/melodic_minor3rd.mp3
42		Audio: The melodic minor scale on the 4th degree (MM4)	https://e-reuter.com/mp3/harmony/melodic_minor4th.mp3
43		Audio: The melodic minor scale on the 5th degree (MM5)	https://e-reuter.com/mp3/harmony/melodic_minor5th.mp3
44		Audio: The melodic minor scale on the 6th degree (MM6)	https://e-reuter.com/mp3/harmony/melodic_minor6th.mp3

45		Audio: The melodic minor scale on the 7th degree (MM7)	https://e-reuter.com/mp3/harmony/melodic_minor7th.mp3
46		Audio: The chords of the melodic minor scale	https://e-reuter.com/mp3/harmony/melodic_minor_harmonies.mp3
48		Audio: The harmonic minor scale HM1	https://e-reuter.com/mp3/harmony/harmonic_minor.mp3
48a		Audio: The harmonic major scale (HD1)	https://e-reuter.com/mp3/harmony/harmonic_major.mp3
48b		Audio: The double harmonic minor scale (DHM1) in C	https://e-reuter.com/mp3/harmony/double_harmonic_minor_c.mp3
48c		Audio: The double harmonic minor scale (DHM1) in A	https://e-reuter.com/mp3/harmony/dhm1.mp3
49		Audio: The harmonic minor scale on the 2nd degree (HM2)	https://e-reuter.com/mp3/harmony/harmonic_minor2nd.mp3
49a		Audio: The harmonic major scale on the 2nd degree (HD2)	https://e-reuter.com/mp3/harmony/hd2.mp3

49b		Audio: The double harmonic minor scale on the 2nd degree (DHM2)	https://e-reuter.com/mp3/harmony/dhm2.mp3
50		Audio: The harmonic minor scale on the 3rd degree (HM3)	https://e-reuter.com/mp3/harmony/harmonic_minor3rd.mp3
50a		Audio: The harmonic major scale on the 3rd degree (HD3)	https://e-reuter.com/mp3/harmony/hd3.mp3
50b		Audio: The double harmonic minor scale on the 3rd degree (DHM3)	https://e-reuter.com/mp3/harmony/dhm3.mp3
51		Audio: The harmonic minor scale on the 4th degree (HM4)	https://e-reuter.com/mp3/harmony/harmonic_minor4th.mp3
51a		Audio: The harmonic major scale on the 4th degree (HD4)	https://e-reuter.com/mp3/harmony/hd4.mp3
51b		Audio: The double harmonic minor scale on the 4th degree (DHM4)	https://e-reuter.com/mp3/harmony/dhm4.mp3
52		Audio: The harmonic minor scale on the 5th degree (HM5)	https://e-reuter.com/mp3/harmony/harmonic_minor5th.mp3
52a		Audio: The harmonic major scale on the 5th degree (HD5)	https://e-reuter.com/mp3/harmony/hd5.mp3
52b			

		Audio: The double harmonic minor scale on the 5th degree (DHM5)	https://e-reuter.com/mp3/harmony/dhm5.mp3
53		Audio: The harmonic minor scale on the 6th degree (HM6)	https://e-reuter.com/mp3/harmony/harmonic_minor6th.mp3
53a		Audio: The harmonic major scale on the 6th degree (HD6)	https://e-reuter.com/mp3/harmony/hd6.mp3
53b		Audio: The double harmonic minor scale on the 6th degree (DHM6)	https://e-reuter.com/mp3/harmony/dhm6.mp3
54		Audio: The harmonic minor scale on the 7th degree (HM7)	https://e-reuter.com/mp3/harmony/harmonic_minor7th.mp3
54a		Audio: The harmonic major scale on the 7th degree (HD7)	https://e-reuter.com/mp3/harmony/hd7.mp3
54b		Audio: The double harmonic minor scale on the 7th degree (DHM7)	https://e-reuter.com/mp3/harmony/dhm7.mp3
55		Audio: The chords of the harmonic minor scale (in C)	https://e-reuter.com/mp3/harmony/harmonic_minor_harmonies_in_c.mp3
56		Audio: The chords of the harmonic minor scale (in A)	https://e-reuter.com/mp3/harmony/harmonic_minor_harmonies.mp3
57		Wikipedia: The diminished or octatonic scale	https://en.wikipedia.org/wiki/Octatonic_scale

