Journey to the Heart of Music

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Example Q

CADENCES IN THE MOS MODEL

A cadence is a chord progression that conveys, to a greater or lesser extent, a sense of closure. This palpable sense of completion may be temporary or total in effect. A cadence may mark the termination of a phrase, section, movement or whole composition, or merely a brief pause or diversion within the onward flow of a musical idea. While all cadences in the MOS model are commensurable chord progressions – i.e. valid exchanges of mutable number digit sequences – not all chord progressions are considered to be cadences. And indeed Willi Apel remarks in the *Harvard Dictionary of Music*: “Unfortunately, the classification and terminology in this field are greatly lacking in uniformity and frequently also in clarity.” Notwithstanding such difficulties, from the viewpoint of the MOS model, a clear distinction can be drawn between cadences and chord progression in general, and from this division, a simple definition of a cadence can be obtained. Namely, that a cadence is a valid mutable number exchange consisting solely of consecutive whole number digits and bases in the most significant column; that is, the exchange is confined to neighboring integer proportions (e.g. 3:4) operating within the topmost series – the outer level of nesting – of a modulating oscillatory system. Thus a cadence is a special class of chord progression (mutable number digit exchange) which, because of its relatively simple structure and exposed position, is of particular vividness and clarity to the ear.

Indeed, the judgement of the ear is paramount: in the MOS approach, the ear's skimming of the objective notes/harmonics and the associated aural processing is posited to be equivalent to the 'math of mutable numbers'. In other words, this is to suggest that the physical procedure described elsewhere in these documents in terms of the algorithm of symmetrical exchange within systems of nested harmonic series and its equivalent formal expression – the conduct of arithmetic in a mutable base positional number system – is effectively synonymous with the ear's processing of objective musical sound. However, this is not to say that the aural cognition of music involves working out of every detail of formal mutable number exchanges but only that the ear, in finding common frequencies linking together succeeding chords (conjunctions in MOS terms), has thereby also found *by implication* the common fundamental and nested structure of mutable numbers and modulating oscillatory systems. Any chord progression that contains a common pitch accessible to the ear, whether that shared frequency be two succeeding notes and/or overtones, must also have a common fundamental – though perhaps at a frequency below the range of hearing – upon which can be constructed a valid modulation exchange. So here below, ploddingly, the analyst assigns digit sequences to chords, calculate their values and attempts to present the cadences of tonal music in the form of physical modulation exchanges and formal mutable number arithmetic; while also recognising the ear's apparent advantage in this regard in having developed a lightening fast 'mathematics of aural sensation' capable extracting the relational essence from musical sound, probably without the necessity of engaging in the full paraphernalia of a mutable base number system. Though of course a precise scientific account of aural cognition is yet to emerge, nature generally achieves its ends with elegance and economy and while it is no more that an unsubstantiated guess: what is more elegant and economical than a number system?

Finally, it must be noted that there are many other aspects involved in cadences beyond those related solely to harmony, for example, the dilation of meter and the application of rhythmic formulas. This is clearly so because cadential harmonic progressions also appear frequently as plain chord progressions within the flow of musical phrases and it is only where these other factors of melody, meter, rhythm, dynamics, etc. combine with cadential harmonies that a cadence is actually felt. (These additional factors are not considered in this document.)

Figure Q.1 reproduces a chart of the primary modulation exchanges from 1:2 to 8:9 first given in Chapter 9, Figure 9.3 (and with the exception of the plagal cadence all the illustrations below are similarly cast in terms of a fundamental tone C, plus overtones). These elemental exchanges of the MOS model form the basis upon which the common cadences of tonal music are constructed. However while the primary exchanges are the basis and beginning of the MOS view of cadences, due to the attributes and limitations of the ear and aural cognition, historical factors and the influence of stylistic development, there are inevitably further complications and permutations which have to be taken into consideration in any discussion of cadences in general. One striking example of the additional features which need to be taken into account is the marked (but not universal) preference for a descending interval in the bass. This stylistic feature perhaps derives in part from the long tradition of contrapuntal thought in western music, resulting in a natural desire for contrary motion between the outer parts – particularly in the 'standard' dominant-tonic close with its upward moving leading-note against a falling bass line. However, from the point of view of the MOS model a falling bass line normally indicates an increase in tension or energy, whereas the archetypal MOS cadential modulation exchange involves a release of tension and an upward moving bass line. Such small deviations from the norms of the model are taken to be examples of the variation and contrariness that can be expected to arise naturally in any human cultural system.

Below, each of the cadences of the tonal era is introduced under the heading of one of the elemental (upward) proportions, 1:2, 2:3, 3:4 etc., with most sections first featuring a rather more elaborate ‘prototype’ version of the basic exchange given in Figure Q.1, followed by what may be described as the more ‘normal’ formulation – the accepted configuration deriving from customary usage and historical style.

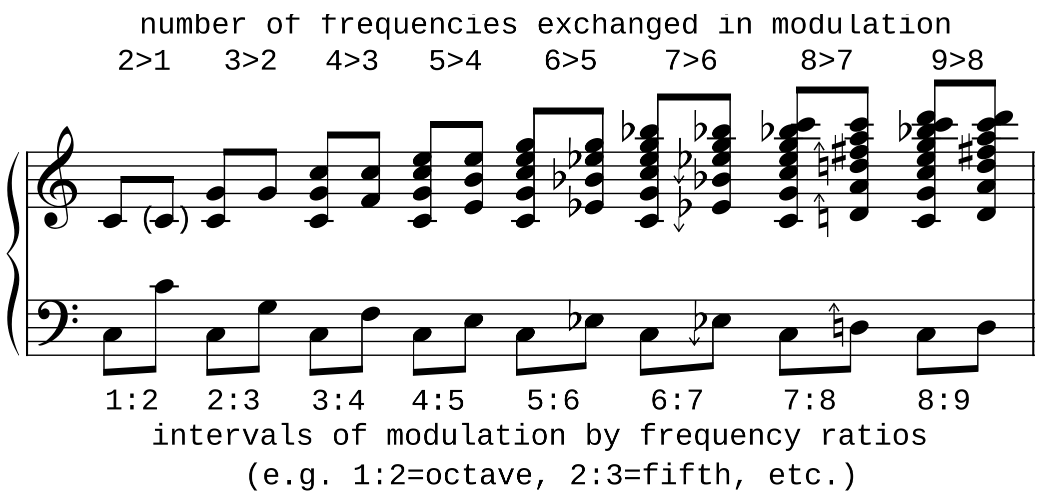
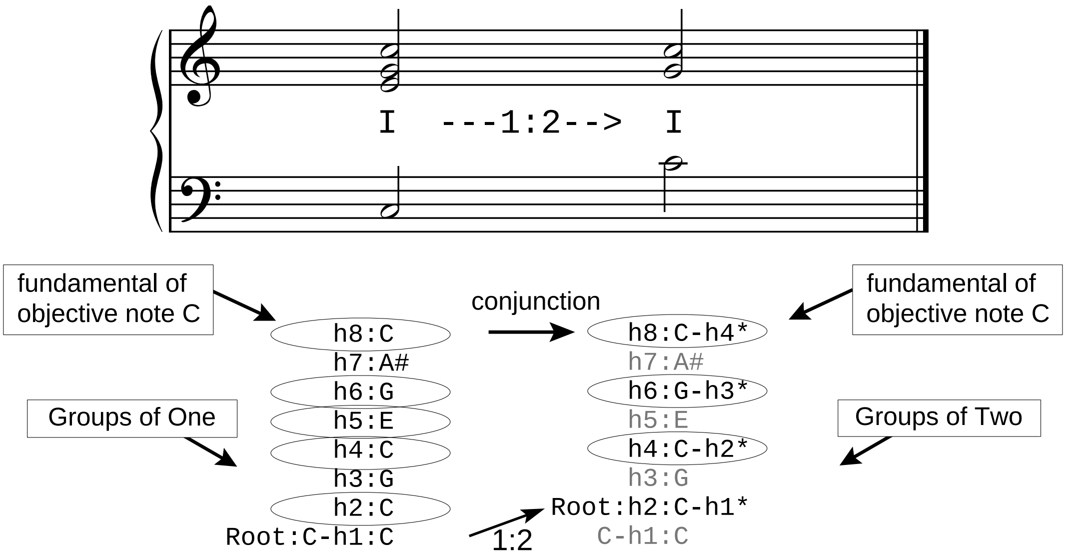


Figure Q.1 Primary modulation ratios expressed in musical (harmonic) terms. In accordance with the algorithm of symmetrical exchange, the interval of modulation (in the bass clef) is mirrored by the reverse number of notes exchanged, i.e. two notes exchanged for one produces an octave modulation, three notes for two a fifth, etc. The semitone modulation 15:16 is not reached in this illustration. (The arrow-adjusted accidentals indicate where the natural harmonics fall foul of the scale degrees.)

The 1:2 ‘Octave’ Cadence

The first and theoretically most powerful cadence of all involves the octave step, the exchange of two for one. Here, immediately, the nature of human physiology and aural cognition interposes and dictates limits upon theory – we do not hear the dupla 1:2 exchange as signifying an immense release of tension, but rather we feel little or nothing has changed! Rather strangely, the ‘octave’ cadence is in practice no cadence at all. The doubling or halving shift to essentially the same set of global relationships writ greater or smaller, underlines the fundamentally relational nature of the ‘tonal universe’. The octave cadence effectively acts as a barrier beyond which intervals, the very stuff of harmony, cannot pass (e.g. the tripla 1:3 exchange gives the impression of a sesquialtera 2:3 exchange). The dupla 1:2 modulation exchange stands guard at one edge of the harmonic space – a door that connects back into the place from which it leads – and at the further opposite edge, the limits of the ear’s sensitivity to finely grained exchanges draws another rather more hazy line (i.e. in the region of 8:9).



Modulation Exchanges: *(8 groups of 1) ---1:2---> (4 groups of 2) Nested Series*

C-h1 to h8 ----------------------------------> Nesting Series

Mutable Numbers: MBN $8_1 = 4_2 0_1$

(Decimal $8 = 8$)

Figure Q.2a The ‘Octave’ cadence in the form of a tertiary dupla 1:2 modulation exchange.

