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DEFINING CONSONANCE AND DISSONANCE IN METAL MUSIC

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Abstract

The theoretical phenomena 'consonance and dissonance' underscore the expression of many musical disciplines and appear in literature dating back to the ancient world. Consonance is a state of rest, or normalcy, usually instantiated by the starting note of a composition, whereas dissonance afflicts tension against this consonance. Ordinarily, dissonance still bears a strong harmonic relation to the prevailing consonance. Whilst a vast body of literature has been dedicated to this concept, its embodiment in metal music has scarcely been studied despite the traits of this genre depending greatly on the existence of consonance and dissonance.

This thesis overviews consonance and dissonance in metal music, and in particular, metal music's unusual approach in that its dissonances can not only lack harmonicity but supersede consonance as a state of normalcy. The lack of a comprehensive text on metal music consonance and dissonance is not only a deficit for music theory literature, but also metal, music psychology, and global music literature. In analysing metal music's approach to consonance and dissonance, this thesis confirms the literature's notion that consonance and dissonance parameters evolve over time.

Furthermore, studying consonance and dissonance in the case of one music genre is highly revealing about how fans derive pleasure and meaningfulness from the music. This is not only relevant to the psychological implications of metal, but to music literature more generally in that scrutiny against theoretical concepts must be maintained if they are to retain relevance to ever-innovating and ever-more creative musical practices.

Detailed analysis of music and listener-perceptions thereof offer important insights into what turn out to be subversive interpretations of consonance and dissonance; although a natural basis for the phenomena is established, their realisation as tension/resolution is shown to be an *individual's* experience. Most likely, however, an individual's definition of consonance and dissonance is enforced by a culture of music. It is shown that metal music favours dissonance highly due to its congruence with aesthetics which transcend the genre; along with analysing music, this thesis observes the overall transgressive, horror-like traits of metal music. Such aesthetics are found to be appealing as they facilitate the exploration and catharsis of negative emotions and ideas in safety, both individually and communally.

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Chapter 1

Introduction

This thesis will investigate the definitions and perceptions of musical consonance and dissonance. It is argued that dissonance, which typically is subpar in musical practice, can be desirable to certain listeners, specifically in metal music. The ensuing investigation will show that consonance and dissonance are subjective definers, and dependant on various contextual factors.

Metal appeared noticeably in the UK and USA around the late 1960s, as an offshoot of rock music. Characterised by overall loudness and density of sound, metal has also remained committed to transgressive cultural signs, such as anti-religious rhetoric. This transgression extends to the thwarting of conventional musical practices, with dissonance and extremity common to much of metal.

There are three objectives central to this project. Firstly, musical and scientific literature demonstrates an abundance of consonance and dissonance concepts. Therein, there exist various arguments concerning the acquisition, conceptualisation, and meaningfulness of these dichotomic concepts. This thesis draws upon this wealth of literature to develop an understanding of consonance and dissonance.

Secondly, an analysis of varying examples of metal is undertaken. These analyses focus on occurrences regarded as dissonant, demonstrating their function and overall ubiquity in metal.

Lastly, the perceptions and meaningfulness of dissonant metal are investigated, supported by sociology-based literature. This argument investigates the existence of a music culture that relies heavily on unusual musical practices, summarising why consonance and dissonance might be perceived atypically.

Overall, the research problem addressed is one of imbalance; despite the depth of consonance and dissonance concepts, their utilities have not been properly accounted for in transgressive music. The significance of dissonance in metal music is demonstrated to

emphasise whether listeners understand consonance and dissonance biologically, culturally, or as a combination of both.

This thesis will define, analyse, then explain the perceptions of consonance and dissonance via the lens of recorded metal. The proceeding chapter is a literature review, followed by a chapter detailing the research methods used.

Chapter 4 then scrutinizes various definitions of consonance and dissonance, including their tentative history. This chapter observes how consonance and dissonance exist as biological auditory phenomena, but can also be altered through cultural experience. Chapter 5 takes these definitions into a detailed analysis of musical function. This chapter demonstrates the abundance of the previously outlined dissonance types in metal, utilising examples from various eras and subgenres to build a comprehensive understanding. Chapter 6 explores why metal performers and listeners favour dissonances, addressing how listeners might perceive dissonances and any meaningfulness embedded within them. Finally, Chapter 7 features a summary of findings and also considerations for future research ideas. This thesis is structured to develop an understanding of consonance and dissonance in metal, before ultimately depicting how these phenomena affect the human listener.