58		Audio: The half-tone whole-tone scale in C	https://e-reuter.com/mp3/harmony/htgt01.mp3
59		Audio: The whole-tone half-tone scale in C	https://e-reuter.com/mp3/harmony/gtht01.mp3
60		Wikipedia: Diminished triad	https://en.wikipedia.org/wiki/Diminished_triad
61		Wikipedia: Whole-tone scale	https://en.wikipedia.org/wiki/Whole-tone_scale
61a		Audio: The whole-tone scale in C	https://e-reuter.com/mp3/harmony/gt01.mp3
62		Wikipedia: Augmented triad	https://en.wikipedia.org/wiki/Augmented_triad
63		Youtube: Stevie Wonder- You are the sunshine of my life	https://www.youtube.com/watch?v=3wZ_b_uUAdQ

64		Audio: The minor pentatonic scale with blue-note	https://e-reuter.com/mp3/harmony/mp1.mp3
65		Audio: The minor pentatonic on the 2nd degree (MP2) with blue-note	https://e-reuter.com/mp3/harmony/mp2.mp3
66		Audio: The minor pentatonic on the 3rd degree with blue-note	https://e-reuter.com/mp3/harmony/mp3.mp3
67		Audio: The minor pentatonic on the 4th degree with blue-note	https://e-reuter.com/mp3/harmony/mp4.mp3
68		Audio: The minor pentatonic on the 5th degree with blue-note	https://e-reuter.com/mp3/harmony/mp5.mp3
69		Wikipedia: Slash-Akkord	https://de.wikipedia.org/wiki/Slash-Akkord
70		Wikipedia: Charlie Parker	https://de.wikipedia.org/wiki/Charlie_Parker
71		Wikipedia: Arnold Schoenberg	https://en.wikipedia.org/wiki/Arnold_Schoenberg
72		Wikipedia: Enharmonic equivalence	https://en.wikipedia.org/wiki/Enharmonic_equivalence

73		Ian Ring´s scales finder	https://ianring.com/musictheory/scales/finder.php

74		Wikipedia: Irrational number	https://en.wikipedia.org/wiki/Irrational_number
75		Wikipedia: Cadence	https://en.wikipedia.org/wiki/Cadence
75a		Wikipedia: Leading tone	https://en.wikipedia.org/wiki/Leading_tone
76		Audio: The cadence of the Ionian major scale / Aeolian minor scale	https://e-reuter.com/mp3/harmony/ionian_cadence.mp3
76a		Audio: The classical cadence of the major scale in C	https://e-reuter.com/mp3/harmony/classical_cadence.mp3
77		Audio: The cadence of the aeolian minor scale inclusive the loan from the HM5 chord	https://e-reuter.com/mp3/harmony/aeolian_hm5_cadence.mp3
78		Audio: The cadence of the harmonic minor scale	https://e-reuter.com/mp3/harmony/hm5_cadence.mp3
79		Audio: The cadence of the melodic minor scale	https://e-reuter.com/mp3/harmony/mm5_cadence.mp3
80		Audio: The cadence with the altered dominant chords	https://e-reuter.com/mp3/harmony/II-V-I-jazz.mp3
81		Wikiwand: Tonic	https://www.wikiwand.com/en/articles/Tonic_(music)

82		Wikipedia: Subdominant	https://en.wikipedia.org/wiki/Subdominant
83		Wikipedia: Dominant	https://en.wikipedia.org/wiki/Dominant_(music)