Although a great release of tension is signified by the exchange of two ratios for one – or as illustrated in Figure Q.2a eight ratios of the harmonic series for four ratios – in the tonal tradition this exchange has not be interpret as a cadence. Indeed, logically what should be the biggest full close of them all, appears to largely pass our ears by. The reason for this can probably be traced to the ear’s reaction to the perfect match between the harmonic spectra of the two chords. In ascending form, the ear perceives the notes and associated overtones of the first chord followed by, not a distinctly different set of frequency relationships, but rather, a strengthening of every even-numbered harmonic and a diminution or disappearance of each odd-numbered harmonic. And, if the ‘octave’ cadence is descending, all of the first chord’s spectra will be matched by the second chord. The ear’s reaction in this situation is to interpret the chord succession, essentially, as a modification to an existing sound – over time some harmonics become more prominent while others have faded. This is a typical pattern for natural sounds. Put in terms of the MOS model, the two mutable numbers (i.e. the two chords of the ‘octave cadence’) have essentially the same digit sequences, only the unit in which they are denominated has changed. The digit sequence is doubled or halved but the meaningfulness of the internal relationships remains constant. What this suggests is that the aural cognition of tonal music is highly dependent upon detecting changes between the internal frequency relationships of musical sounds while being much less concerned with absolute changes in frequency. From the ear’s perspective the two chords of the ‘octave’ cadence present it with an cornucopia of conjunction frequencies, at least one conjunction for every other overtone generated by the second chord, and without any change to the internal structure between the two chords the perception is of continuity rather than change. This perhaps provides a physical basis to the concept of pitch classes, much used in modern musical set theory.

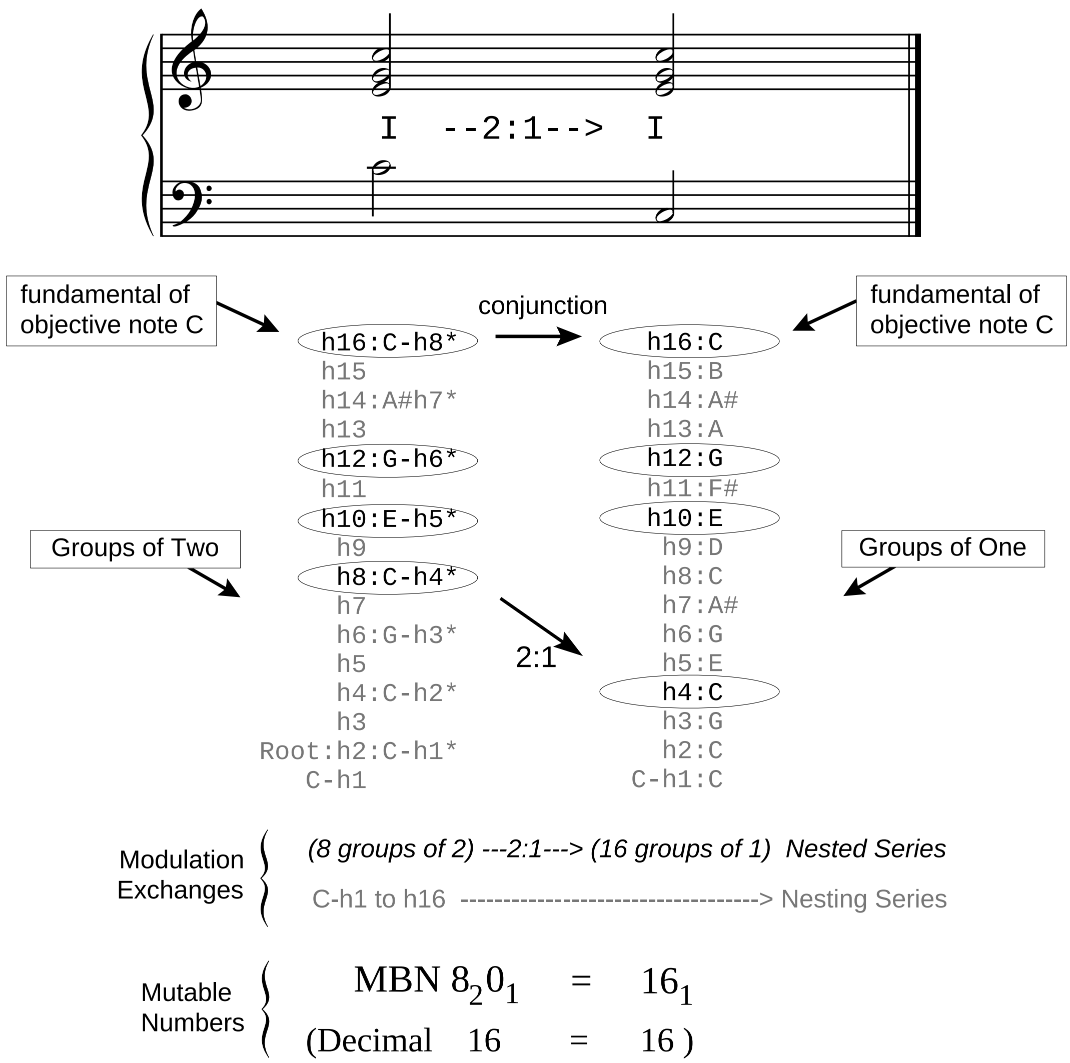


Figure Q.2b The ‘Octave’ cadence in the form of a descending or reverse quaternary dupla 2:1 modulation exchange.

REGULAR CADENCES

Of the two ‘standard’ tonal cadences – the V–I full cadence and the IV–I plagal cadence – the plagal cadence has tended to feature more in the music of earlier composers in the tonal era, the cadence being rather popular with composers up to the end of the sixteenth century, thereafter falling out of general use. The cadence’s particular virtue is that the conjunction tone of the exchange is the root of the tonic chord (and the fifth of the preceding subdominant) which allows the principal melody (not always in the upper part) to reach the tonic-finalis in the penultimate chord of the cadence, thereby reinforcing the impression of closure. Probably the strength of melodic/contrapuntal thought throughout the first half of the tonal era, combined with the lasting influence of modal practice and theory, made the characteristics of the plagal cadence an amenable face of harmony’s most effective modulation exchange (i.e. the juxtaposition of chords based on a frequency difference of 2 and 3). There is a trend in the use of cadences running through the tonal era that leads from II–I, through IV–I, to the total domination of V–I. Quite early in the tonal period the overtly melodic II–I (7:8, 8:9 and 9:10) cadences disappear, as the growing harmonic structuring of tonal music provides the more powerful ratios of exchange involving two and three and thus arguably a more profound sense of closure. Though consciously composers often continued to think in melodic terms, increasingly their unconscious harmonic instincts were being guided first towards the use of the plagal cadence and full cadence in more or less equal measures and from the seventeenth century onward, toward a marked preference for the full (V–I) cadence.

In a full cadence the added potency of an ascending leading-tone – melodically the seventh scale degree rising to the tonic (e.g. B-->C) – enhances the power of the progression. Interestingly the II–I cadence also features an ascending leading-tone – Figures Q.9a and Q.11. Thus to some degree the full cadence (V–I) can be viewed as combining the harmonic power of the exchange of frequencies built on ratios of two and three, with the melodic power of the leading-note succession. Indeed, in the V^7–I full cadence a semitone succession is doubly manifest: both rising and falling. For example, in the chord progression G^7 to C-major: B-->C ascending and F-->E descending. The ascending leading-note motion is the more energetic and 'ear-catching' of these two semitonal voice-leadings and perhaps significantly it is the more passive descending form (F-->E) alone that is found in the plagal cadence (IV–I) – Figure Q.3b. Looked at from a dualistic standpoint, the plagal cadence's descending half-step F-->E is rather reminiscent of an inverted full cadence, particularly so if the subdominant chord takes the minor form (iv–i); however, to obtain a complete inversion of V–I would require the minor tonic as well (iv–i).

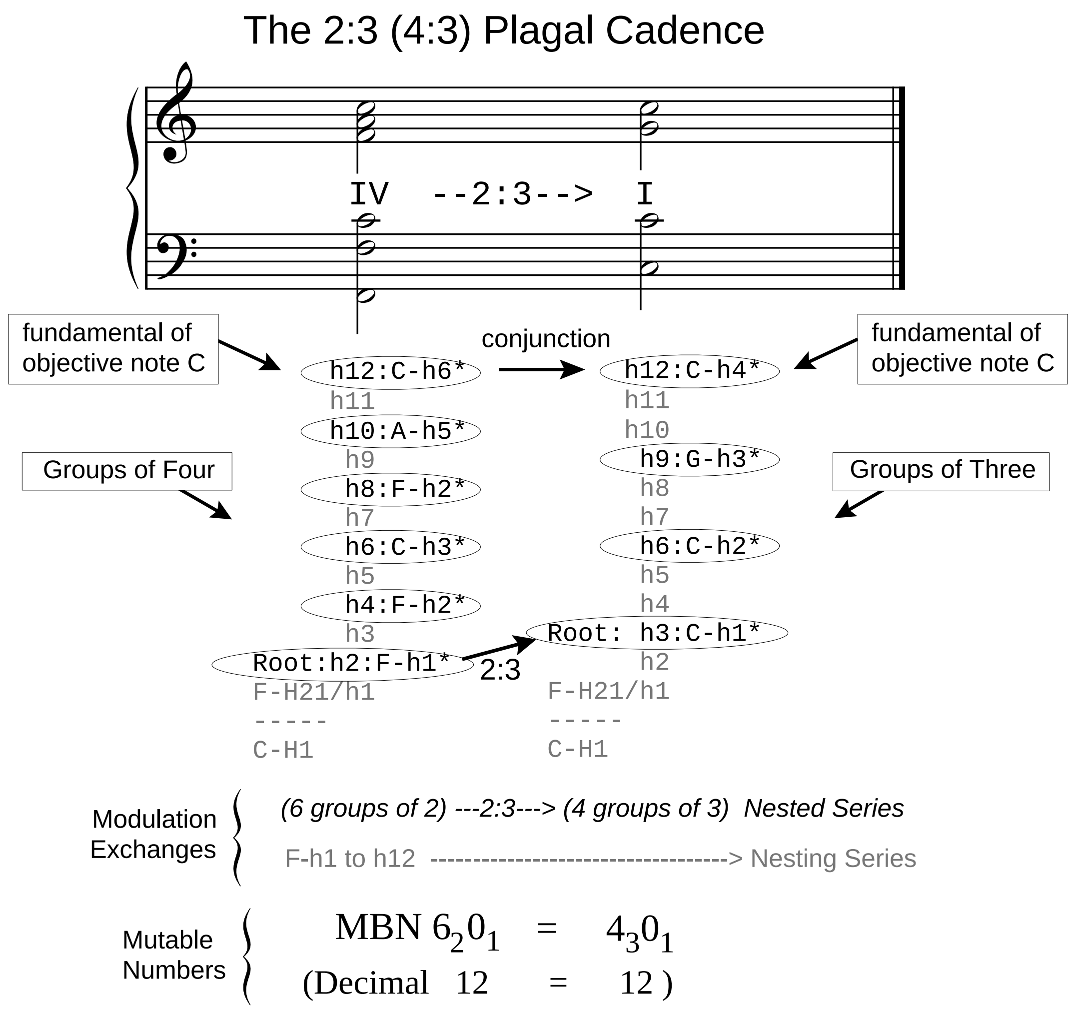


Figure Q.3a The Plagal cadence in the form of a secondary sesquialtera 2:3 modulation exchange

Perhaps also a contributing factor in the early prevalence of the plagal cadence was the conservative stylistic feature of omitting the interval of a third from the final chord. Given this empty configuration (illustrated in Figure Q.3a) the plagal cadence could be obtained within twelve ratios of the harmonic series, and in such a simple arrangement the cadence might have been more readily grasped, in relational terms, by the gradually emerging tonal consciousness of the late medieval 'ear'. Often composers would dwell upon the subdominant chord with complex contrapuntal figuration, the ornamental resolution of dissonance and strong dilation of the pulse before finally moving to the closing tonic chord, as if to help reinforce the cadential quality of the IV–I plagal cadence.

