ESA LILJA
University of Stavanger

Harmonic function and modality in classic heavy metal[1]

{355} **ABSTRACT**

This article explores harmonic function, modality and guitar distortion in so-called classic heavy metal. I suggest a dual framework for analysing heavy metal, including such mirror-symmetries as 'major'/'minor', 'sharp'/'flat', 'bright'/'dark', 'dominant'/'subdominant' and 'authentic'/'plagal'. My central aim is to demonstrate that heavy metal harmony tends towards plagal systems and darker modes, and yet has constant major elements added from the distorted power chords.

My starting point is threefold, including musical acoustics, modal framework and harmonic function. First, any theory of heavy metal harmony should consider the sonic characteristics of distorted guitar. Second, as suggested by {356} e.g. Moore (1992, 1995, 2001: 53–55), pop/rock music is typically constructed on and better conceived through the so-called church modes rather than major/minor scales. Third, the dualist theoretical/analytical device developed here has characteristics of Hugo Riemann's original theory of harmonic function, more recent neo-Riemannian theories, and most notably Harrison's (1994) dualist and function theories, alongside practical elements borrowed from Motte (1983) and Burbat (1988).

Musical examples are from the so-called traditional or classic era, which ranges roughly from the late 1960s to the mid-1980s, as outlined by Lilja (2009: 29–42). Many of the bands and the music of that era are now deemed 'heavy metal classics' by fans, scholars and critiques (cf. Popoff 2003, 2004). In this time heavy metal as a musical style went through a process which Byrnside (1975: 161) calls a pattern of 'formation, crystallization, and decay'. Even though opinions may vary on specific turning points, it can be argued that during this time period the musical code of heavy metal as we still hear it today was established. 'Code' here refers to a 'set of rules that allows one to objectively determine whether a song, an album, a band, or a performance should be classified as belonging to the category "heavy metal"' (Weinstein 2000: 6).

My approach to this material is not statistically systematic. Rather, the observations made in this article are based in my more than three decades long exposure to this material as a listener, player, composer, teacher and researcher. For my previous research (e.g. Lilja 2009, 2015), I have gone through hundreds of heavy metal compositions. The examples

[1] I owe many thanks to the anonymous referees for their invaluable insights for the improvement of this article.

presented here can all be found in one or both of Martin Popoff's massive worldwide polls *The Top 500 Heavy Metal Songs of All Time* (2003) and *The Top 500 Heavy Metal Albums of All Time* (2004). Thus, they are clearly recognized by fans as being somewhat central repertoire. All examples are online in e.g. YouTube. All transcriptions and reductions are mine, unless noted otherwise.

I make several comparisons to Euroclassical music and music theories. This might sound old hat, because much extensive work has been done on popular music theory especially during the past decades, and the usefulness of Euroclassical harmonic theories in popular music and heavy metal studies has been proven before (e.g. Walser 1993; Lilja 2009). However, I find these comparisons useful for two main reasons. Firstly, in my more than twenty years of teaching experience of both the Euroclassical and the 'popular', I have found that connections between the two are not self-evident for most people. Revealing the similarities and differences between various styles of music widens people's musical perspective. Secondly, the division between Euroclassical and popular music still exists in many parts of the academic, institutional and intellectual fields of music theory. This artificial gap should be narrowed down, and there is still much work to be done to establish a common ground.

Guitar distortion and the power chord

The most frequent chord structure in heavy metal is the so-called power chord, which is compiled of only two different notes: chord root and the fifth. Thus, the power chord is often theoretically confused with an open chord without the third (e.g. Everett 2000: 330–35). However, the harmonic structure of the power chord is more complex. The power chord has been characterized by {357} distortion and loud volume (cf. Walser 1993: 43), but only distortion is necessary to produce its characteristic harmonic structure (Lilja 2009: 102–14).

Previous study has shown that due to intermodulation distortion the power chord contains a number of harmonics that would not be there without distortion. Figure 1 shows Philip Tagg's simplification of Lilja's (2009: 104–14) findings. The left hand side of the figure shows the A5 power chord (*a2* = 110 Hz, *e3* = 165 Hz) and five natural harmonics (2f–5f), which are integer multiples of the chord root *a2* (e.g. 2 × 110 Hz = 220 Hz, etc.). These harmonics together generate combination tones (by difference and summation), which form a new set of harmonics on the right. All these harmonics fit into the harmonic series of the *distortion fundamental*, which is the lowest and simplest difference tone (165 Hz – 110 Hz = 55 Hz).

> [T]he distortion fundamental may be regarded as a chord root, rather than the chord root that is actually played. Furthermore, all the higher partials belong to the same harmonic series, which is not the case with, for example, the minor triad. This is why the power chord is […] regarded as the most consonant chord structure. (Lilja 2009: 113.)

Moreover, a combination tone of particular interest here is the major third (*c*♯, 5f = 275 Hz and 10f = 550 Hz). It is generated by multiple summations and differences, which makes it especially prominent and aurally detectable. Example 1 shows the chords accompanying the guitar solo in Black Sabbath's (1970) 'Black Sabbath' from *Black Sabbath*. The fingered tones of the G^5 power chord and $G^{4\text{–}4\text{–}4}$ quartal (i.e. stacked fourths) chord are in open note heads. The major third *b*♮ of the G^5 power chord (which is the fifth harmonic partial counting from the distortion fundamental) is in black note head. Power chords in the opening of Motörhead's (1980) 'Love Me Like a Reptile' from *Ace of Spades* and in the ending of Judas Priest's (1977)

'Sinner' from *Sin After Sin* offer similar easy-to-hear examples. To summarize matters briefly, although the power chord is played with only two pitch classes (e.g. with *g* and *d* in the G5 power chord), it sounds like a major chord. This acoustic fact should be taken into account whilst analysing heavy metal harmony. In the analyses below, power chords are treated as major chords.

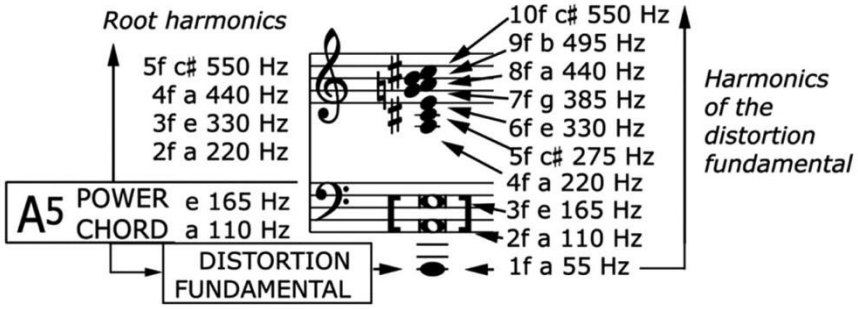

*Figure 1: Harmonics for A⁵ power chord (*a2 *= 110 Hz,* e3 *= 165 Hz; open note heads) (Tagg 2014: 281).*

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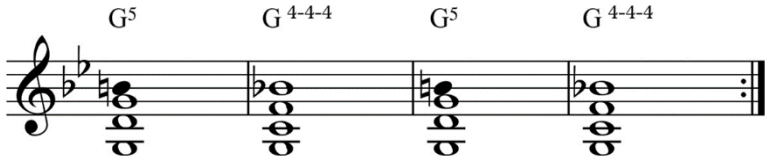


*Example 1: G⁵ power chord with a distortion harmonic (*b♮*) and G⁴⁻⁴⁻⁴ quartal chord in 'Black Sabbath', outro, ca. [5:58–]. (After Lilja 2015: 398.)*

Modal framework

Mode refers to a set of tones (usually in the form of scales), some of which have special names (such as 'major', 'melodic minor' and 'Dorian'). Church modes form a set of scales that originate from medieval times (e.g. Cotto [1100] 1784: Ch. XI), although it was not until the renaissance theorist Heinrich Glarean, who systematized and introduced the nowadays-common seven modes in his *Dodecachordon* (1547). Church modes form a convenient framework for melodic/harmonic analysis of pop/rock music in general and heavy metal in particular, and have frequently been used as such before (e.g. Moore 1992; Walser 1993; Lilja 2009). In addition, this modal framework has long been in daily use by many heavy metal musicians (Walser 1993: 90).

Table 1 shows the seven church modes as they are understood today. Circumflexed numbers refer to *scale degrees*, which denote a note's position in a scale relative to central note of a mode (i.e. Î or Tonic). For example, in C Ionian mode (i.e. common C major scale) the scale degrees Î, 2̂, 3̂, etc. correspond to pitch classes *c*, *d*, *e*, etc. (i.e. the white keys on the piano starting from *c*). Modes are often described as alterations of the major scale (i.e. Ionian mode), and in terms of their relative 'brightness'/'darkness' (e.g. Miller 1996: 17). Thus, the major scale can be transformed into the Lydian mode by raising (or adding a sharp to) the fourth scale degree to make ♯4̂. Raising scale degrees makes a mode 'brighter', while lowering scale degrees (such as ♭7̂ in the five lowest rows of Table 1) makes a mode 'darker'.