Chapter 2

Literature Review

Whilst texts particular to metal are essential to this thesis, the topic of consonance/dissonance (hereafter, cons/diss) within musical texts is the initial consideration in this review. Regarding metal texts themselves, sociological-based texts remain relevant, although studies concerning theory and form of metal are most significant. Lastly, texts addressing perceptions of and applications of music are reviewed.

Academic metal literature is a burgeoning field, with publications emerging from a range of disciplines external to music, including sociology and psychology. As this thesis ultimately addresses the perceptual experience of dissonant metal, literature concerned with metal psychology is an important consideration.

Whilst such developments give researchers an abundance of source material, this diversification is a relatively recent trend. Early metal literature focused more on musicology, such as Walser's (2014) *Running with the Devil*, Berger's (1999a) *Metal, Rock, and Jazz: Perception and the phenomenology of Musical Experience*, and Weinstein's (2000) *Heavy Metal: The Music and its Culture*. Texts such as these were comprehensive for their time, discussing many musical attributes such as modality, timbre, and lyrical content. However, as metal has become more widely studied, the significance of the music itself has become comparatively neglected.

2. 1 Consonance and Dissonance

There exist various definitions outlining cons/diss. Also notable are the adaptions of such definitions through time, as Tenney (1988) documents in *A History of Consonance and Dissonance*, and the subsequent acknowledgement that at least some level of cons/diss perception is culturally informed. For the latter reason, there is a degree of importance in assessing cons/diss in any given culture of music; understanding what its constituents perceive as normative and subversive is crucial before verifying any behaviour beyond this.

Concerning the conceptual definitions of cons/diss, a significant area of study concerns the *physics* of sound, particularly regarding the overtone series (Bowling 2015: 11156), and auditory 'roughness'. Moreover, studies addressing the biological grounding of cons/diss find that physical parameters are not the sole determiner. Bidelman (2014: 204) and Terhardt (1984: 288) observe how brain activity readily recognises pitch relations deemed consonant, and that a consonant system of musical intervals correlates with the parameters of human speech.

Such scientific texts also recognise that speech is an acquired phenomenon learned during infancy. Thus, it is likely that consonance, as inferred from human speech, is at least partly 'learned' (Terhardt 1984: 294). Indeed, many musical texts address how cons/diss is an interchangeable concept, whose definition depends on the system of music at hand. For instance, McGowan (2008) claims that within jazz,

> consonance and dissonance refer to stable/passive and unstable/active harmonic entities within the musical grammar of a distinct cultural system, as influenced by sonorous euphony. By ''sonorous euphony'' I mean simply what sounds ''pleasant'' when accounting for its context. The definition reflects a number of distinct traditions of conceptions of consonance and dissonance.

In part, this suggests why cons/diss definitions have not remained static and why an assessment of cons/diss in transgressive metal will be useful in further understanding these concepts. The adaption of definitions runs parallel to newly emerging musical practices, and increasingly complex compositional possibilities. This includes creative choices as well as technological possibilities. As such, the potential for consonance or dissonance has encompassed the melodic, to the harmonic, to larger and more complex aggregates, and finally to the timbre of any sound (Tenney 1988: 97).

Moving to varying types of cons/diss, Harmonic and melodic pitch relations are fundamental definers. A comprehensive text outlining note relations is Persichetti's (1978) *Twentieth Century Harmony*. Discussions of pitch relations in metal literature often conform to detailed concepts found in less genre-particular texts such as Persichetti's. Notable examples include Lilja (2009 and 2019), along with Herbst (2018a). Also, there exist texts which take *connotations* of pitch relations as a means of interpreting the meaningfulness of metal, such as Cope's (2010) *Black Sabbath and the rise of heavy metal music*. Whilst the pitch functions of metal are researched in these texts, less present is a rigorous consideration of

its purely dissonant functions, along with an overall assessment of the role of dissonance within metal and how it is perceived.