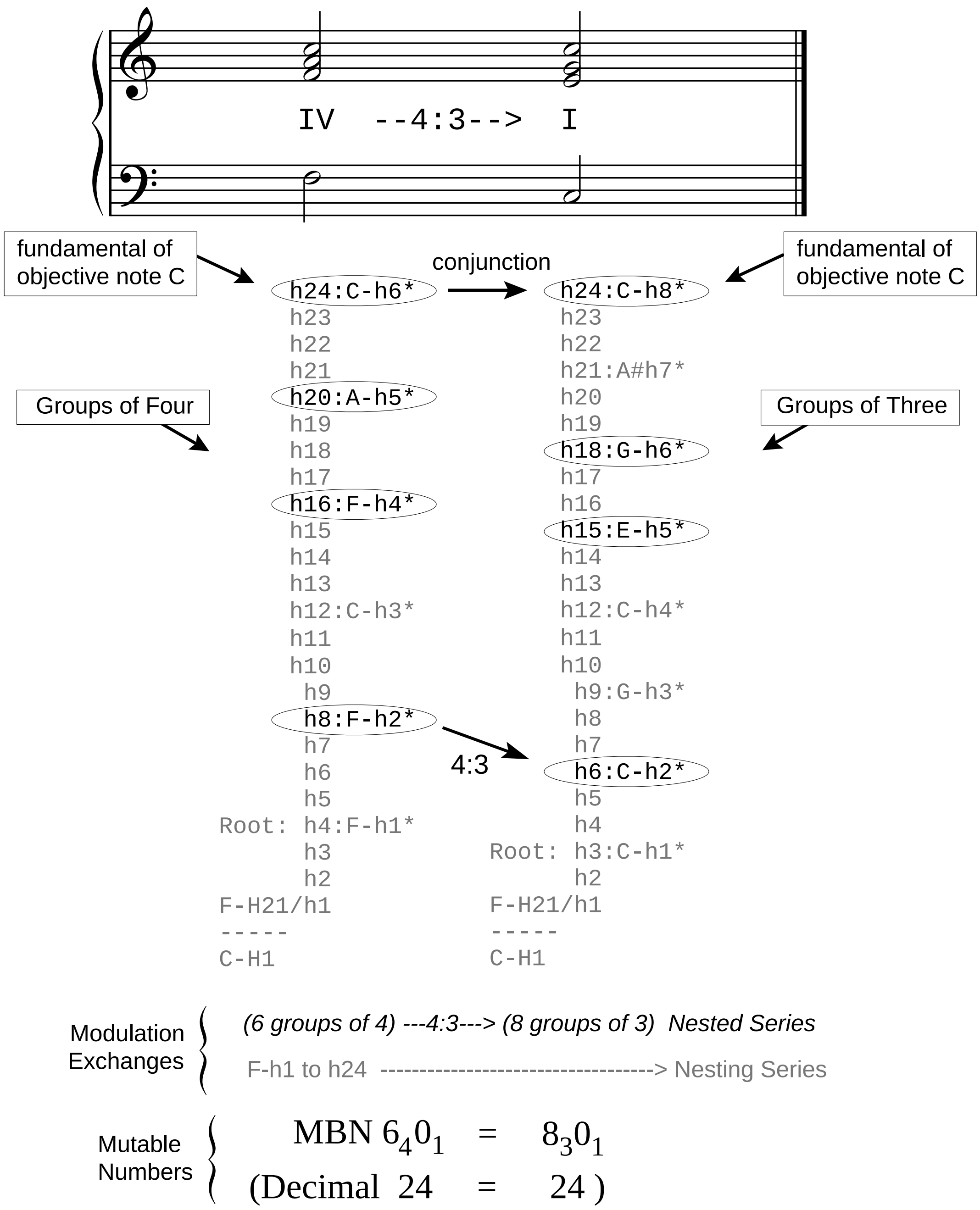


Figure Q.3b The Plagal cadence in the form of a downward or reverse secondary sesquialtera 4:3 modulation exchange.

The 3:4 (3:2) Full Cadence

The full cadence (V–I) is the defining musical termination of the tonal era. This cadence, in its many possible configurations, was the pre-eminent final cadence throughout the tonal era and particularly during zenith of tonal composition from the middle of the seventeenth century to the close of the nineteenth century.

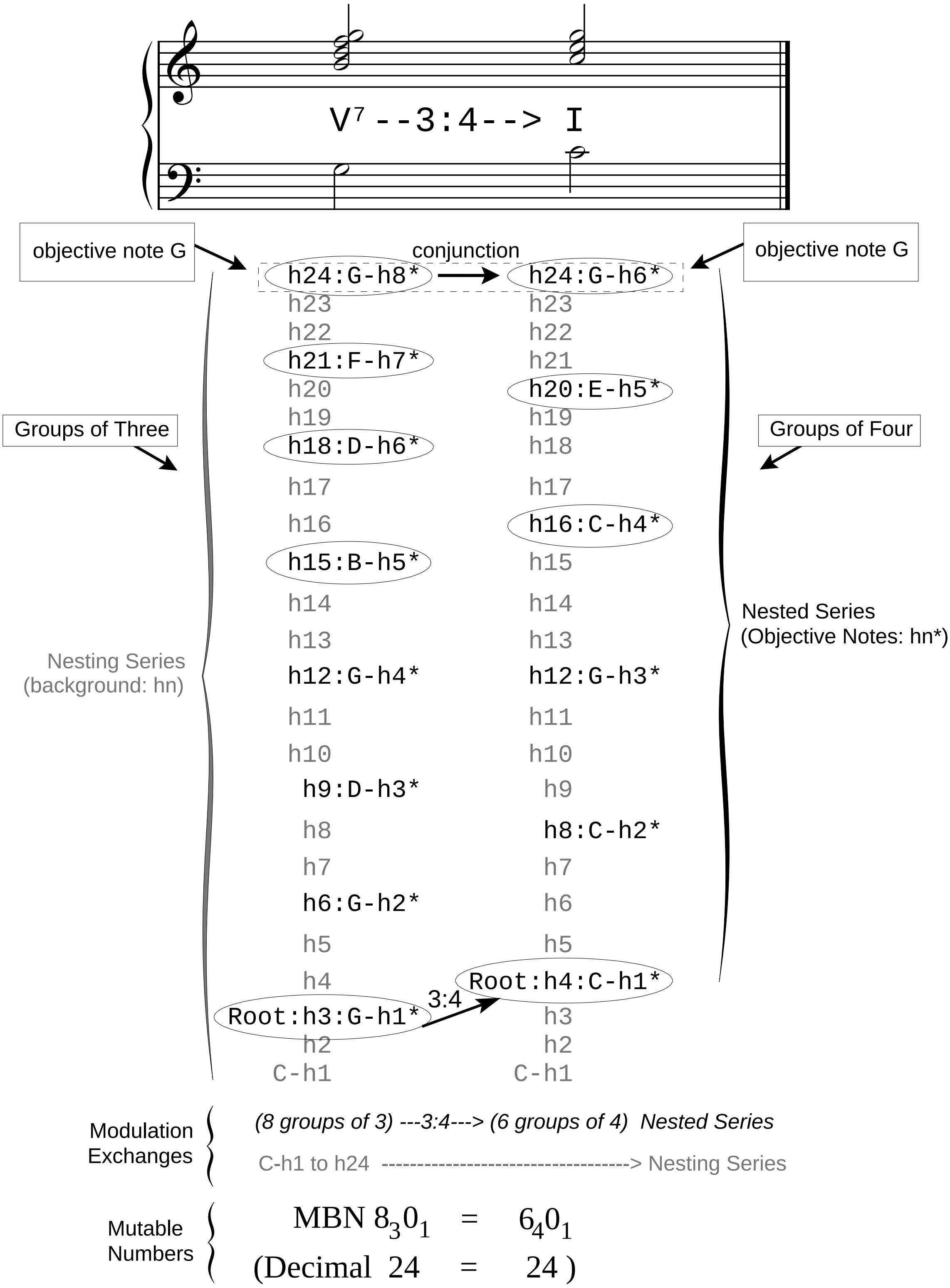
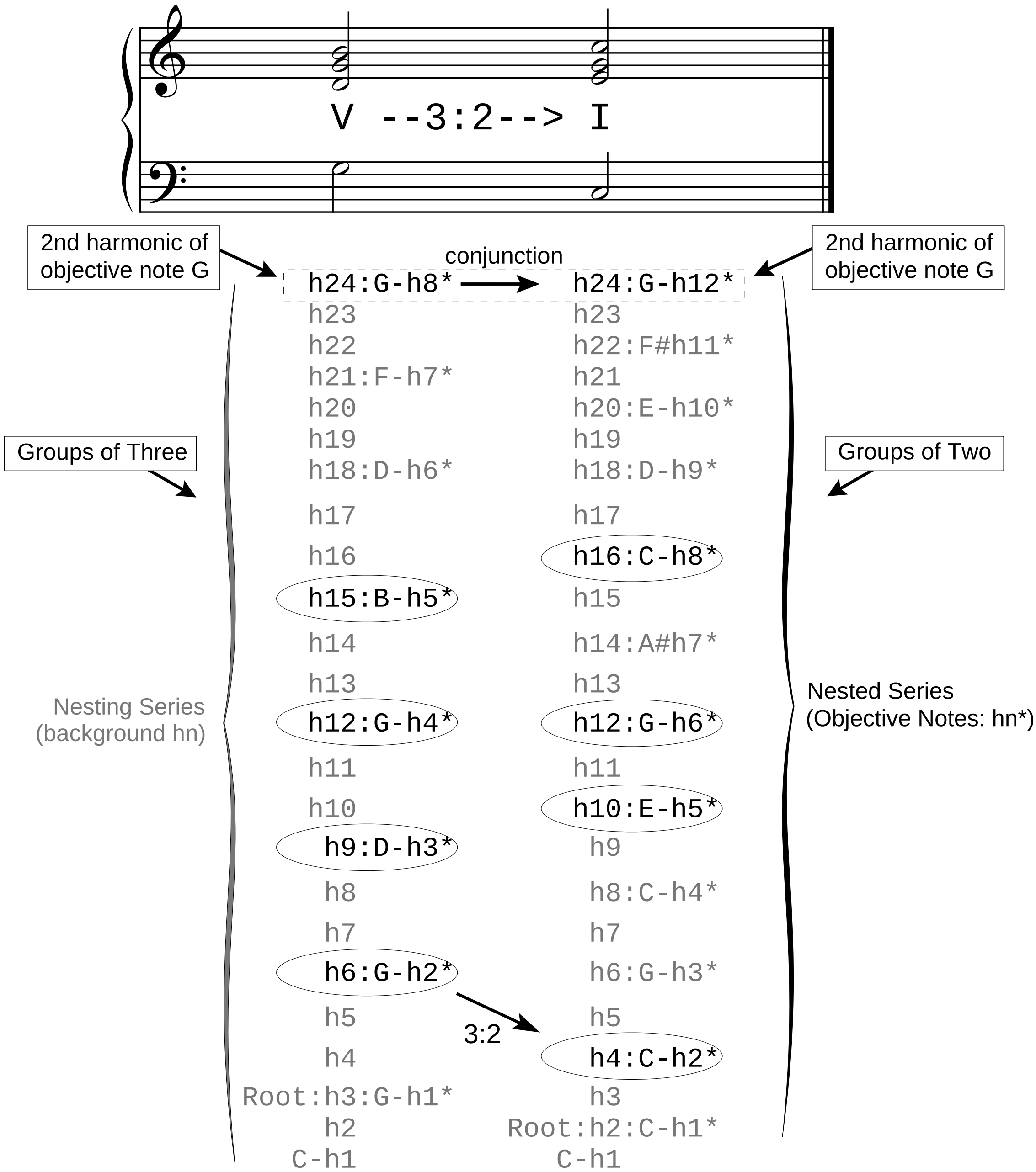