Lydian	$\hat{1}$	$\hat{2}$	$\hat{3}$	$\sharp\hat{4}$	$\hat{5}$	$\hat{6}$	$\hat{7}$
Ionian	$\hat{1}$	$\hat{2}$	$\hat{3}$	$\hat{4}$	$\hat{5}$	$\hat{6}$	$\hat{7}$
Mixolydian	$\hat{1}$	$\hat{2}$	$\hat{3}$	$\hat{4}$	$\hat{5}$	$\hat{6}$	$\flat\hat{7}$
Dorian	$\hat{1}$	$\hat{2}$	$\flat\hat{3}$	$\hat{4}$	$\hat{5}$	$\hat{6}$	$\flat\hat{7}$
Aeolian	$\hat{1}$	$\hat{2}$	$\flat\hat{3}$	$\hat{4}$	$\hat{5}$	$\flat\hat{6}$	$\flat\hat{7}$
Phrygian	$\hat{1}$	$\flat\hat{2}$	$\flat\hat{3}$	$\hat{4}$	$\hat{5}$	$\flat\hat{6}$	$\flat\hat{7}$
Locrian	$\hat{1}$	$\flat\hat{2}$	$\flat\hat{3}$	$\hat{4}$	$\flat\hat{5}$	$\flat\hat{6}$	$\flat\hat{7}$

Table 1: Church modes.

What is harmonic function?

In any theory of music, *harmonic function* refers to a chord's significance within a key. Unfortunately, the term has become ambiguous in time and use. 'Loosely put, function signifies harmonic meaning or action' (Kopp 1995: 1). In short, the nowadays two main perspectives are: (1) *Funktiontheorie* ('function theory'), in which harmonic function is simply a chord category (i.e. function as meaning), and (2) *Stufentheorie* ('scale degree theory'), in which {359} harmonic function is constituted by a limited number of allowable chord successions (i.e. function as action).

For reasons given later, I find the first strain more useful for the analysis of heavy metal. However, since the second perspective has been predominant in twentieth-century anglophone music theory and become mainstream in popular music studies, I will briefly explain the main differences between the two perspectives as I see them.

The German music theorist Hugo Riemann (1849–1919) coined the term 'function' in music theory. '[H]e borrowed the word from mathematics, where it was used to designate the correlation of two variables, an argument and a value' (Hyer 2002: 736; for a more detailed discussion, see Hyer 2011: 112–20). Riemann (e.g. 1896) had three functions, which he named after Rameau's (e.g. 1750: 32) 'primary chords': the referential Tonic (chord built on $\hat{1}$, e.g. C in the key of C major) surrounded by two dominants. Dominant ('over-dominant') is situated a fifth above Tonic (on $\hat{5}$, e.g. G in C major) and Subdominant ('under-dominant') a fifth below Tonic (on $\hat{4}$, e.g. F in C major). Similar to mathematics, Riemann's functions have different values: more than one chord can represent a given function through family relations or transformations. For instance, D minor and F major are two possible values for subdominant function in the key of C major (transformations are discussed in detail later on).

The nowadays more common 'function as action' perspective draws the definition of function from the ways chords proceed, or are supposed to proceed, to other chords.[2] This makes sense due to vernacular connotations attached to the word 'function' itself. 'After all, in everyday usage, the function of any object or concept has to do with what it does more than with what it is' (Kopp 1995: 14). Harmonic theories in general have been developed in the context of 'Euroclassical tonality' (Tagg 2014: 488), in which certain chord progressions are

[2] This line of thinking owes much to Sechter's (1854; also see Caplin 1980) *Stufentheorie*, which remains the core theory in English speaking countries much thanks to Heinrich Schenker and Arnold Schönberg. In the 1854 treatise *Die Grundsätze der musikalischen Komposition* Sechter posited that 'the essence of theory of harmony is the knowledge of the allowable successions of degrees of the diatonic scale, each of which acts as the theoretical root of a chord' (Wason 1985: 33). This view is at fundamental odds with Riemann's *Funktiontheorie*.

more prevalent and 'normal' than others. For example, in Viennese classical syntax dominant chords normally proceed to tonic, whereas subdominants (or 'pre-dominants') proceed to dominant (e.g. Caplin 1998: 23). However, in blues-based styles and in heavy metal, chords need not behave in this way (e.g. Temperley 2011).

Over the years, the original meaning of 'harmonic function' has been gradually merged into and confused with syntactical guidelines of a single musical style. The following sentence might illustrate a corresponding line of thought. 'If dominant, tonic and subdominant are harmonic functions, and dominant normally proceeds to tonic and never to subdominant, we can conclude that the function of dominant (i.e. dominant function) is to proceed to tonic'.[3]

Probably this confusion has made it difficult for popular music theorists to discuss harmonic function in musical styles that make use of harmonic vocabulary different from the Euroclassical. Some recent rock harmony analysis is based on 'harmonic-function theory which groups chords that *behave* similarly into larger categories' (Biamonte 2010: 96, emphasis added). Most recently, work has been done to '[…]advocate for a syntactical definition of harmonic function in rock music such that function is acquired not by a chord's scale degree content but by its role in the context of a song's form' (Nobile 2016: 149).[4] These perspectives are more than understandable given the history of the field, and although I might have reservations towards the starting points of these studies, I do not necessarily disagree with their outcomes.

{360} Riemann was not particularly interested in giving specific rules for harmonic progression: virtually no guidelines were set as to how chords should proceed.[5] This absence of chord progression rules in Riemann's theory adds to its flexibility and applicability to heavy metal, in which the distribution of harmonic functions many times differ from the Euroclassical.

For the purposes of this article, harmonic function is better conceived as a sense of 'value' that may or may not have a direct relationship to syntax of chord successions. As for 'function', I use a Riemann-based reading, in which 'function' refers to harmonic 'meaning' and 'identity' (Kopp 1995: 14; Hyer 2011: 92–94) instead of 'action' or 'progression' (e.g. Piston and DeVoto 1987: 53; Aldwell and Schachter 1989: 118; Naus 1998: 11). In other words, 'function' is from this point on treated as a noun rather than as a verb.

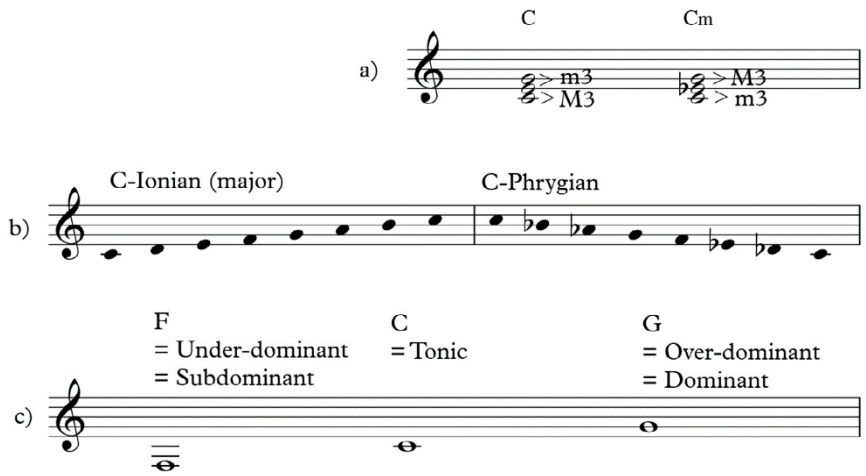
Harmonic and modal dualisms

Dualism is one of the key concepts in Riemannian theory, which I find useful for the analysis of heavy metal harmony. Harmonic dualism is fundamentally about symmetries. 'At a most basic level, dualism reflects the structural equality of major and minor systems: in a dualistic framework, the minor triad is recognized as a mirror-symmetric image of the major' (Gollin and Rehding 2011: 579). The major and the minor triads constitute two superposed intervals

[3] A more detailed description of this development would deserve a separate article.
[4] While stating that IV-I progression sometimes 'plays the role of authentic cadence' Nobile (2016: 149) adopts a stance Riemann himself had to face and reject more than a century ago (e.g. Harrison 1994: 272–73). However, Riemann concluded that the plagal D–S–T progression is no less 'functional' than the authentic S–D–T progression (e.g. Kopp 1995: 10; Gollin and Rehding 2011: 579).
[5] For Dahlhaus (1990: 47–59) this is a shortcoming in Riemann's theory, but I find this exact feature very useful in applying Riemann's theory beyond the Euroclassical.

of the third (Example 2a). In the major triad, the lower third is major (M3) and the higher third is minor (m3), whereas in the minor triads these thirds are in reversed order.[6]

Other symmetries include 'sharp'/'flat', 'bright'/'dark', 'dominant'/'subdominant' and 'authentic'/'plagal' (see, e.g. Harrison 1994: 15–42; Klumpenhouwer 2002: 456–76; Rings 2011: 500–02).