84		Audio: Kadenz mit Sekundärdominanten	https://e-reuter.com/mp3/harmony/II-V-I-jazz-sec.mp3
85		Wikipedia: Chromatic Approach	https://en.wikipedia.org/wiki/Approach_chord
86		Audio: Kadenz mit Zwischendominante	https://e-reuter.com/mp3/harmony/zwischendominante_v7b9.mp3
87		Audio: Kadenz mit vermind. Akkord als Zwischendominante	https://e-reuter.com/mp3/harmony/zwischendominante_v7b9_dim.mp3
89		Slash chord tool	https://e-reuter.com/index.php?location=harmony/slashchords/tool
90		Ionian sound cloud in E	https://e-reuter.com/mp3/harmony/e_ionian.mp3
91		Dorian sound cloud in E	https://e-reuter.com/mp3/harmony/e_dorian.mp3
92		Phrygian sound cloud in E	https://e-reuter.com/mp3/harmony/e_phrygian.mp3
93		Lydian sound cloud in E	https://e-reuter.com/mp3/harmony/e_lydian.mp3

94		Mixolydian sound cloud in E	https://e-reuter.com/mp3/harmony/e_mixolydian.mp3
95		Aeolian sound cloud in E	https://e-reuter.com/mp3/harmony/e_aeolian.mp3
96		Locrian sound cloud in E	https://e-reuter.com/mp3/harmony/e_locrian.mp3
97		Melodic minor (MM1) sound cloud in E	https://e-reuter.com/mp3/harmony/e_mm1.mp3
98		The sound cloud of the melodic minor on the 2nd degree (MM2) scale in E	https://e-reuter.com/mp3/harmony/e_mm2.mp3
99		The sound cloud of the melodic minor on the 3rd degree (MM3) scale in E	https://e-reuter.com/mp3/harmony/e_mm3.mp3
100		The sound cloud of the melodic minor on the 4th degree (MM4) scale in E	https://e-reuter.com/mp3/harmony/e_mm4.mp3
101		The sound cloud of the melodic minor on the 5th degree (MM5) scale in E	https://e-reuter.com/mp3/harmony/e_mm5.mp3
102		The sound cloud of the melodic minor on the 6th degree (MM6) scale in E	https://e-reuter.com/mp3/harmony/e_mm6.mp3

103		The sound cloud of the melodic minor on the 7th degree (MM7) scale in E	https://e-reuter.com/mp3/harmony/e_mm7.mp3
104		Audio: G^{7}-Akkord	https://e-reuter.com/mp3/harmony/g7.mp3
105		Audio: G$^{7/9/13}$ chord	https://e-reuter.com/mp3/harmony/g7_9_13.mp3
106		Audio: G$^{7/9/13}$ chord	https://e-reuter.com/mp3/harmony/g7_9_13.mp3
107		Audio: G$^{7sus4/9/13}$ chord	https://e-reuter.com/mp3/harmony/g7_sus4_9_13.mp3
108		Audio: Dm$^{7/9/11}$ chord	https://e-reuter.com/mp3/harmony/dm7_9_11.mp3
109		The sound cloud of the harmonic minor scale on the1st degree (HM1) scale in E	https://e-reuter.com/mp3/harmony/e_hm1.mp3
109a		The sound cloud of the harmonic major scale on the1st degree (HD1) scale in E	https://e-reuter.com/mp3/harmony/e_hd1.mp3
109b		The sound cloud of the double harmonic minor scale (DHM1) scale in E	https://e-reuter.com/mp3/harmony/e_dhm1.mp3
110		Sound cloud of the harmonic minor scale on	https://e-

		the 2nd degree (HM2) scale in E	reuter.com/mp3/harmony/e_hm2.mp3
110a		The sound cloud of the harmonic major scale on the 2nd degree (HD2) scale in E	https://e-reuter.com/mp3/harmony/e_hd2.mp3
110b		The sound cloud of the double harmonic minor scale on the 2nd degree (DHM2) scale in E	https://e-reuter.com/mp3/harmony/e_dhm2.mp3
111		The sound cloud of the harmonic minor on the 3rd degree (HM3) scale in E	https://e-reuter.com/mp3/harmony/e_hm3.mp3
111a		The sound cloud of the harmonic major on the 3rd degree (HD3) scale in E	https://e-reuter.com/mp3/harmony/e_hd3.mp3
111b		The sound cloud of the double harmonic minor on the 3rd degree (DHM3) scale in E	https://e-reuter.com/mp3/harmony/e_dhm3.mp3