Figure Q.4a The Full cadence in the form of a secondary sesquitertia 3:4 modulation exchange.

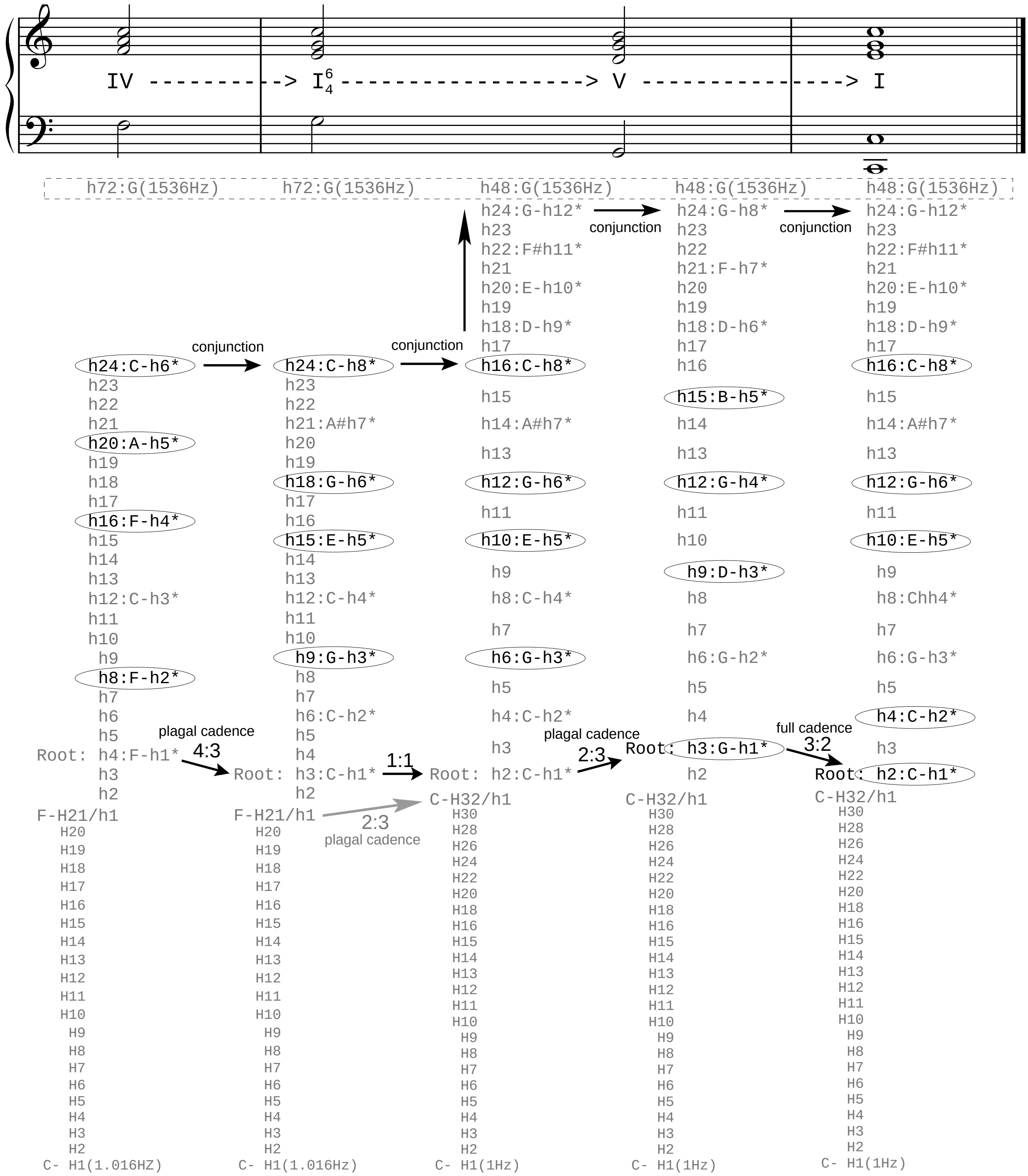
The full cadence in its most absolute form – the authentic cadence (Figure Q.4b) – is configured so that the leading-note rises to the tonic in the upper part (B-->C) while in the bass the dominant note, the fifth scale degree, falls to the tonic. Optionally the penultimate chord my include a minor-seventh.



Modulation Exchanges { *(8 groups of 3) ---3:2---> (12 groups of 2) Nested Series*
C-h1 to h24 ----------------------------------> Nesting Series

Mutable Numbers { MBN $8_3 0_1 \; = \; 12_2 0_1$
(Decimal 24 = 24)

Figure Q.4b The ‘authentic’ Full cadence in the form of a downward or reverse secondary sesquialtera 3:2 modulation exchange.



(6 groups of 4) ---4:3---> (8 groups of 3) ----1:1---> (8 groups of 2)
(+4 groups of 2)
(12 groups of 2) ----2:3---> (8 groups of 3) ---3:2---> (12 groups of 2)

(8 x three) --2:3----------> (8 x two)
(+8 x one)
(12 x two) -------------------------------------- Nested Series--->

C-h1 to hn -- Fundamental Series --->

Modulation Exchanges

$$\text{MBN}\ \ 6_4 0_{21} 0_1 = 8_3 0_{21} 0_1 \simeq 8_2 0_{32} 0_1 + 4_2 0_{32} 0_1 = 12_2 0_{32} 0_1 = 8_3 0_{32} 0_1 = 12_2 0_{32} 0_1$$

$$(\text{Decimal}\ \ 504 = 504 \simeq 512 + 256 = 768 = 768 = 768\,)$$

Mutable Numbers

Figure Q.4c A Mixed Cadence: two Plagal cadences nesting within another more fundamental Plagal cadence.

The tonal canon falls naturally into two broad halves with the first period dominated by vocal music and the second by instrumental music. It could be argued that there might be a connection between the rise of instrumental music during the second-half of the tonal era and the declining use of the plagal cadence. In contrast to the relatively subdued harmonic spectra of purely vocal music, the strength of the higher harmonics in the sound produced by most instruments perhaps favored the move from one cadential form to the other. Both the plagal and full cadences juggle a basic relationship between ratios of two and three, and both achieve their commensurability through the conjunction of tones. However, while the plagal cadence is conjoined by the tonic note, the full cadence uses the more distant fifth degree of the scale (the dominant) for its conjunction and perhaps the vividness with which instrumental timbres produce the third, fourth, fifth and sixth harmonics renders the full cadence somewhat more effective in instrumental music. Of course this would not be the sole cause for the declining use of the plagal cadence, many other factors are involved such as the full cadence allowing the powerful motion of leading-note succession rising to the tonic mentioned above and not available in the subdominant chord.

Finally, there are two other cadences involving the dominant and tonic chords: the Half cadence and the Mixed cadence. The half cadence (I–V) reverses the order of the full cadence and normally occurs within the broad sweep of a musical idea rather than at the end point. The Mixed cadence (Figure Q.4c) is really a cadential formula, two cadences set back to back: a plagal cadence followed by a full cadence (IV–I–V–I). In this arrangement the first tonic chord generally takes a six–four configuration resolving to the the dominant. In the MOS interpretation of the mixed cadence the overall structure resembles the nesting of two cadences within another cadence, rather like the structure of the II–V–I cadential formula discussed in Example P, however for the mixed cadence the nested structure is built of plagal cadences (followed by a full cadence). As well as the individual arrow-marked conjunctions (Figure Q.4c), the four chords of this cadential formula are united by the common frequency G-1536Hz – the third harmonic of C and the fourth harmonic of G – thus present in each chord's spectra. Another approach to the mixed cadence treats the tonic six-four chord as an appoggiatura to the dominant rather than a harmony in its own right and though not illustrated in Figure Q.4c this construction may be obtained via a sesquioctava 8:9 exchange (i.e. 4:3 × 2:3 = 8:9).

IRREGULAR CADENCES

In traditional harmonic theory the many varieties of cadence that are found in the music of the period of common practice other than the full and plagal cadences are generally classified together as 'irregular' cadences. These irregular cadences are conventionally held to be formed by the substitution of the final tonic chord of the two standard cadences by some other chord. Many terms have been coined to describe these irregular cadences – avoided, broken, evaded, surprise, false, interrupted, deceptive, etc. – and there is a degree of imprecision and overlap in the use of these names. The traditional view appears to be rather inadequate on two counts: it does not recognise the irregular cadences as structures in its own right but rather treats them as altered forms of the standard cadences and it does not distinguish analytically between the many different types of irregular cadence. In contrast the MOS approach is to interpret all cadences as different forms of one structure arising from the application of one process – the algorithm of symmetrical exchange. The model distinguishes between different irregular cadences (and indeed all cadences) through differing ratios of exchange confined to the outer layer of nesting – i.e. the most significant mutable digit.

Perhaps the most recognisable of the irregular cadences is the deceptive/interrupted cadence which is formed by an ascending step progression between the cadential chords. Most typically this cadence occurs on the dominant to submediant scale degrees (i.e. chords V–vi and V–VI), through it can be formed on other degrees and even with a half-step between the chords. This progression is discussed under the ratios 7:8 and 9:10 but before this, some less common irregular cadences built on wider ratios must be considered.