Example 2: Some dualisms.

Raising (i.e. sharpening) the third of the minor triad transforms it into the major triad, and lowering (i.e. flattening) the third of the major triad transforms it into the minor triad. As discussed before, similar kinds of sharpening/flattening of scale degrees results in brightening/darkening of the modes. Furthermore, scale step structures of the modes include mirror-symmetries. The Phrygian mode is an exact mirror image of the Ionian (Example 2b). In {361} other words, the distribution of whole- and semitones counting upwards the Ionian is exactly same as counting downwards the Phrygian. The other modal counterparts are Lydian–Locrian and Mixolydian–Aeolian; Dorian is a mirror image of itself.

Riemannian functions are fundamentally based on symmetries. The primary triads, which are at the core of his theory, are built on the central note (Tonic) and the two dominants that surround it symmetrically (Example 2c). Dominant–Tonic progressions are often called 'authentic' and Subdominant–Tonic progressions are called 'plagal'.

Despite critical views against dual frameworks (e.g. Quinn 2005), I find them useful in approaching harmonic practices of heavy metal. In Table 2 in the last part of this article, I will propose a dualistic modal/functional framework, towards which I will build in the following sections.

Functional scale degrees and transformations

Chord notation here originates from Riemann (e.g. 1896) with some modifications adopted from Motte (1983) and Burbat (1988). However, following neo-Riemannian practice (unlike Motte and Burbat), I have maintained Riemann's original 'leading-tone change' as one of the transformational categories (see, e.g. Hyer 2011: 102–03). Theoretical and analytical principles regarding functional scale degrees are adopted from Harrison (1994).

[6] This mirror imaging of the two triads is generally accredited to the nineteenth-century theorist Moritz Haptmann, although Riemann observed similar lines of thinking with the sixteenth-century theorist Giuseppe Zarlino (Klumpenhouwer 2002: 459–62).

'A function is essentially a primary triad and those chords derived from it under certain, specified operations' (Harrison 1994: 38). Primary triads are built on $\hat{4}$, $\hat{1}$ and $\hat{5}$, and called Subdominant, Tonic and Dominant (abbr. ***S***, ***T***, ***D***), which in the key of C major would constitute F-major, C-major and G-major triads, respectively. In the text, function symbols are written in bold italics to differentiate them from other symbols. Figure 2 shows each scale degree assigned with a functional role based on its position in one of the primary triads. Each scale degree has its own role and relative strength in expressing a function (Harrison 1994: 45–57).

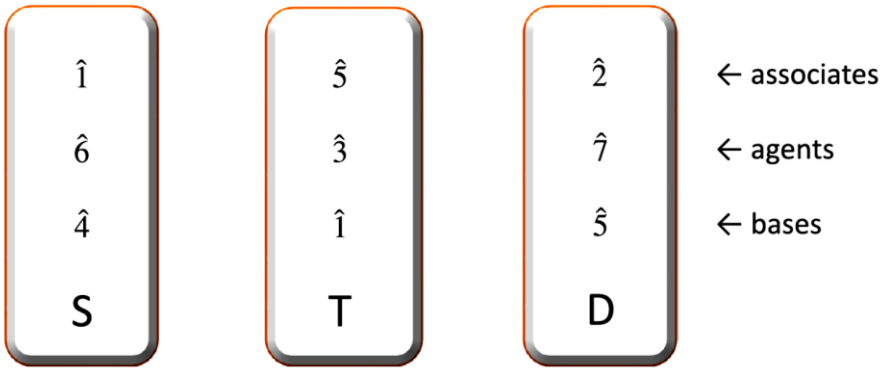
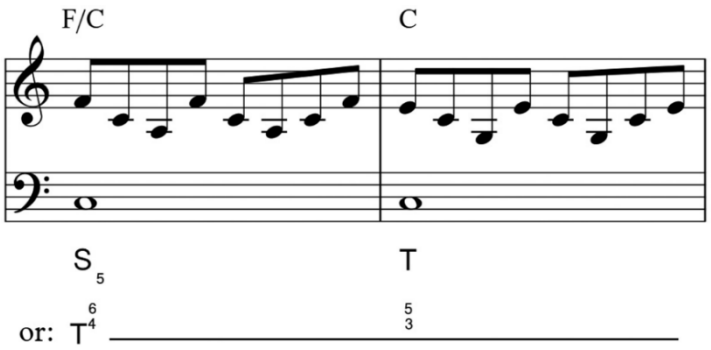


Figure 2: Scale degrees and their functional descriptions (after Harrison 1994: 45).

Functional *bases* are reductions of the three functions, as already grounded by Rameau (e.g. 1750: 32). The base is the strongest representative of a function, given that it is the lowest sounding note in a chord (Harrison 1994: 46). For example, $\hat{5}$ in a root-position V triad is a strong dominant advocate, whereas in root-position I triad, in which is serves as Tonic *associate*, it is considerably weak in expressing either function. Of the bases, $\hat{4}$ works for no {362} other than Subdominant function. 'Thus, $\hat{4}$ should be theoretically […] able to communicate Subdominant function while appearing in any voice' (Harrison 1994: 48). An example of contrasting functional forces is illustrated in Example 3, where $\hat{1}$ (i.e. the pitch *c* in the bass) serves as both the Tonic base and Subdominant associate. This example also underlines the conceptual difference between 'chord' and 'function': the former stands for the actual collection of notes that have been played or heard, the latter stands for the possible roles a chord can have in its harmonic context.



Example 3: Uriah Heep's (1971) 'July Morning' from Look at Yourself*; partial keyboard introduction at [0:00].*

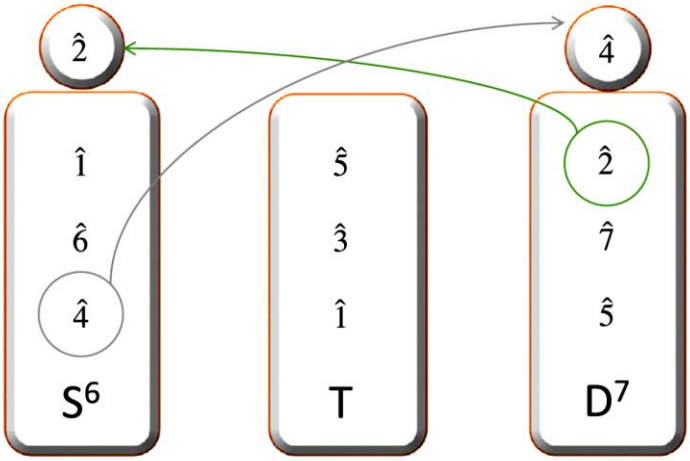


Figure 3: Characteristic dissonances. Chord notation adopted from Riemann (1896: 55).

Functional associates cannot express their function on their own. Reflecting this, a possibility to omit them from the primary chords has been a common practice at least since the times of Johann Sebastian Bach (e.g. Motte 1983: 51–57). Instead and alongside, it has been customary to use characteristic dissonances (Rameau 1737: 125–27; also Hyer 2002: 734), which are borrowed from another function. Chords in Figure 3 constitute what Riemann declared {363} the 'three pillars of harmony' (Mickelsen 1977: 194). The Dominant associate $\hat{2}$ is lent to the Subdominant to form an added sixth chord (***S***^{6}, e.g. F^{6} in the key of C). Similarly, the Subdominant base $\hat{4}$ is lent to the Dominant to form a seventh chord (***D***^{7}, e.g. G^{7} in the key of C).

Functional *agents* are the most important carriers of functional meaning. 'Agents, in contrast to bases, are entirely dedicated to the function in question, in the sense that all the scale degrees working as agents are unique entries [in the three pillars of Figures 2–4]' (Harrison 1994: 49). Agents define whether a primary triad is a major or minor chord (marked with upper- and lower-case symbols, respectively; Figure 4). Unlike bases and associates, agents also carry information about modal characteristics. For the most common modes, the modal agencies are embedded in function symbols as follows: Ionian ***S***, ***T***, ***D***; Mixolydian ***S***, ***T***, ***d***; Dorian ***S***, ***t***, ***d***; Aeolian ***s***, ***t***, ***d***. Following the practice coined by Weber (e.g. 1851), capitalized symbols indicate major chords and lower-case symbols indicate minor chords.