Rhythmic and meter-based consonance and dissonance has been studied notably by Schillinger (1977), Krebs (1987), and Kaminsky (1989). Whilst the likes of Temperley (1999), Pieslak (2007), Biamonte (2014), Hannan (2018), and Lucas (2018) have applied such studies to rock and metal, metrical dissonance has not been overviewed comprehensively, perhaps in part due to favouritism towards the extreme metal subgenre; the succeeding subsection explores this in greater depth.

The texts cited above explore conflicting and unconventionally grouped rhythmic layers and how these might be experienced empirically. These texts largely maintain Krebs' nomenclature, however, another problem for meter-based dissonance is a lack of consensus, where identical phenomena are often identified by various terminologies, especially outside of academia. 4. 3. 3 clarifies such issues of taxonomy.

Timbral qualities have frequently been scrutinised as consonant or dissonant, with citations often made to German physician Helmholtz (1877). Given that guitar distortion is essential to metal, it is unsurprising that the quality of its timbre has been researched extensively. Prominent examples such as Berger and Fales (2005), Lilja (2009), and more recently, Herbst (2017a), Mynett (2017), and Virtala (2018) acknowledge how increased overtones of notes under distortion create roughness. Most importantly, distortion contributes to the empirical effect of heaviness. What is missing, however, is a consideration of these metal timbres as an independent form of dissonance, exploring how dissonances are used to create characteristic traits of metal, rather than dissonance being a side effect of such traits.

Additionally, authors have noted the difficulty in matching sound theory with its artistic use (Lilja 2009: 65). The objective causes of cons/diss, such as the parameters of human speech frequencies, only emphasise that multiple interpretations of phenomena are essential in creating any subsequent artistic claim; an analyst should not assume that theoretical function and listener-realisation of a theory correspond.

In summary of how the concepts of cons/diss have evolved, a general conclusion is that through time, intervals and note groups once considered dissonant become accepted as consonances (Tenney 1988: 97-99, Persichetti 1978: 17). This adaption is a change of

cultural doctrine, via the perception of composers, listeners, and academics. For this reason, this thesis is not only addressing dissonance within metal but simultaneously with what metal contributes to the changing definitions of cons/diss.

2. 2 Metal Music Literature

Research such as Kahn-Harris (2007), Partridge (2012), and the aforementioned Weinstein (2000), illustrates the nature of a metal culture. Kahn-Harris describes metal culture as an active and complicated social infrastructure, wherein members can experience 'mundanity', with their lives and careers existing exclusively within the culture (Kahn-Harris 2007: 60). Additionally, unconventional forms of capital are recognised, such as the 'subcultural capital' of members being up to date with fashion, and slang vocabulary (Kahn-Harris 2007: 121).

Of course, any particularities of a culture fall within its overall existence. Therefore, significant themes common to these sociological texts, such as metal audiences revering technically and theoretically-accomplished performers (Weinstein 2000: 122), are retained throughout this thesis. Indeed, many specific aspects of metal relate to socio-musical themes. For instance, authors typically claim that authentic expression is an essential definer (Walser 1993: 104, Weinstein, 2000: 79, Kahn-Harris 2007: 129, 131), along with transgression against mainstream practices (Bayer 2009: 81, Cope 2010: 12, Partridge 2012: x). Specific theories and analyses in this thesis will be underscored by such broad themes.

It is at this point worth mentioning why analyses in this thesis will be centred on the electric guitar. Along with being the primary source of dissonance, the electric guitar is the principal instrument in metal. Bands are often judged by the qualities of their guitarist, such as in Weinstein (2000: 122), Bayer (2009: 93), and Walser (1993: 41). Unsurprisingly, this insinuates a literature gap where far less research has addressed drumming and bass playing aspects of metal. However, this thesis will remain centred on the guitar, due to the main concern being with dissonance.

Kahn-Harris (2007), Smialek (2008), Reyes (2013), and Morris (2015) are examples that in essence outline the operations of metal audiences. They acknowledge ubiquitous concepts such as metal audiences willingness to work; to learn to enjoy initially unappealing songs (Smialek 2008: 112-113). Also, that metal commonly offers a sense of 'empowerment' for its listeners to enjoy (Kahn-Harris 2007: 52). Recognising these significant characteristics is vital before addressing any specifics of the genre's audience. These texts provide an outline of what metal offers to audiences and how they might receive it, with this thesis seeking to understand how the concepts of dissonance contribute to such meaningfulness.