The 4:5 (5:4) Irregular 'Major-third' Cadence

Between the standard full/plagal cadences involving intervals of a fourth and fifth, and the relatively strongly characterised deceptive cadence based on a step interval, lie the weaker cadences built on intervals of a major-third and minor-third. In Figure Q.5a an ascending major-third interval between the chord roots is illustrated, with the final chord taking (an optional) minor form. Figure Q.5b reverses the chord sequence of Q.5a so as to produce a descending major-third interval between the chord roots and the E-based chord in this example is shown in its major form.

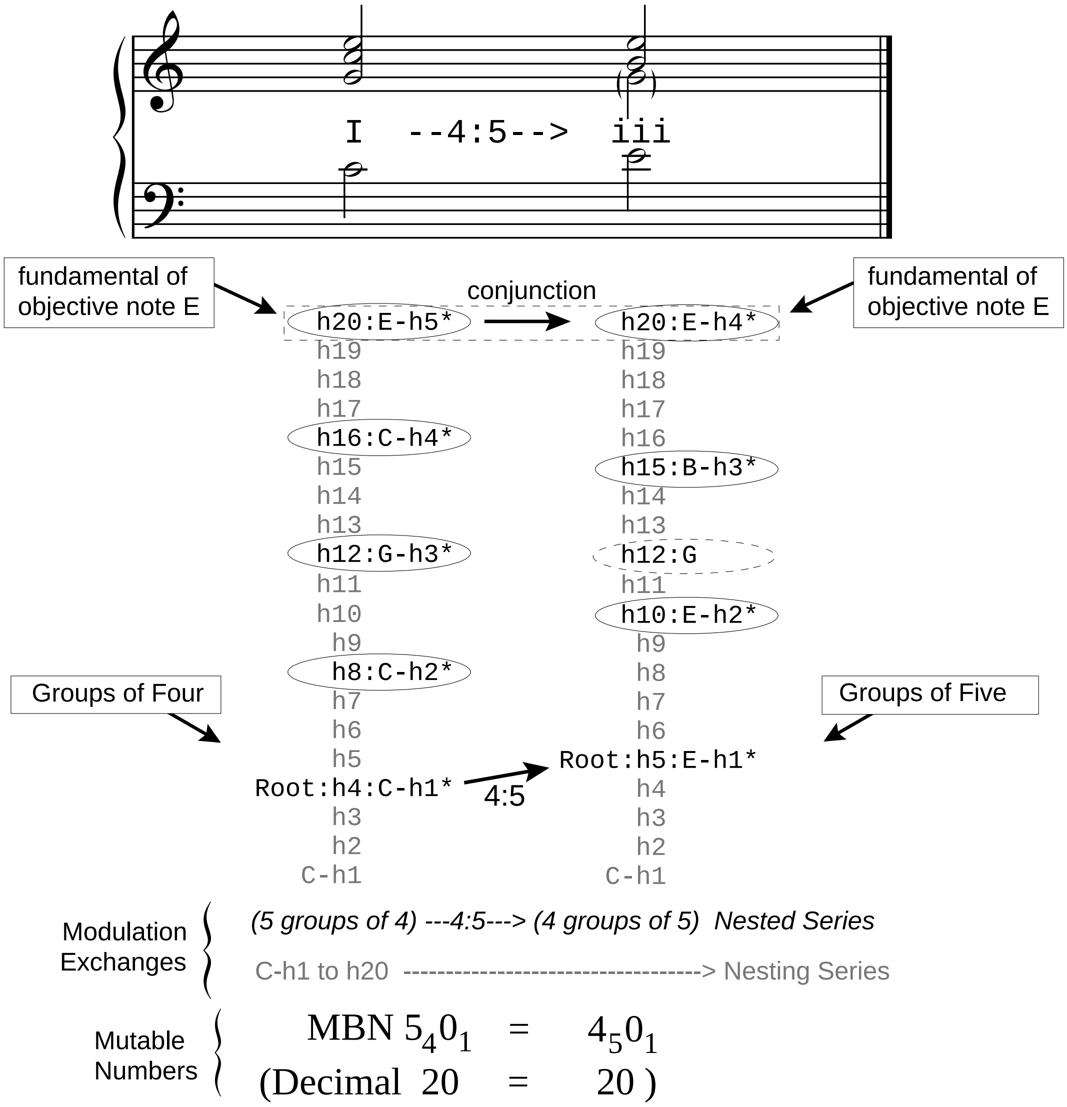
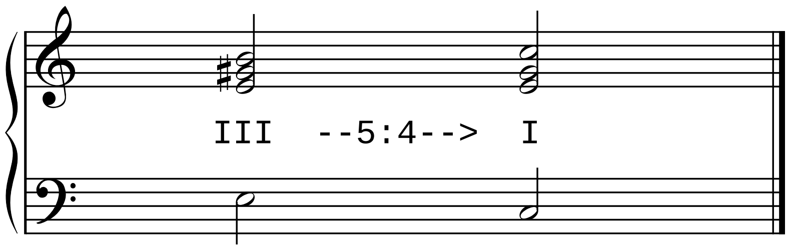


Figure Q.5a An Irregular cadence in the form of a primary sesquiquarta 4:5 modulation exchange. If G-h12 from the underlying series is allowed to interpose within the nested groups of five based on E-h5, a minor close can be obtained from the 4:5 cadence.



2nd harmonic of objective note E

conjunction

2nd harmonic of objective note E

h40:E-h8*	h40:E-h10*
h39	h39
h38	h38
h37	h37
h36	h36:D-h9
h35:D-h7*	h35
h34	h34
h33	h33
h32	h32:C-h8*
h31	h31
h30:B-h6*	h30
h29	h29
h28	h28:A#h7*
h27	h27
h26	h26
h25:G#h5*	h25
h24	h24:G-h6*
h23	h23
h22	h22
h21	h21
h20:E-h4*	h20:E-h5*
h19	h19
h18	h18
h17	h17
h16	h16:C-h4*
h15:B-h3*	h15
h14	h14
h13	h13
h12	h12:G-h3*
h11	h11
h10:E-h2*	h10
h9	h9
h8	h8:C-h2*
h7	h7
h6	h6
Root:h5:E-h1*	h5
h4	Root:h4:C-h1*
h3	h3
h2	h2
C-h1	C-h1

Groups of Five

Groups of Four

5:4

Modulation Exchanges
(8 groups of 5) ---5:4---> (10 groups of 4) Nested Series
C-h1 to h40 -----------------------------------> Nesting Series

Mutable Numbers
$$\text{MBN } 8_5 0_1 = 10_4 0_1$$
$$(\text{Decimal } 40 = 40)$$

Figure Q.5b An Irregular cadence in the form of a downward or reverse secondary sesquiquarta 5:4 modulation exchange. In this arrangement the cadence closes on a major chord.

The 5:6 (6:5) Irregular ‘Minor-third’ Cadence

The irregular cadence based on a root movement of a minor-third is likewise illustrated ascending and descending; however, in this case two different ratios are used: 5:6 and 6:7. Equal-temperament obliterates the possibility of savouring the true quality of the latter proportion because the interval between G-h6 and A#h7 (6:7) is stretched into a tempered minor-third (i.e. 5:6 = 6:7.135...). This, combined with the tolerance of the ear results in two different cadential chord progressions both fitting a root movement of a minor-third. Indeed, as the ratios of exchange between cadential chords become ever finer, more viable chord progressions emerge. For the whole step ‘major-second’ cadence there are three ratios: 7:8, 8:9 and 9:10.