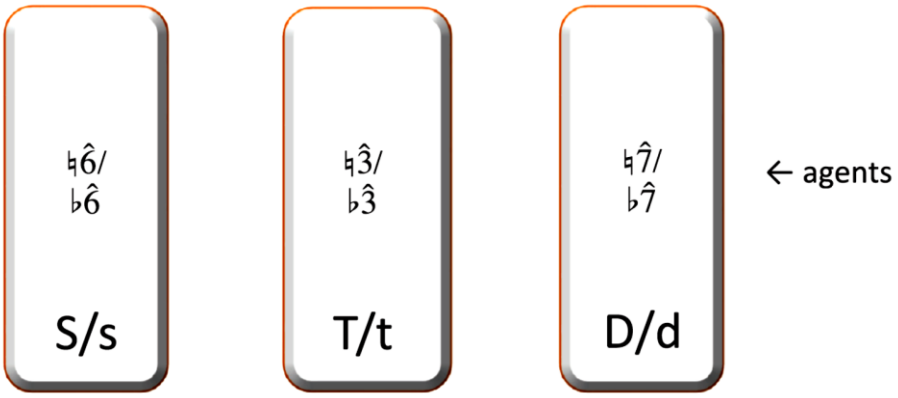
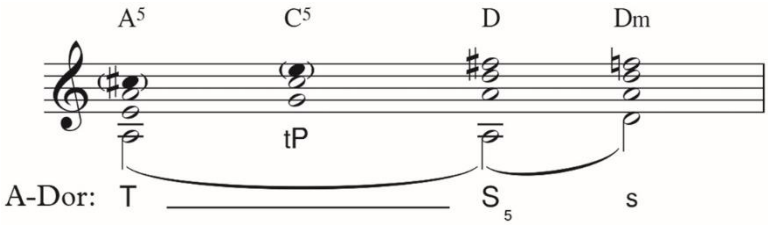


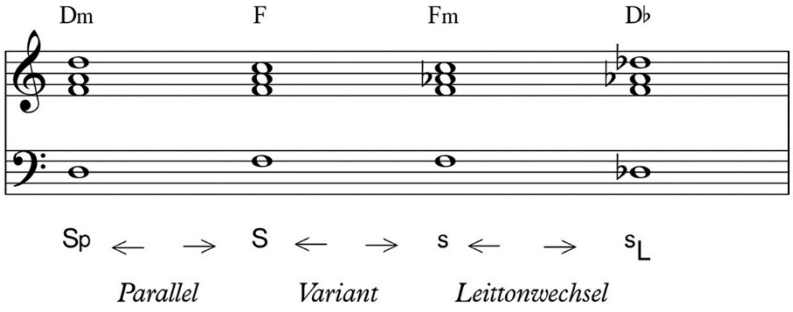
Figure 4: Modal variants of functional agents.



Example 4: Judas Priest's (1986) 'Out in the Cold' from Turbo*; reduction of the guitar riff at c. [1:28].*

Example 4 shows a partial reduction of the guitar riff in the opening/chorus of Judas Priest's (1986) 'Out in the Cold' from *Turbo*. Distortion harmonics (major thirds in power chords) are in black note heads in parentheses. A synthesizer melody preceding the riff has set the tonal/modal context to A-Dorian. Tonic function shifts from major to minor mode due to the use of both Tonic agents ♮$\hat{3}$ and ♭$\hat{3}$ (i.e. distortion harmonic *c*♯ in the A^5 power chord and the root of the C^5 power chord). Likewise, the Subdominant appears in both its modal forms: Dorian ♮$\hat{6}$ (*f*♯) and Aeolian ♭$\hat{6}$ (*f*) are the Subdominant agents appearing in the D-major (***S***) and the D-minor chords (***s***), respectively (the subscript 5 in $\boldsymbol{S_5}$ denotes chord fifth i.e. functional associate in the bass).

{364} In describing functional family relations, the neo-Riemannians use operations they call 'parsimonious transformations', the purpose of which are to maximize pitch-class intersection between pairs of distinct triads (i.e. Cohn 1997: 1).[7] There are three kinds of these operations, or simply put, tone-relations (Example 5), all of which result from changing one note only.

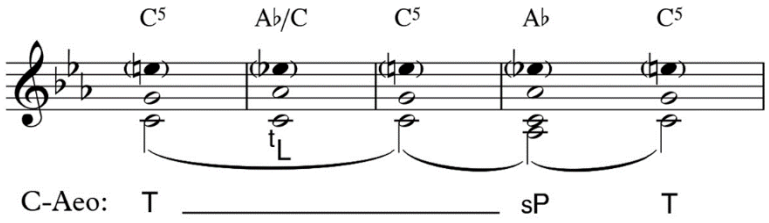


Example 5: Riemannian tone-relations for Subdominant in the key of C.

I use the original German names for these transformations (see, e.g. Hyer 2011: 102–03). *Variant* (instead of the English 'parallel') refers to chords that share a common fifth (e.g. ***S*** and ***s***), *Parallel* (instead of the English 'relative') to chords that share a major third (***S*** and ***Sp***), and *Leittonwechsel* ('leading tone change') to chords that share a minor third (***s*** and ***sL***). Binomial symbols are read like this: the first character denotes chord's function and the primary triad it has been derived from; the last character gives the type of transformation and chord's major/minor quality. The Subdominant chords, i.e. F-major and the F-minor triads are each other's *Variants* (***S*** and ***s***). The D♭ (***sL***, i.e. leading-tone change of the minor Subdominant) is

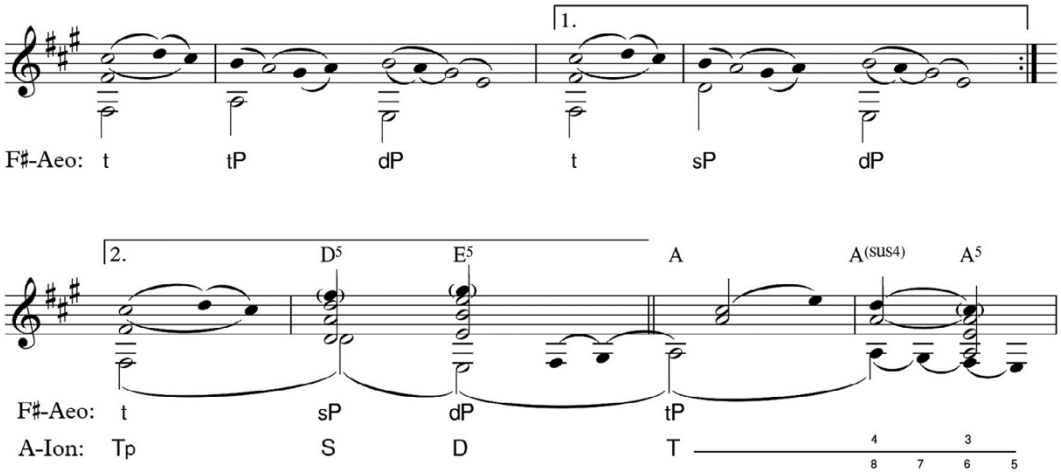
[7] Although my conception of Parsimonious transformations is most directly related to neo-Riemannian theory (e.g. Cohn 1997: 1), I have chosen to use nomenclature derived from more traditional Riemannian German theorists Motte (1983) and Burbat (1988). However, there is one difference. Motte and Burbat use the term 'counterparallel' (Ger. *Gegenparallel*), which I have rejected in favour of the original Riemann-based transformational categories including the 'leadingtone change' (*Leittonwechsel*). Thus, my basic nomenclature is most similar to that of e.g. Dahlhaus' (1990).

derived from the minor *Variant* of the primary Subdominant triad (thus, the lower case ***s***); the leading-tone change itself is a major chord (thus, the upper case ***L***). The Dm (***Sp***, i.e. major Subdominant *Parallel*) is derived from the major Subdominant triad F (***S***); the *Parallel* itself is a minor chord (***p***).



Example 6: Accept's (1985) 'Metal Heart' from Metal Heart*; reduction of the guitar riff at c. [1:14].*

Chords can act as representatives of more than one function. Harrison (1994: 60–72) calls these chords 'functional mixtures', because they have characteristics of more than one primary triad. For instance, in the C-Aeolian riff in Example 6 the A♭ chord serves as both ***tL*** and ***sP***. The A♭ contains strong elements of both Tonic (functional base *c* and agent *e♭*) and Subdominant (functional agent *a♭*). To which function each chord is assigned, depends on relative weights of these elements. These, in turn, are dependent on key {365} context, chord's voicing and orchestration. The A♭ as ***tL*** has the repeated Tonic base *c* in the lowest note, so the motion *g–a♭–g* is easy to hear as a minor contrapuntal embellishment on the Tonic function. Conversely, the A♭ as ***sP*** has the Subdominant agent *a*b in the bass, which contributes to a much clearer change of function from preceding Tonic to Subdominant. In other words, in the higher parts of the chord the individual *a♭* has less functional strength than in the bass part. Thus, under certain conditions, one chord can express different functions, even within the same riff.