112		The sound cloud of the harmonic minor on the 4th degree (HM4) scale in E	https://e-reuter.com/mp3/harmony/e_hm4.mp3
112a		The sound cloud of the harmonic major on the 4th degree (HD4) scale in E	https://e-reuter.com/mp3/harmony/e_hd4.mp3
112b		The sound cloud of the double harmonic minor on the 4th degree (DHM4) scale in E	https://e-reuter.com/mp3/harmony/e_dhm4.mp3
113		The sound cloud of the harmonic minor on the 5th degree (HM5) scale in E	https://e-reuter.com/mp3/harmony/e_hm5.mp3
113a		The sound cloud of the harmonic major on the 5th degree (HD5) scale in E	https://e-reuter.com/mp3/harmony/e_hd5.mp3
113b		The sound cloud of the double harmonic minor on the 5th degree (DHM5) scale in E	https://e-reuter.com/mp3/harmony/e_dhm5.mp3
114		The sound cloud of the harmonic minor on the 6th degree (HM6) scale in E	https://e-reuter.com/mp3/harmony/e_hm6.mp3
114a		The sound cloud of the harmonic major on the 6th degree (HD6) scale in E	https://e-reuter.com/mp3/harmony/e_hd6.mp3
114b		The sound cloud of the double harmonic minor on the 6th degree (DHM6) scale in E	https://e-reuter.com/mp3/harmony/e_dhm6.mp3

115		The sound cloud of the harmonic minor on the 7th degree (HM7) scale in E	https://e-reuter.com/mp3/harmony/e_hm7.mp3
115a		The sound cloud of the harmonic major on the 7th degree (HD7) scale in E	https://e-reuter.com/mp3/harmony/e_hd7.mp3
115b		The sound cloud of the double harmonic minor on the 7th degree (HM7) scale in E	https://e-reuter.com/mp3/harmony/e_dhm7.mp3
116		Audio: C^{maj7} chord	https://e-reuter.com/mp3/harmony/c_maj7.mp3
117		Audio: $C^{maj7/6/9}$ chord	https://e-reuter.com/mp3/harmony/c_maj7_6_9.mp3
118		Audio: Dm^7 chord	https://e-reuter.com/mp3/harmony/dm7.mp3
119		The sound cloud of the whole-tone half-tone (WTHT) scale in E	https://e-reuter.com/mp3/harmony/e_ght.mp3
120		The sound cloud of the half-tone whole-tone (HTWT) scale in E	https://e-reuter.com/mp3/harmony/e_htgt.mp3

121		The sound cloud of the whole-tone (WT) scale in E	https://e-reuter.com/mp3/harmony/e_gt.mp3
122		Wikipedia: Blue note	https://en.wikipedia.org/wiki/Blue_note
123		The sound cloud of the minor pentatonic (MP1) in E	https://e-reuter.com/mp3/harmony/e_mp1.mp3
124		The sound cloud of the minor pentatonic on the 2nd degree (MP2) in E	https://e-reuter.com/mp3/harmony/e_mp2.mp3
125		The sound cloud of the minor pentatonic on the 3rd degree (MP3) in E	https://e-reuter.com/mp3/harmony/e_mp3.mp3
126		The sound cloud of the minor pentatonic on the 4th degree (MP4) in E	https://e-reuter.com/mp3/harmony/e_mp4.mp3
127		The sound cloud of the minor pentatonic on the 5th degree (MP5) in E	https://e-reuter.com/mp3/harmony/e_mp5.mp3