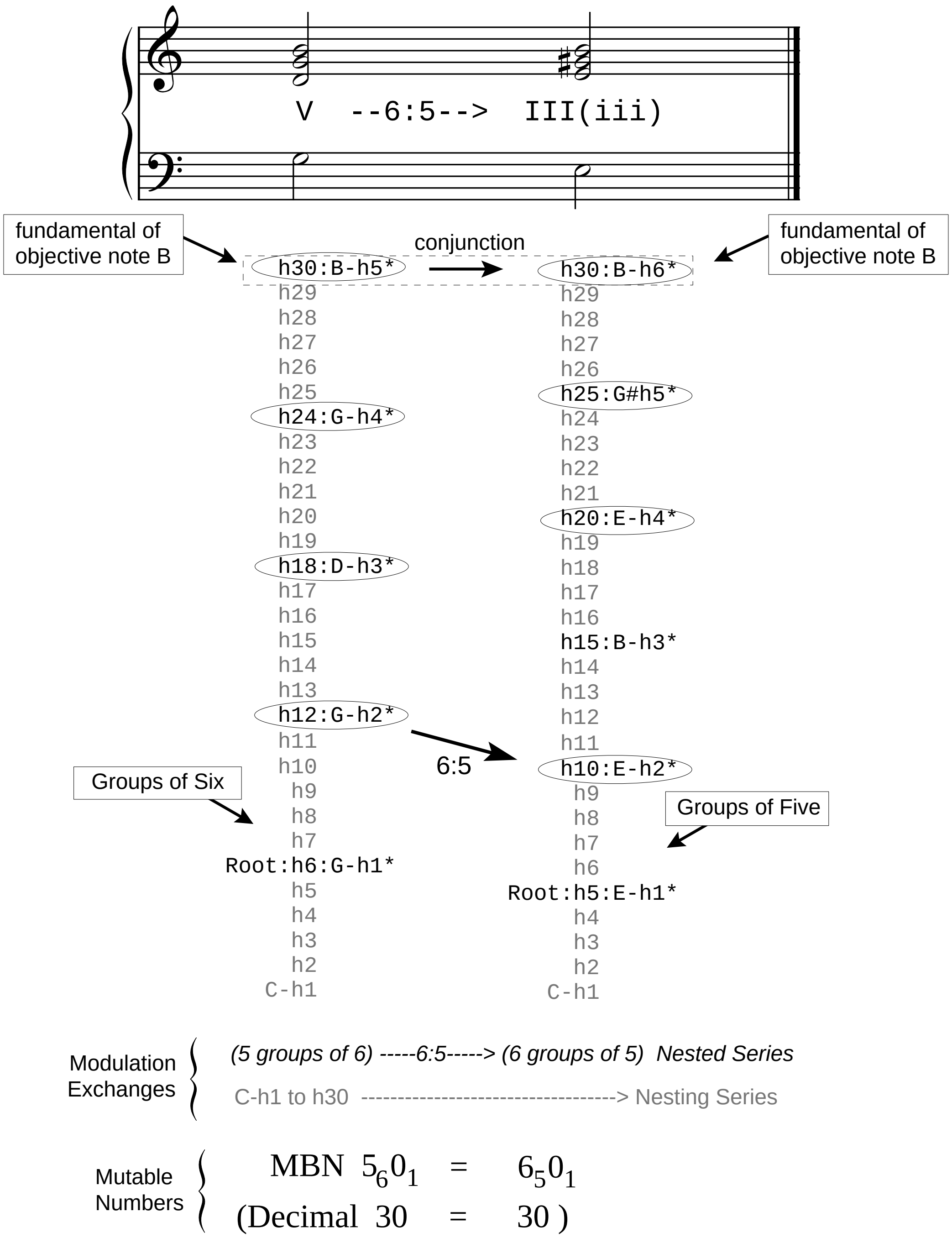
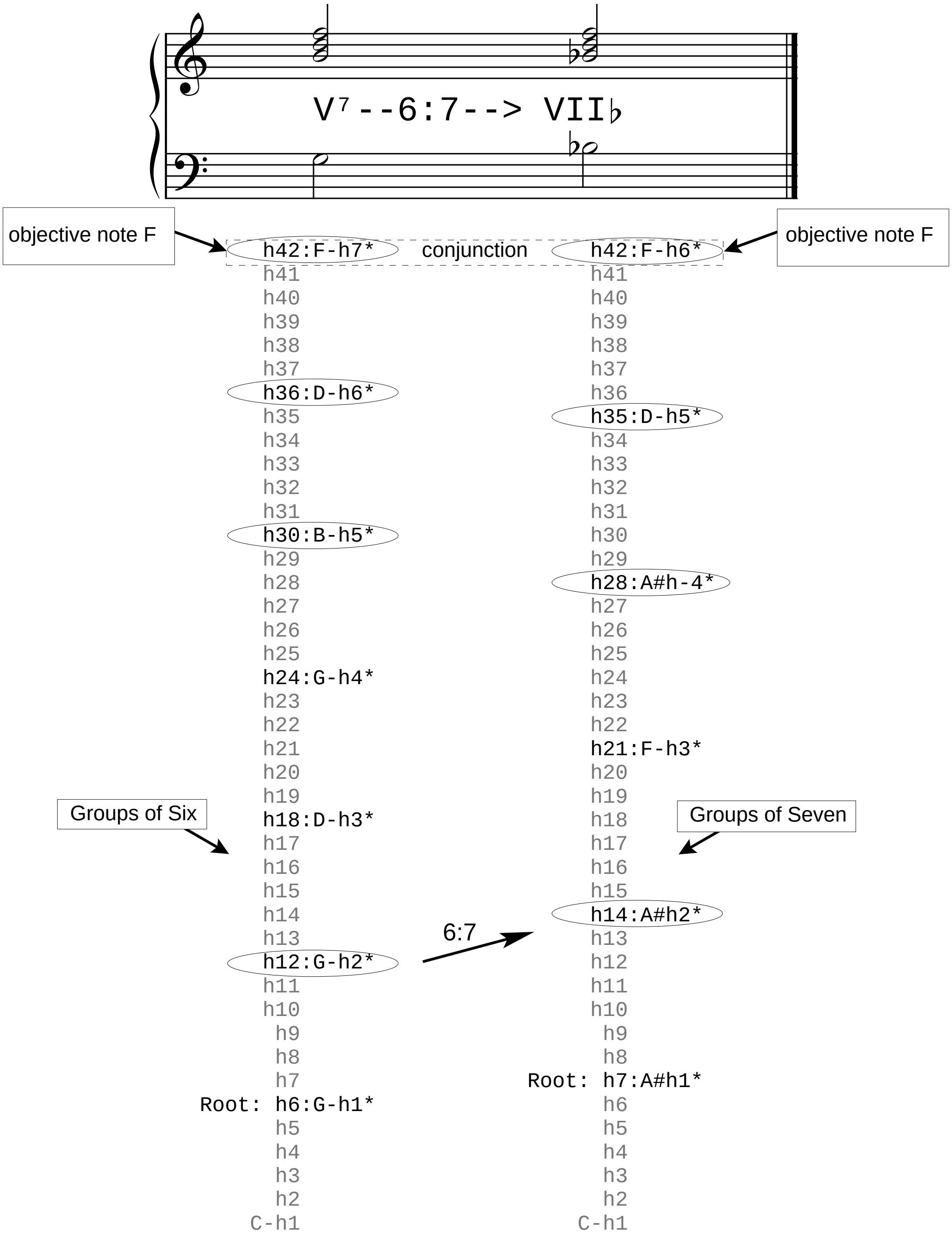


Figure Q.6a An Irregular cadence in the form of a downward/reverse primary sesquiquinta 6:5 modulation exchange.

The 6:7 Irregular 'Minor Third' Cadence



Modulation Exchanges: *(7 groups of 6) ------6:7------> (6 groups of 7) Nested Series*

C-h1 to h42 ------------------------------------> Nesting Series

Mutable Numbers:

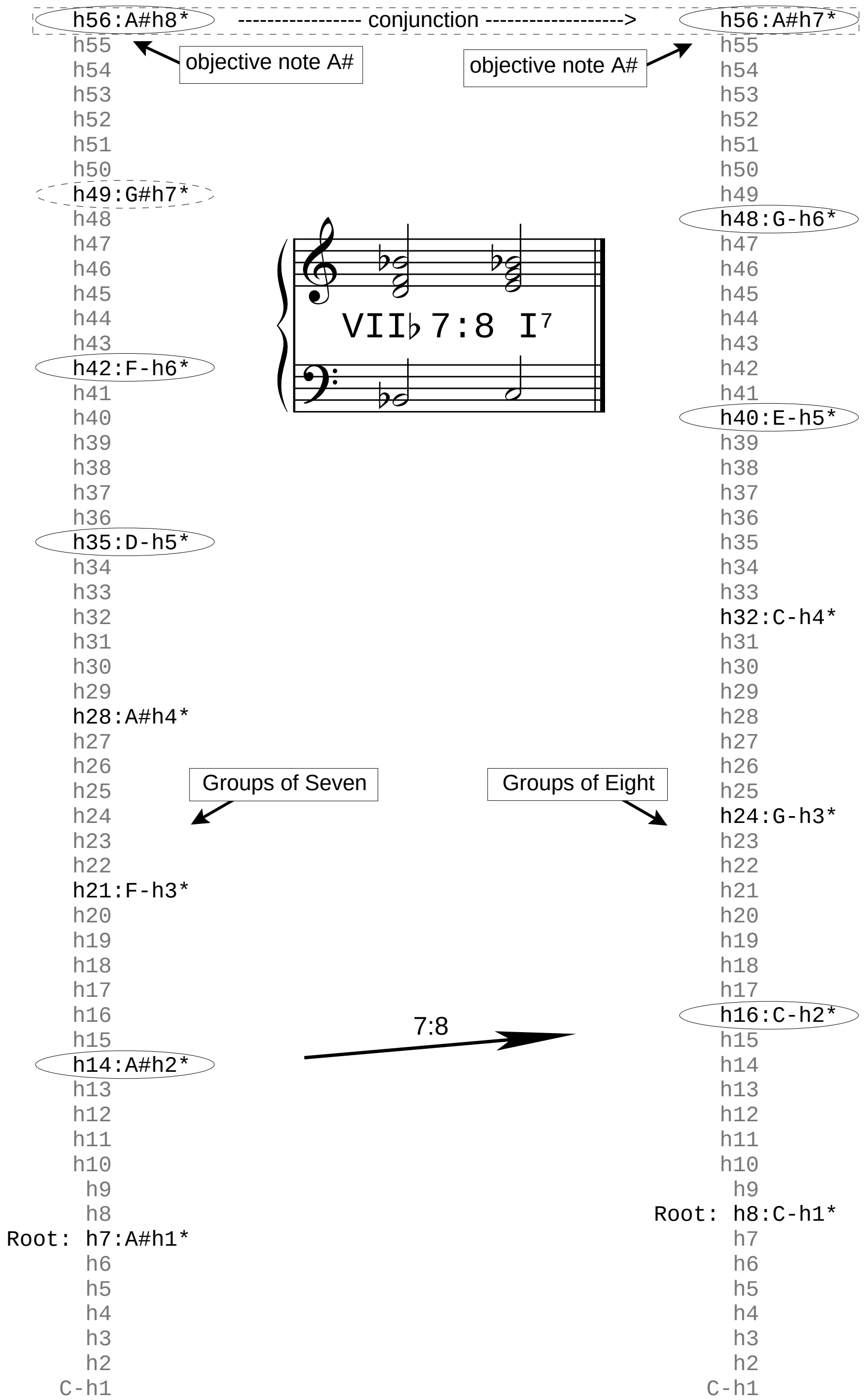
$$\text{MBN } 7_6 0_1 = 6_7 0_1$$

$$(\text{Decimal } 42 = 42)$$

Figure Q.7a An Irregular cadence in the form of a primary sesquiquinta 6:7 modulation exchange.

The 7:8 Deceptive 'Major Second' Cadence

(See also below under 9:10 Deceptive Cadence.)



Modulation Exchanges
(8 groups of 7) --------------------------7:8--------------------------> (7 groups of 8) Nested Series
C-h1 to h56 --> Nesting Series

Mutable Numbers

$$\text{MBN } 8_7 0_1 = 7_8 0_1$$

$$(\text{Decimal } 56 = 56)$$

Figure Q.8 The major-major Deceptive cadence in the form of a primary sesquiseptima 7:8 modulation exchange.