Example 7: Ozzy Osbourne's (1981) 'Crazy Train' from Blizzard of Ozz*, reduction of the riffs to introduction and verse at c. [0:18].*

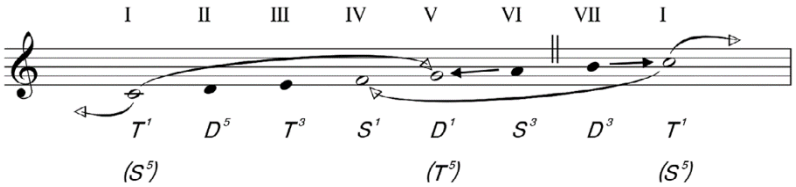
Example 7 illustrates shuttling between *Parallel* keys (English: 'relative'). These major/minor keys share the same key signature, but have different tonal centres. In this example, the chords however maintain the same basic functions even though the tonal centre changes. By bar 5, the F♯-Aeolian mode has been established (tonal centre here is *f♯*). The chords on F♯, D and E serve as ***t***, ***sP*** and ***dP***, respectively. Arrival at bar 7 changes the perception of the preceding D^5 and E^5. In retrospect, they clearly serve as ***S*** and ***D*** of the new Tonic A. Moreover, from this perspective the F♯-based introduction as a whole (bars 1–6) gets a new meaning as

a section based on ***Tp*** of A-Ionian. This is an example on how chord sequences reveal their functions only *after* the key is established and the chord's relationship with each other has been heard.

Harmonic function without primary triads[8]

Next, I will address two separate but interrelated features that are typical to heavy metal harmony and less typical to Euroclassical music. Firstly, primary dominant triads (both ***S*** and ***D***) have lesser structural importance than their transformations. Secondly, chord progressions are frequently stepwise (i.e. chords are built on subsequent scale degrees). To illustrate this, I will turn away from chord structures in the interim, and discuss tonal tendencies of individual scale degrees instead, because they remain the same regardless of chord construction habits of a single musical style.

Functional bases and agents 'trigger' their respective functions (Quinn 2005) especially strongly, when they are situated in the lowest sounding note. {366} It is more the role of functional agents than bases to express Subdominant and Dominant functions in much heavy metal. Tonal tendency of $\hat{7}$ is directed up towards the Tonic base, whereas tendency of $\hat{6}$ is down towards Tonic associate. In Example 8 (borrowed from Harrison 1994: 95–96) the Roman numerals do not denote chords but scale degrees instead (as is also done in Louis and Thuille 1913: 10). Furthermore, function symbols in this example denote individual scale degrees and their functions according to Harrison's system: *T1* = Tonic base, *S5* = Subdominant associate, etc.



Example 8: Tendencies of scale degrees (Harrison 1994: 95–96).[9]

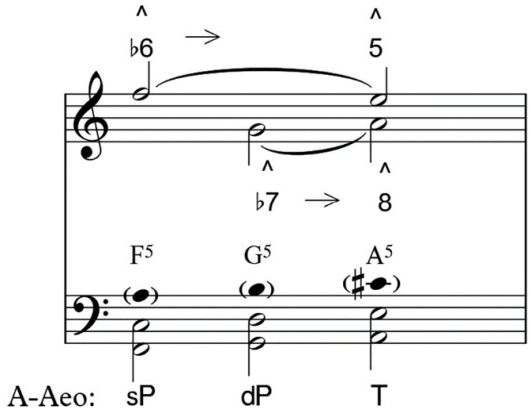
Functional strength of the agents varies according to the mode (Harrison 1994: 50–55). Semitone relationships are considered stronger functional advocates than whole-tone relationships. Thus, ♮$\hat{7}$–$\hat{8}$ discharge (Harrison's term) from the Dominant (e.g. melodic progression *b*–*c* in C-Ionian) is stronger than ♭$\hat{7}$–$\hat{8}$ discharge (e.g. *b*♭–*c* in C-Mixolydian). Despite the relative weakness of the latter, ♭$\hat{7}$ still holds its ability to advocate Dominant function. Similarly, ♭$\hat{6}$–$\hat{5}$ discharge from the Subdominant (e.g. *a*♭–*g* in C-Aeolian) is stronger than ♮$\hat{6}$–$\hat{5}$ discharge (e.g. *a*–*g* in C-Dorian) (Harrison 1994: 50–55). In this regard, chords containing the Aeolian ♭$\hat{6}$ are potentially stronger Subdominant representatives (e.g. ***s***, ***sP***, ***sL***) than chords containing the Dorian ♮$\hat{6}$ (e.g. ***S***, ***Sp***, ***Sl***). Likewise, chords with the Ionian ♮$\hat{7}$ are stronger Dominant representatives (e.g. ***D***, ***Dp***, ***Dl***) than those with the Mixolydian ♭$\hat{7}$ (e.g. ***d***,

[8] The title of this section is borrowed from Quinn (2005), although our views on its meaning might differ.

[9] Harrison (1994: 95–96) quotes the 10th edition of Louis and Thuille's *Harmonielehre* (1932: 14; rev. Walter Courvoiser, Richard G'scheyr, Gustav Geierhaas and Karl Blessinger, Stuttgart: Erns Klett). There are several differences between this example and earlier editions of *Harmonielehre* (e.g. 1913: 10): added hash marks in between 6 and 7, function symbols substituted for Roman numerals below the staff, and arrows indicating tonal tendencies. {After email correspondence with Harrison and with help from Jaakko Tuohiniemi at the University of Helsinki Library and Simone Welti at the Zürcher Hochschule der Künste, I was finally able to track down the 10th edition and confirm that Harrison's example is an exact reproduction from that edition, p. 14. However, by that time this article was already in print.}

dP, ***dL***). Thus, lower case ***s*** denotes strong Subdominant agency, whereas upper case ***D*** denotes strong Dominant agency.

Discharges from the dominant agents can also be implied. In other words, a tendency to proceed in a certain direction can be felt and anticipated, even if these expectations were delayed or even never fulfilled. Consider, for example, playing a C major scale and ending it on $\hat{7}$ (i.e. *b*). Tonal tendency of that note is so strong that you most likely hear the $\hat{8}$ (*c*) in your head, regardless if it is played or not. Similar anticipation processes are at work with $\flat\hat{6}$ leading to $\hat{5}$. Let us consider the Aeolian ***sP–dP–T*** (i.e. ♭VI–♭VII–I, cf. Björnberg [1984] 2001), which is as common to heavy metal's harmonic practice as the Ionian ***S–D–T*** (IV–V–I) is to Euroclassical harmonic theories. For instance, in Iron Maiden's (1984) 'Aces High' from *Powerslave* this Aeolian progression is used extensively in navigating through various tonal centres (for a detailed analysis, see Lilja 2009: 185–86, 203–04). Example 9 shows the tonal tendencies and anticipations of the strong Subdominant agent $\flat\hat{6}$ and the weak Dominant agent $\flat\hat{7}$ in the A-Aeolian progression.



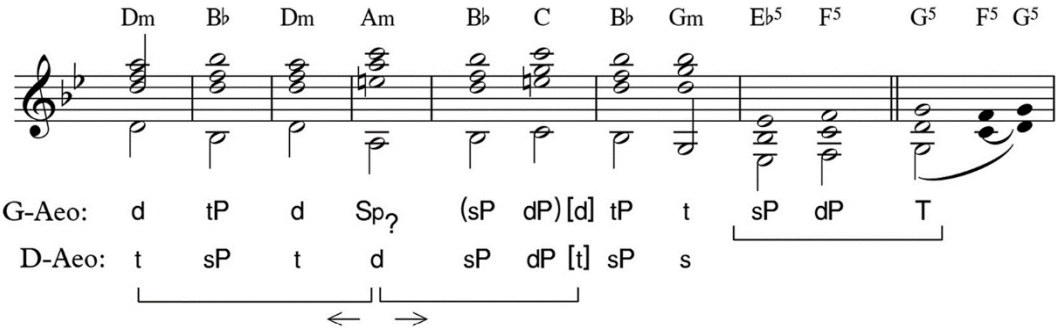
Example 9: Tonal tendencies of dominant agents in A-Aeolian **sP–dP–T** *progression. {This example is originally on p. 367.}*

Through extremely common usage, the Aeolian ***sP–dP–T*** might have gained some cadential and predictive power. Rainbow's (1975) 'Man on the Silver Mountain' from *Ritchie Blackmore's Rainbow* serves as an example, in which the Aeolian progression also disorientates the listener slightly. The piece begins with a G-Aeolian power chord riff and verse. The key is unequivocal until Example 10. Triads in the reduction are arpeggiated with only mild distortion (this probably explains the use of minor triads, which otherwise is atypical {367} to heavy metal). The D-minor triad is heard in Dominant function until the appearance of the A-minor triad. Rather than major Subdominant *Parallel*, the Am suggests a clear although weak Dominant force resulting in temporary, if not completely unambiguous, tonicization of pitch class *d*. However, this not only changes the perception of the preceding chords to D-Aeolian (***t*** and ***sP***), but the following B♭ and C can also be heard as an Aeolian ***sP–dP*** progression leading to D-minor (in functional chord notation, parentheses indicate relation to the following chord, whereas an anticipated but missing chord is put in brackets). The D-minor, however, never shows up again. Instead, the listener is slightly confused about the tonal centre for a couple of chords, until another Aeolian progression $E\flat^5$–F^5 leading to the Tonic G.

Euroclassical harmony is ultimately based on chord root progressions in fifths and occasionally in thirds. Ideally, there should always be at least one common tone in subsequent chords.[10] Heavy metal harmony is free of such restrictions. In fact, stepwise root progression

[10] For this reason some theorists (such as Rameau in the 18th, and Sechter in the nineteenth century) have banned stepwise root progressions altogether. Thus, the T–S–D–T succession of

without common tones, such as the Aeolian progression, can communicate changes of function effectively.



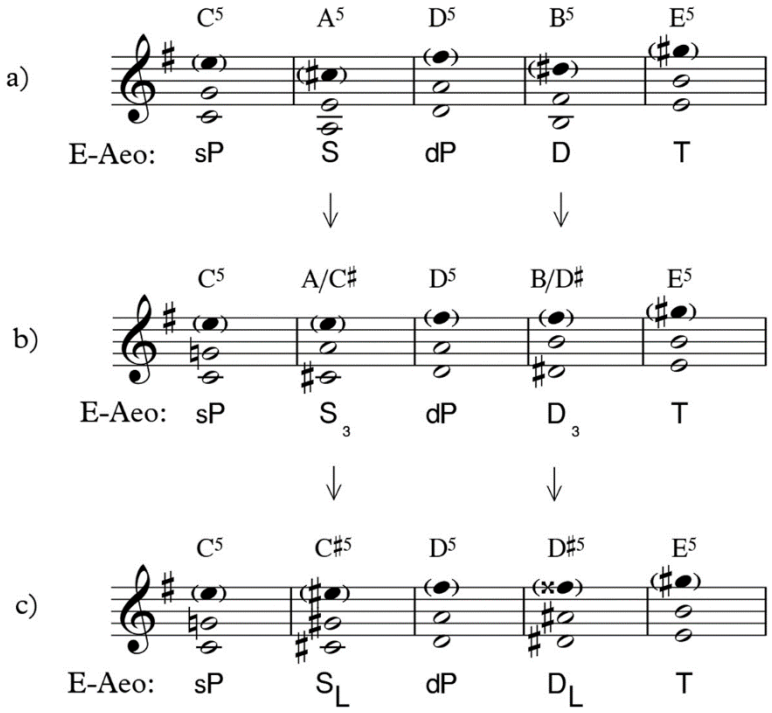
Example 10: Rainbow's (1975) 'Man on the Silver Mountain' from Ritchie Blackmore's Rainbow*; harmonic reduction at [0:45]. {This example is originally on p. 368.}*

Furthermore, it has been suggested that if subsequent chords have no common tones, they cannot represent the same function (e.g. Dahlhaus 1990: 53–54). Importantly however, as it is understood here, 'functional scale degree constituent' and 'common tone' are not the same thing. I base my view on Harrison's explanations of functional scale degrees (see above in this article). For example, $\hat{3}$ and $\flat\hat{3}$ are different pitch classes (e.g. *e* and *e♭* in the key of C). However, they play the same functional role (i.e. Tonic agent), only with different modal attitude. Thus, I treat them as belonging to the same category of functional scale degree constituents (i.e. major and minor versions of the Tonic agent). The same treatment applies to other functional scale degrees (refer back to Figures 2–4). Thus, chords such as ***dP*** and ***DL*** (which do not have any common tones, but share common functional scale degree components) belong to the same category of Dominant functioned chords. Examples 11(a–c) illustrate both this and stepwise functional progression with three examples from Judas Priest.

{368} All three examples are transposed to the same key for easier comparison. If only the fingered tones are considered, the two Subdominant representatives ***sP*** and ***S*** (the power chords C^5 and A^5) in Example 11(a) have no common tones. However, when we look at distortion harmonics, we see that this is not the case. They share the same Subdominant associate $\hat{1}$ (i.e. pitch *e*), which is by far the weakest functional component. More importantly, ***sP*** and ***S*** do share a common functional scale degree component – namely Subdominant agent in its both strong and weak form ($\flat\hat{6}$ and $\hat{6}$, i.e. pitches *c* and *c♯*). The case is the same with the Dominant representatives ***dP*** and ***D*** (power chords D^5 and B^5 include weak and strong Dominant agents $\flat\hat{7}$ and $\hat{7}$, i.e. pitches *d* and *d♯*). Thus, we can hear a progression from the strong to weak Subdominant and further from weak to strong Dominant. As for scale degrees, this progression is most strongly represented by the functional agents, which form a chromatic ascend $\flat\hat{6}$–$\hat{6}$–$\flat\hat{7}$–$\hat{7}$ (pitches *c*–*c♯*–*d*–*d♯*).

Examples 11(b) and 11(c) show different transformations of the same progression; the gradual transformations of ***S*** and ***D*** are indicated with arrows between the three examples (i.e. ***S*** → ***S₃*** → ***SL*** and ***D*** → ***D₃*** → ***DL***). As always, aural analysis should confirm the fundamental similarity and close family relationship between the three examples.

three functions was to be executed by root progressions such as $\hat{1}$–$\hat{4}$–$\hat{2}$–$\hat{5}$–$\hat{1}$. The connecting common tone $\hat{2}$ has a double meaning as Subdominant 6th and Dominant associate (Rameau called this the *douple emploi*).



Example 11: Functions in Judas Priest's (a) 'The Hellion/Electric Eye' from Screaming for Vengeance *(1982) at [1:21], (b) 'Some Heads Are Gonna Roll' from* Defenders of the Faith *(1984) at [0:50] and (c) 'Hell Bent for Leather' from* British Steel *(1980) at [0:04]. {This example is originally on p. 369.}*

Heavy metal harmony has a tendency towards plagal systems and minor modes, especially through the popularity of the strong Subdominant agent ♭$\hat{6}$. Why, then, is the primary minor Subdominant (***s***) played on the distorted guitar as a full triad not frequent at all? The minor Subdominant in the Judas Priest piece discussed earlier (Example 3) is indeed one of the rare occurrences of the distorted full minor triad in classic heavy metal. Again, the answer has to do with distortion. It has been demonstrated elsewhere that the acoustic structure of the distorted minor triad is much more dissonant than that of the power chord or the major triad (for a detailed discussion, see Lilja 2009: 114–51). If a more consonant chord structure is desired (as it usually is), the minor Subdominant quality can be communicated effectively with the power chord on Aeolian ♭VI.

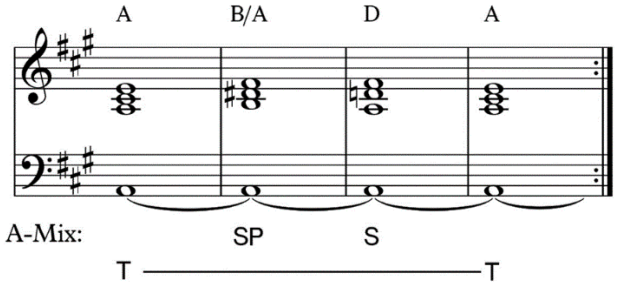
Modes with 'altered tonal degrees'

With few exceptions, all the previous examples have been in either Aeolian, Dorian, Mixolydian or Ionian mode. The remaining three – Lydian, Phrygian and Locrian – are usually mixed with other modes. The special characteristic {369} of these modes is the alteration of scale degrees, which traditional theory has assigned with the dubious title of *tonal degrees*, 'since they are the mainstay of tonality' (Piston and DeVoto 1987: 54–55). In each of these modes one of the primary triads is a diminished one, which makes them tonically unstable (Lydian ♯iv♭5, Phrygian v♭5, Locrian i♭5; none of these have any substantial use in classic heavy metal harmony). These modes stray further away from the stable tonal centre than those presented before. Moreover, they test the boundaries of perceptible family relationships of functions (I will discuss this further in the last part of this article).