The 8:9 (9:8) ‘Landini’ Cadence

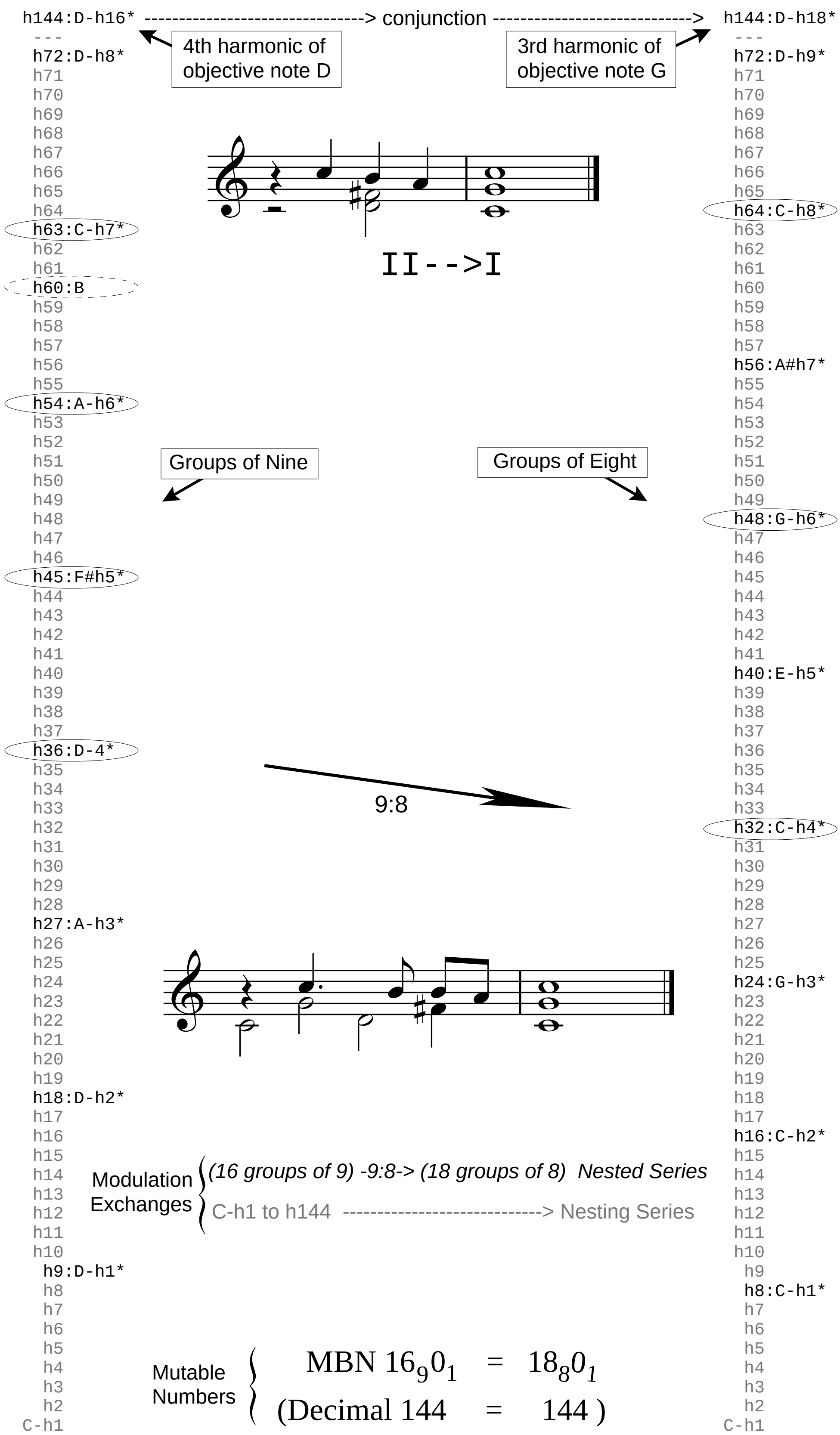


Figure Q.9a The Landini cadence in the form of a downward/reverse secondary sesquioctava 9:8 modulation exchange.

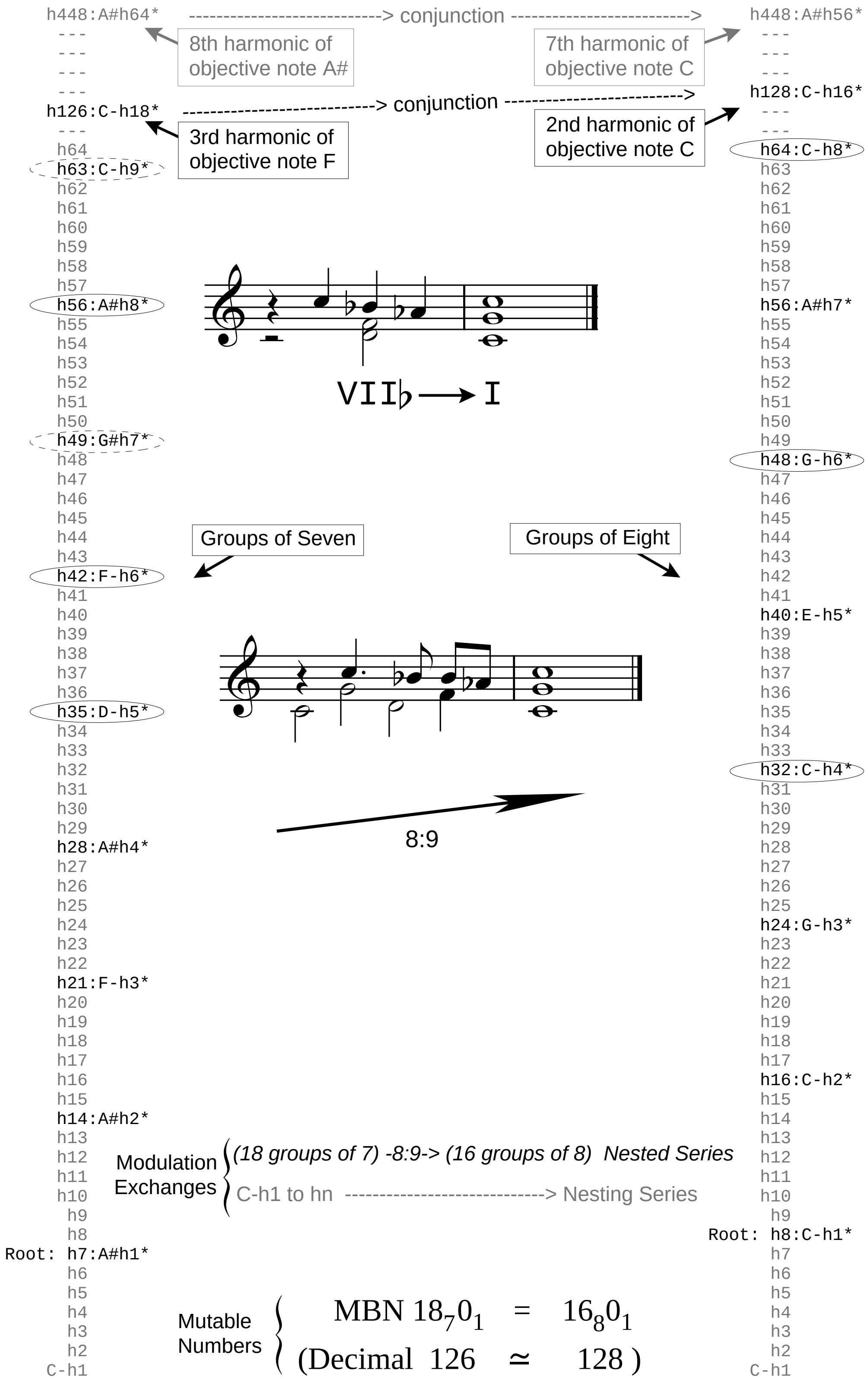


Figure Q.9b The Landini cadence in the form of a secondary sesquioctava 8:9 modulation exchange. Interestingly this less common form of the cadence fudges the math of exchange to produce a slightly 'bent' conjunction, but a conjunction acceptably within the tolerance of the ear.

Named after Francesco Landini (1325–1397) a leading composer of the Italian Ars Nova, the Landini cadence is an elaborated form of the II–I leading-note cadence in which the seventh scale degree falls to the sixth scale degree before finally rising to the tonic. This simple formula was often further ornamented, particularly by repetition of the seventh scale degree. The Landini cadence was one of the stylistic cliches of the Burgundian school and one of the most commonly used forms of the leading-note cadence which dominated the opening years of the tonal era. Although the Landini cadential flourish blunted its direct effect, implicitly the cadence contains two ascending semitone successions like the double leading-note cadence below– illustrated in Figure Q.11.

Rather exceptionally, a flattened form of the cadence was also occasionally used by composers– illustrated in Figure Q.9b – and in this unusual arrangement groupings of 7 and 8 ratios are exchanged at the rate of 8:9! Explicitly, 7 × 9 approximately equals 8 × 8. Again this feature derives from the fineness of ratios of exchange combined with the tolerance of human hearing – the ear and aural cognition is not interested in the ‘bent’ mathematics of the exchange but rather in discovering order and meaningful relationship in the sound. This it finds in the near conjunction of harmonics h126 and h128.[1]

The 9:10 Deceptive Cadence

The ‘deceptive’ cadence is perhaps the most well-characterised of the multitude of irregular cadences and it is normally considered in terms of a full cadence in which the terminating tonic chord is ‘deceptively’ supplanted by a submediant chord, either major or minor. Thus in a major key the full cadence V–I might be deceptively changed to become V–vi (Figure Q.10) or in a minor key V–VI (Figure Q.8 – a similar deceptive cadence can also be constructed on the ratio 8:9). The effect of the progression is to divert the forward impetus of the harmonic motion (usually toward a standard cadence) on to a side path where the phrase may ‘linger’ or be elaborated upon, before resuming its expected course toward the cadence.

The 15:16 Double Leading-note Cadence

Naturally the ear could not possibly grasp a harmonic series stretching from h1 up to h240 but perhaps the ear and aural cognition can do something simpler and equivalent to computing the mutable number exchange MBN $16_{15}\,0_1 = 15_{16}\,0_1$, that is, to notice that two contiguous harmonics generated by a chord progression are the same. In Figure Q.11 this would involve connecting the eighth harmonic of objective note B to the fifth harmonic of note G in the succeeding chord. Certainly this is something of a stretch and toward the farther reaches of the ear’s sensitivity. However, to ears schooled on the easy harmonic ratios of two and three which predominate in tonal music it is perhaps not impossible that aural cognition would apply such skills to fainter and more distant stimuli. Of course in this exchange there are very strong melodic cadential clues provided by the voice leading of two semitone successions (F#–G and B–C) and probably at the opening of the tonal era (1400–1500) when these cadences were in use, the melodic component was even more strongly felt by contemporary musicians. Today perhaps we hear these antique cadences as having a greater harmonic content than their original authors would have perceived. Indeed looking back across the history of western music from the perspective of the farther edge of the tonal era, we can perhaps decern the beginnings of a trend toward tonal organisation of which the composers and musicians of the time were entirely unaware.