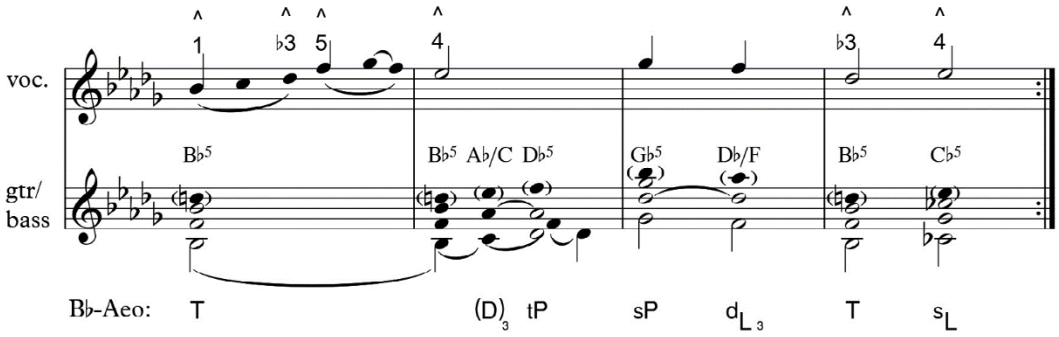
A piece of music rarely abides by a single mode, but Lydian examples are especially hard to find in heavy metal. The non-distorted guitar riff in Led Zeppelin's (1973) 'Dancing Days' from *Houses of the Holy* at [0:00] is a rare example. In their 'Immigrant Song' from *Led Zeppelin III* (1970) at [0:10] ♯$\hat{4}$ works as a leading tone to $\hat{5}$ (i.e. as a 'secondary dominant

agent') rather than as an advocate for Lydian mode. On the other hand, the ***SP*** in Example 12 seems to carry Lydian properties more clearly. 'Even if it is not without doubt, the chord [***SP***] seems to be more tied to Subdominant than to Dominant function' (Lilja 2009: 91).

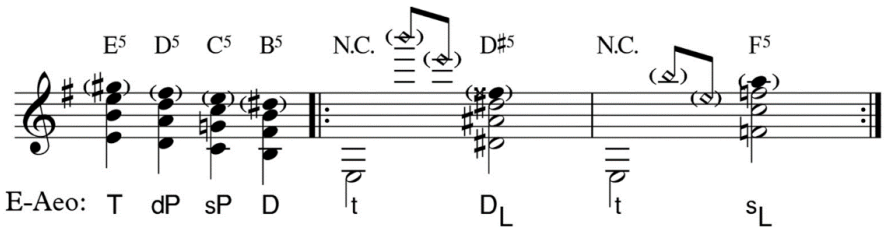
Different to Lydian, Phrygian and Locrian scale degrees frequently serve as chord roots. Such is the case in Example 13, in which the C♭ power chord serves as a Phrygian minor Subdominant (***sL***) in an otherwise clearly Aeolian context (in Euroclassical music theory this chord is frequently {370} labelled 'Neapolitan'). Phrygian chords on ♭$\hat{2}$ can be found in, for example, Iron Maiden's (1980) 'Remember Tomorrow' from *Iron Maiden* at [0:00], Whitesnake's (1987) 'In the Still of the Night' from *Whitesnake* at [1:50], Deep Purple's (1971) 'Smoke on the Water' from *Machine Head* at [1:25] and Metallica's (1986) 'Master of Puppets' from *Master of Puppets* at [2:00].



Example 12: Keyboard chords in Deep Purple's (1971) 'The Mule' from Fireball *at c. [1:06].*



Example 13: Ozzy Osbourne's (1986) 'Shot in the Dark' from The Ultimate Sin*; harmonic reduction at c. [1:02].*

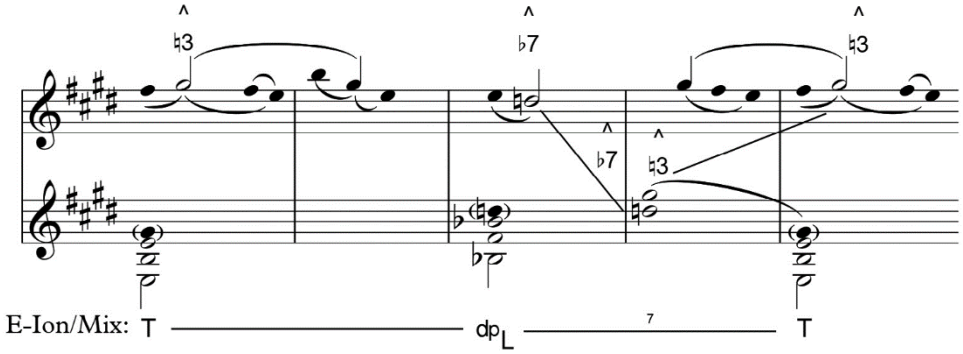


Example 14: Black Sabbath's (1983) 'Disturbing the Priest' from Born Again*; harmonic reduction at [0:00].*

Example 14 provides two power chords D♯5 and F5, which are rooted on the lower and upper leading tones of the Tonic E. (The guitar is tuned a whole-tone down, so the original key is D-Aeolian. The diamond-shaped note heads represent fingered natural harmonics in no-chord

[N.C.] {371} situations.) These chords are directed to the Tonic with the two strong dominant agencies: the minor Subdominant agent and the major Dominant agent. Although the Phrygian minor Subdominant ***sL*** is rather common, the Lydian major Dominant ***DL*** (including Lydian ♯$\hat{4}$ and ♮$\hat{7}$) is certainly not. Metallica's (1986) 'Master of Puppets' at [1:30] provides an alternative example on ***DL***.

Historically carrying horror imagery (e.g. Riemann, quoted in Engebretsen 2011: 375), the Locrian ♭$\hat{5}$ seem to have a special place in heavy metal harmony. Examples include Black Sabbath's 'Black Sabbath' from Black Sabbath (1970) and 'Symptom of the Universe' from *Sabotage* (1975) at [0:00], and Metallica's 'Master of Puppets' from *Master of Puppets* (1986) and '...And Justice for All' from *...And Justice for All* (1988) at [2:00]. Example 15 shows Locrian ♭$\hat{5}$ as a chord root in an otherwise Ionian/Mixolydian context. The B♭ power chord is interpreted as ***dpL***, which emphasizes its relation to the minor Dominant agent. A rather long chain of transformation illustrates the chord's complicated relation to the Tonic ('major variant of the minor variant of the minor Dominant parallel'). Mixolydian ♭$\hat{7}$ and ♮$\hat{3}$ (pitches *d* and *g♯* in the vocal melody and higher guitar part) serve as common tone links between the two chords, which otherwise would be unrelated.



Example 15: Ozzy Osbourne's (1981) 'Revelation (Mother Earth)' from Blizzard of Ozz*; reduction at [1:24].*

Modal/functional framework

Table 2 draws together all what has been said above about the relationships between scale degrees, modes, functions and their related dualisms. The equal-tempered circle of fifths is presented as a horizontal line segment, which extends to opposite directions from the referential Tonic C. Moving to the right with ascending fifths (Authentic direction) or sharpening a scale degree increases the number of major scale degrees and thus brighter modal qualities. Similarly, moving to the left with descending fifths (Plagal direction) or flattening a scale degree increases the number of minor scale degrees and darker modal qualities. (Cf. e.g. extensive discussion on dualisms in Harrison 1994: 22–34.) The further one goes from the centre the lesser the number of modes, which include that scale degree. The two rows below the modes show the functional roles of scale degrees (cf. Figure 2 and Example 8 above). Again, going right increases *Dominantness*, and going left increases *Subdominantness* (these adjectives are from Rings 2011: 501–02). For example, the strong Dominant 'triggers' $\hat{5}$ (*D1*) and ♮$\hat{7}$ (*D3*) are on the right, whereas strong Subdominant triggers $\hat{4}$ (*S1*) and ♭$\hat{6}$ (*s3*) are on the left. Conversely, the {372} weak Dominant and Subdominant agents are on the opposite, 'wrong' side of the continuum.

Plagal (flat) direction
- Descending 5th
- Minor mode scale degrees

S ← T → D

Authentic (sharp) direction
- Ascending 5th
- Major mode scale degrees

	G♭	D♭	A♭	E♭	B♭	F	C	G	D	A	E	B	F♯
Scale degree →	♭5	♭2	♭6	♭3	♭7	4	1	5	2	6	3	7	♯4
Possible modes →	LOC	PHR LOC	AEO PHR LOC	DOR AEO PHR LOC	MIX DOR AEO PHR LOC	ION MIX DOR AEO PHR LOC	LYD ION MIX DOR AEO PHR LOC	LYD ION MIX DOR AEO PHR	LYD ION MIX DOR AEO	LYD ION MIX DOR	LYD ION MIX	LYD ION	LYD
Scale degree function: primary →			*s3*	*t3*	*d3*	*S1*	*T1*	*D1*	*S6*	*S3*	*T3*	*D3*	
secondary →						*D7*	*S5*	*T5*	*D5*				
	dpL	***sL***	***sP***	***tP***	***dP***	***S/s***	***T/t***	***D/d***	***Sp***	***Tp***	***Dp***	***Dl***	***SPl***
	ssL		***tL***	***dL***	***SS***				***DD***	***Sl***	***Tl***		***DDl***

Root of e.g. this chord:
← primary
← alternative

Table 2: Modal/functional framework.