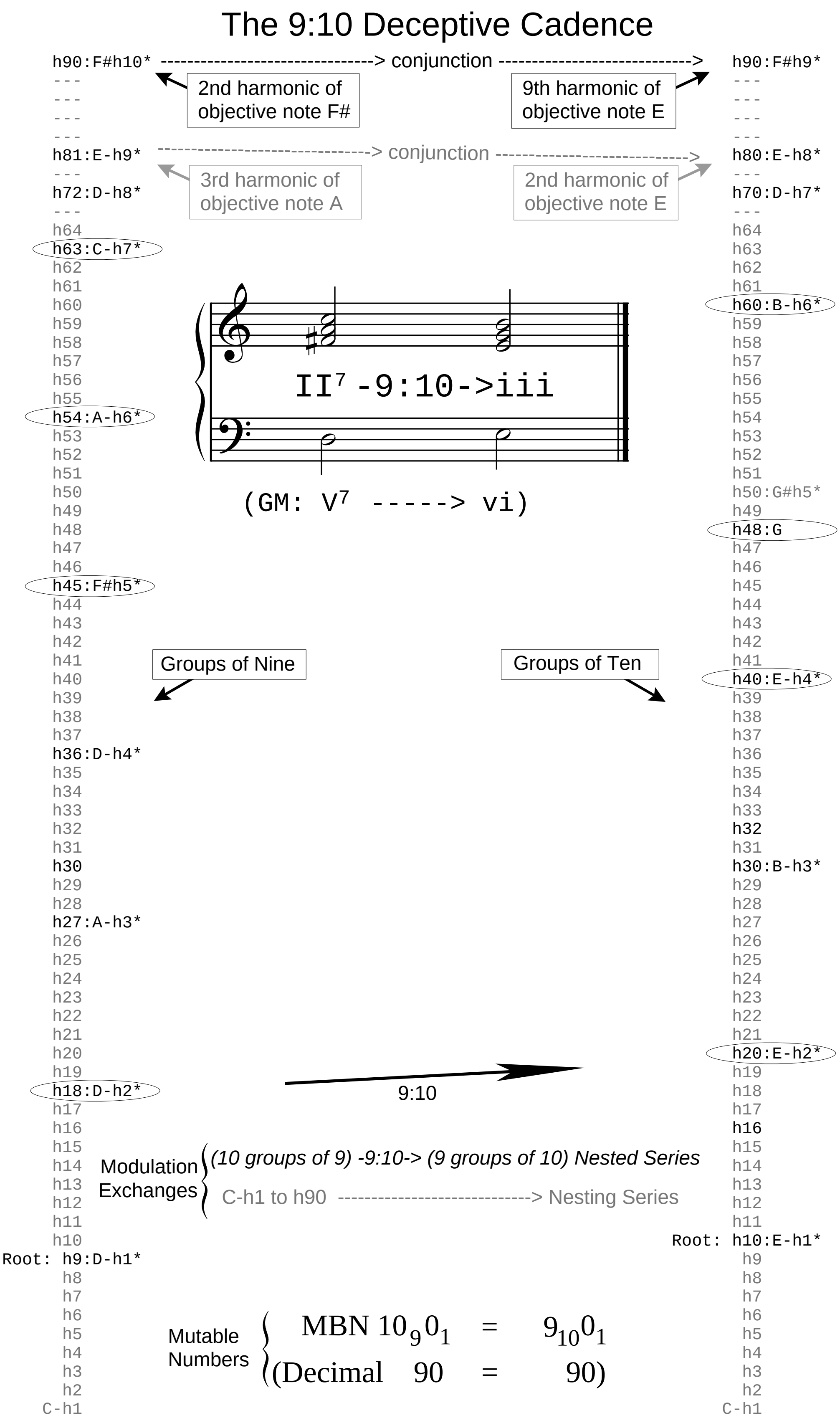


Figure Q.10 The major-minor Deceptive cadence in the form of a sesquinona 9:10 modulation exchange.

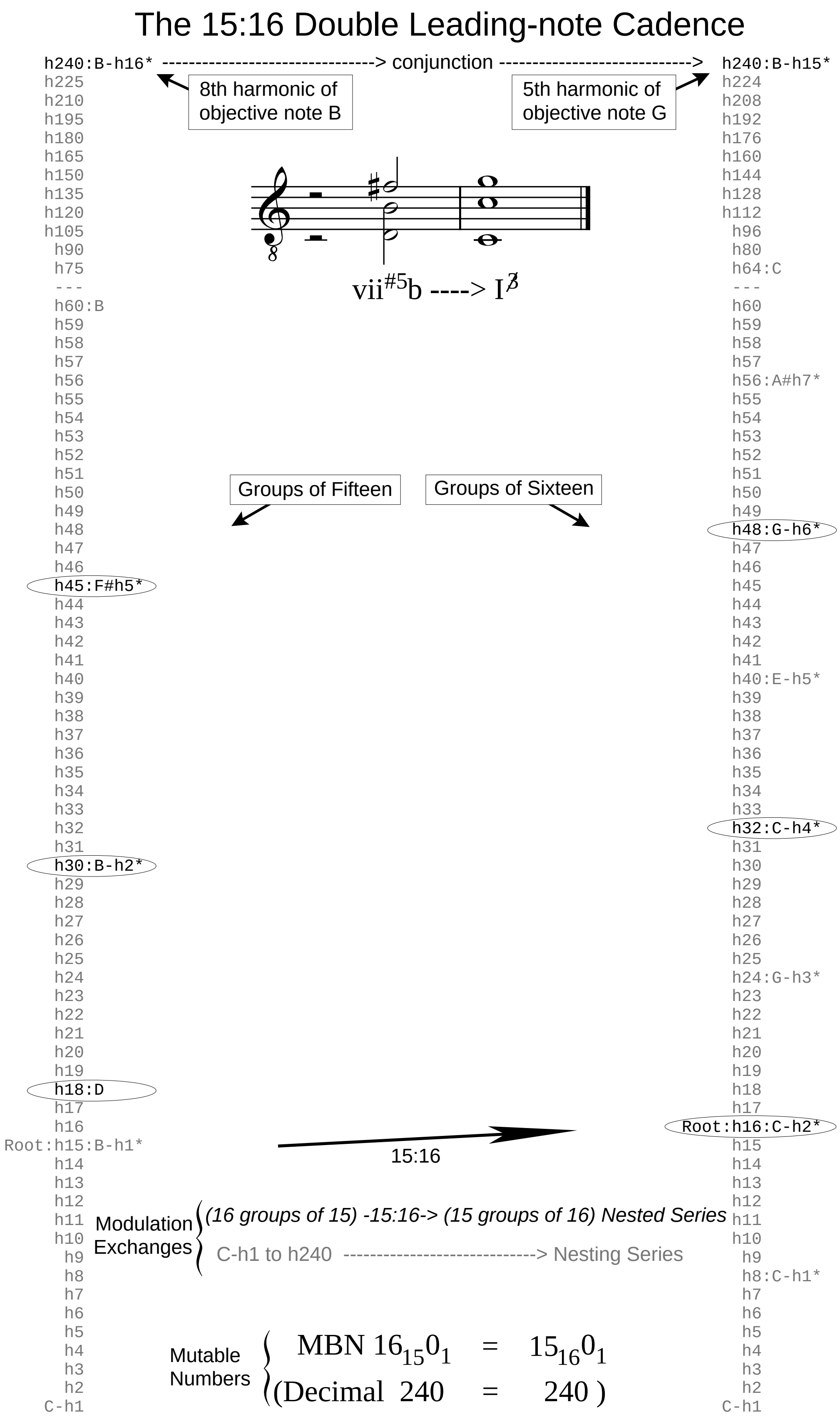


Figure Q.11 The Double Leading-note cadence in the form of a 15:16 modulation exchange.

The 16:17 Deceptive Cadence

The deceptive cadence also occasionally occurs with a half-step between the chord roots (Figure Q.12) and in this form it exceeds the limits to which the MOS interpretation of cadences may be taken in terms of a realistic description of hearing and aural cognition. Given the definition of a cadence as a single integer exchange between top-level series within a nested system of harmonic series, the exchange of 17 groups of sixteen harmonics for 16 groups of seventeen harmonics would stretch the capacity of human hearing beyond any reasonable competence. Though of course as a mathematical contrivance such a mutable number exchange as MBN $17_{16}\,0_1 = 16_{17}\,0_1$ is as secure as an authentic full cadence.

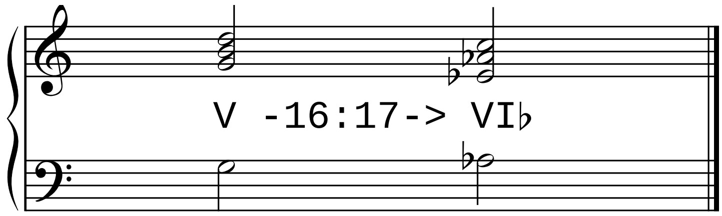


Figure Q.12 The Half-step Deceptive cadence. No MOS/mutable number analysis is given because the modulation exchange lies beyond the ear's range.

What appears to happen as the fineness of the ratios of exchange approaches the semitone interval and therefore the points of conjunction between the arrays of harmonics generated by the two cadential chords become fewer and ever more distant from the fundamental tones, is that aural cognition is forced to switch from a 'harmonic mode' of processing to what might be termed 'parallel mode'. Effectively in a semitonal exchange the 'ear' finds no conjunction frequency whereby the chords may be linked together as differing aspects of a single sound event. There is no unifying common frequency, though the conjunction is still there, at least in theory and perhaps in practice to, but beyond the ear's capacity to grasp. Indeed, to put this situation in context: from the starting point of the 1:2 'octave' cadence where there were effectively too many conjunctions for aural cognition to recognise that something had changed, we have travelled through the various cadential ratios (2:3, 3:4, etc.) which contain balanced numbers of conjoined and discrete harmonics and have arrived at the far side where the balance has tipped over into complete disjointness. From the ear's perspective, only the middle ratios which balance unity (common frequencies) and variety (different frequencies) produce viable cadences. Thus in a deceptive cadence of this type the sound stimulus captured by the ear consists essentially of two succeeding harmonic spectra with no common frequency between them. In this situation aural understanding perceives one spectra of harmonic relationships followed by another disconnected spectra of harmonic relationships set at a slightly higher or lower pitch, which yields the impression of a '(half-)stepped parallelism'. The noticeable structural feature that emerges from such close exchanges as these is the increment of displacement – the semitone shift between the fundamental and harmonics of the two chords. The ear and aural cognition, bereft tonal music's usual lattice of conjunctions, is left with this narrow parallel motion as the best alternative organising principle for making sense of the musical stimuli. Aural cognition appears to switch from normal tonal processing involving crunching the mutable numbers (harmonic mode) to riding the roller coaster of a segmented glissando effect (parallel mode). Though not unknown, throughout the tonal era passages of parallel root motion are rare and where used as a musical effect, usually of short duration – as for example in the half-step deceptive cadence. More generally, parallel motion – particularly parallel fifths and octaves – were prohibited as deleterious to tonality by both theorists and practical musicians, while contrary motion between parts, which better supports the warp and weft of the tonal fabric, was considered the norm. Indeed, the great theorist and composer Jean-Philippe Rameau noted that root motion predominantly by fourths and fifths was an essential driving force in tonal organisation and conversely that stepped and half-stepped root progressions were to be avoided or used sparingly as special effects. The litany of ratios from 2:3 to 16:17 presented above bears testimony to Rameau's conclusions: the regular cadences with root movement by fourths and fifths are strong and effective, while in contrast, the narrower intervals of the irregular cadences display a gradual decline in tonal force that eventually fades into a perception of parallel motion.

Notably as tonality waned towards the end of the nineteenth century and during the short span of the chromatic style in the early twentieth century, parallel motion became much more prominent as means of musical organisation. With tonality seriously weakened and before the rigors serialism, 'parallelism', whether of modal origin for the historically inclined composers or as one of the new resources of the avantgarde chromatic composers, was to experience something of a heyday.

[20/08/2010]

Notes

1. In Chapter 15, below Figure 15.14 an interesting parallel of serendipitous near equality is described concerning the famous prediction made by Fred Hoyle about the near equality of energy levels which he thought must exist between beryllium and carbon atoms, in order that stars should produce enough carbon for life, as found on Earth, to exist.