As for the two bottom rows, there are such chord transformations in which each scale degree serves as a chord root. Again, strong Subdominant agencies (chords with lower case ***s***) dominate on the left, strong Dominant agencies (chords with upper case ***D***) on the right. Secondary dominants (***DD*** and ***SS***; e.g. Motte 1983: 118–28) and their transformations were not discussed in the analyses above.

Dominant and Subdominant chains present a special case of applying either plagal or authentic direction in the extreme. These chains are formed with root progressions in fifths. In the Dominant ('authentic') chains, each chord is constructed on the fifth of the next one (e.g. root progression E–A–D–G–C). The Dominant chain is a common Euroclassical compositional device. Deep Purple (1974) copied a complete D-chain section from Johann Sebastian Bach's *Fugue, D-minor* (BWV 565) for 'Burn' from *Burn* at e.g. [2:48]. Other examples include Rainbow's (1981) 'I Surrender' from *Difficult to Cure* at [0:56] and Judas Priest's (1978) 'Exciter' from *Stained Class* at [3:38]. In the Subdominant ('plagal') chains, each chord is constructed on the fourth of the next one (e.g. root progression C–G–D–A–E) as in The Jimi Hendrix Experience's (1966) 'Hey Joe'. Other examples include Deep Purple's (1968) 'Hush' from *Shades of Deep Purple* at [0:38] and Black Sabbath's (1973) 'A National Acrobat' from *Sabbath, Bloody Sabbath* at [0:28]. Generally speaking, S-chains tend to be shorter than D-chains.

As a rule, the further we go from the centre of the diagram, the more complicated transformations we get. The reading of the Locrian ♭V as ***dpL*** is just one example (this chord was troublesome to Riemann as well; Engebretsen 2011: 364). The more we want to go to the modal extremes, the further away we stray from unambiguous harmonic functions. This applies to the both dark and bright extremes, even though the dark side is more common to heavy metal. Modal extremes like ***dpL*** include some of the most distinctive sonorities in later styles of metal music. These more distant harmonies have become much more prominent in later styles such as thrash metal. They can {373} be found in almost any piece in Metallica's *Master of Puppets* (1986) and *...And Justice for All* (1988). In the extreme styles, such as black metal, the Locrian mode is even more essential. A representative example would be Bathory's (1988) album *Blood Fire Death*.

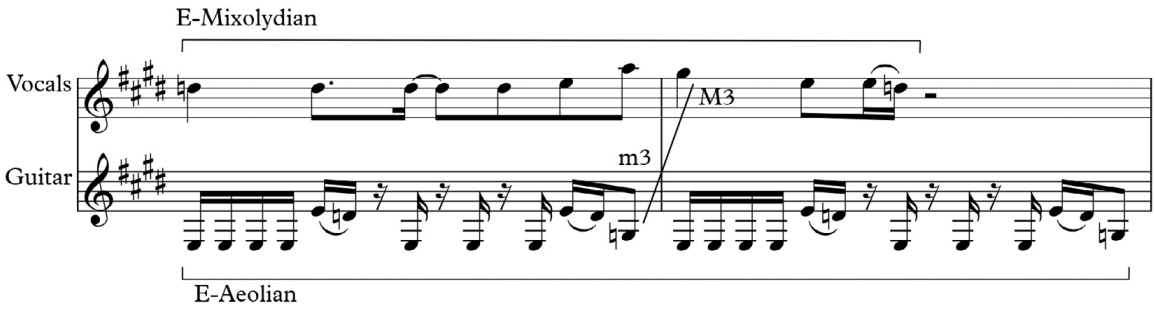
Further linking the dichotomies 'minor/major', 'authentic/plagal' and 'S-ness/D-ness' to modal qualities, the left hand side transformations are based on minor, and the right hand side transformations are based on major variants of the primary triads. Conversely, transformation on the left are major chords, whereas on the right they are minor chords. The left hand side transformations dominate the chord repertoire in the musical examples above. The right hand side chords, if they are used, almost always go through yet another

transformation into major variants. This, of course is due to guitar distortion harmonics, especially the major third. The left hand side chords already are major chords, and thus need no additional transformations, which might be another reason for favouring the modes in question. Those chords abide by both the mode and the acoustic necessity of the chords' major quality.

This leads us to a brief discussion on vertical and horizontal harmony. In much heavy metal the minor type modes dominate in melodies, riffs and chord roots. This makes the horizontal harmony appear as minor/dark. However, due to distortion the chords themselves are usually major, and thus, belong to the major/bright side of the dual framework: chord roots are mostly from the left, chord thirds mostly from the right side of the framework in Table 2.

This modal dichotomy is a stylistic link with Renaissance polyphonic practices, where virtually any chord could, and the ending chord definitely would, be a major triad. 'The medieval composers down to Sebastian Bach used for their closing chords either exclusively major chords, or doubtful chords without the third' (Helmholtz 1954: 217). Numerous works by e.g. Orlando di Lasso, Thomas Tallis and William Byrd serve as testimonies on this practice (e.g. Haar 1977; Urquhart 1993). For instance, frequent 'false' or 'cross relations' can be found in both styles. 'Cross relation' refers to subsequent or simultaneous use of two different forms of one scale degree. For instance, in Judas Priest's 'Out in the Cold' (Example 3 above) the first chord ***T*** contains a *c*♯ ($\hat{3}$), whereas the subsequent chord ***tP*** has a *c* ($\flat\hat{3}$). The so-called 'English cadence' of the Renaissance refers to simultaneous use of the major and minor thirds. It is 'found in the music of such composers as Tallis, White, Byrd, Gibbons, and even as Henry Purcell' (Urquhart 1993: 16). Urquhart (1993: 16–21) offers numerous musical examples, in which the major third is in the highest part. In heavy metal, though, the minor third is usually superposed with the power chord (having a major third in the distortion). This is the case in the two Judas Priest compositions in Examples 11(a) and 11(b): over the final power chord E^5 in the guitars there is a *g* natural (i.e. $\flat\hat{3}$) in the vocals (not notated), which would seem to conflict with the *g*♯ (i.e. $\hat{3}$) distortion harmonic (see Lilja 2009: 162–65, for more examples on this kind of situations). Moreover, if the minor third is actually played, the major third and the minor seventh are usually included. This idiomatic 'Jimi Hendrix chord' (e.g. $E^{7\sharp 9}$) is used in e.g. Deep Purple's (1971) 'No One Came' from *Fireball* at [0:08] and in Black Sabbath's (1972) 'Supernaut' from *Vol. 4* at [0:20]. Although the means and reasons to accomplish these kinds of dualistic sonorities in the Renaissance period were certainly different from heavy metal, the sounding results are strikingly similar. Moreover, these kinds of modal mixtures are almost non-existent in the so-called common practice period of western art music.

{374} A final mirror-symmetry presented here is fundamentally a melodic one. In Example 16, an E-Mixolydian vocal melody is superposed with an E-Aeolian guitar riff, which is its dual-modal counterpart. This is a rare example of such cross relation in classic heavy metal, in which the higher part (vocals) has $\hat{3}$ (pitch *g*♯) while the lower part (guitar) has $\flat\hat{3}$ (pitch *g*). As discussed earlier, the reverse order is more common.



Example 16: The guitar and the vocal parts in Black Sabbath's (1970) 'War Pigs' from Paranoid *at c. [2:17].*

Conclusions

The analytical examples above, I hope, have demonstrated that heavy metal harmony has a tendency towards plagal and minor mode systems, in which distorted power chords add constant major elements. As I see it, the dual framework (refer back to Table 2) is more than suitable for illustrating this. An advantage of the Riemann-based system is to separate chord function from chord succession rules. Compared to progression-based *Stufentheorie*, the Riemann-based *Funktiontheorie* effectively shows the family relationships of chords seemingly distant from each other. Moreover, it provides a meaningful analysis of tonally distant or ambiguous chords like ***dpL*** or ***sL***, when these chords are played right next to Tonic triads. These are some of the most distinctive harmonic motions in heavy metal, because they mark heavy metal apart from other styles. To gain more understanding of the historical development of heavy metal harmony, further research should include systematic statistical corpus analyses.

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CONTRIBUTOR DETAILS

Esa Lilja is a researcher, musician and composer in the fields of both Euroclassical and popular music. His academic background is in musicology, especially in music theory and analysis. Since 1997 Lilja has worked as a teacher/lecturer of e.g. music theory, analysis, transcription, history and ensemble work at all levels of Finnish music education ranging from private music schools to professional music education and universities. His academic publications and presentations have been mainly concerned with music theory and analysis, guitar distortion, heavy metal and music education.

Contact: Music Theory, Department of Classical Music, Faculty of Performing Arts, University of Stavanger, N - 4036 Stavanger, Norway. E-mail: esa.lilja@uis.no

https://orcid.org/0000-0002-3066-6028

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