Also, distinctions of genre is an important consideration. Immediately, a problem of subjectivity arises; virtually no composition can truly be categorised, with each one drawing from countless influences to create a multi-faceted product which in turn might be heard uniquely by different listeners and their outlooks. This problem is relevant to any study within a given genre, begging the question, what even is that genre, to begin with?

Given that in-depth debate distinguishing genres is beyond the scope of this thesis, a generalisation is made by borrowing Moore's notion of style:

> styles, in relation to other pertinent cultural practises, can be considered fixed rather than flexible […] a musical style creates, and is created by, a social identity […] the style reflects the parent culture. (Moore 2001: 191-3)

Hereby, a more generalised definition of genre, as a mode of thinking, is reached. Whilst this does risk oversimplification (Mynett 2019: 297), metal scholars have utilised Moore's ideology:

> although there can be no unchanging and definitive description of [Contemporary Metal Music], the author similarly proposes that there are ways of expressing common musical sounds, performance perspectives and a coherent set of practises that are frequently shared… 'points on a style continuum' (Moore 2001: 148). (Mynett 2019: 298)

Rather than becoming tangled in the nuances of singular songs, genre is best defined by broader consistencies within this thesis.

It is worth noting contemporary literature's concern with rethinking genre; Shuker (2012), Smialek (2015), and Kennedy (2018) consider the interconnected relationships between subgenres. Such publications also consider how small-scale stylistic elements, including non-musical notions such as audience attitudes and behaviours, influence the boundaries of sub-genres. On the other hand, Hillier proposes a musicology-focused model for defining

subgenres (Hillier 2020: 5-6). Whilst not arguing for genre distinctions directly, stylistic particularities and audience behaviours discussed in this thesis are still relevant to these arguments.

Most significant to consider is metal theory literature. Whilst music-theory underpinning metal and reference to dissonance within metal is by no means omitted (Lilja (2009: 134) is a strong example), the lack of a rigorous analysis of dissonance in metal, contrasting how various dissonances act to create layers of meaning and function, will become apparent.

In finalising the previous problem of genre, objective factors such as distortion contribute to the more abstract concept of heaviness. This argument is maintained within comprehensive metal texts such as Mynett (2017), and Thomas (2015), suggesting this factor is essential to a composition being metal, as can be found empirically.

Heaviness is not the sole determiner of metal, however, as was demonstrated with several socio-musical themes. Metal can also be determined with similarly abstract concepts, such as extremity. Along with being the namesake of an apparent subgenre, addressed in Smialek (2015) and Thomas (2015: 196), extremity is important to metal's transgressive, boundary-pushing nature. Variants of extremity have been acknowledged by Phillipov (2012), St-Laurent (2016), and Hannan (2018), wherein Hannan describes intense rhythmic complexity (2018). Despite extremity being significant for metal, only limited measurable scales and tools exist which determine how extreme a song is. Czedik-Eysenberg's (2017) 'Hardness' model is a nascent example. Analysing how artists use creative choices such as dissonance to create extremes (along with other conceptual outcomes) will contribute to understanding such abstractions.

Assessing texts concerning dissonance in metal, an apt mentioning is 'Death metal tonality and the act of listening' (Berger 1999b), which considers the ambiguity of metal tonality and listeners perceptions thereof. Such a text is bedrock to this thesis, particularly in outlining the importance of listener perspectives regarding music that whilst unusual, still very much reflects a culture. However, considering dissonance as a multi-faceted and fluid concept necessitates reference to texts concerned more directly with theory. Lilja (2019) stresses metal musician's preference for 'darker' modality, although texts such as Mynett

(2019) and Kazdan (2017) come closer to describing metal's tendency to *break* theoretical rules.

Additionally, complexity deriving from metal musicians' approach to theory is documented in 'Re-casting Metal: Rhythm and Meter in the Music of Meshuggah' (Pieslak 2007), *Re-thinking metal aesthetics: Complexity, authenticity, and audience in Meshuggah's "I" and "Catch 33* (Smialek 2008)*,* 'Difficulty as heaviness: Links between rhythmic difficulty and perceived heaviness in the music of Meshuggah and The Dillinger Escape Plan' (Hannan, 2018), and 'So Complete in Beautiful Deformity: Unexpected Beginnings and Rotated Riffs in Meshuggah's *obZen*' (Lucas 2018). A notable shortcoming is the tendency of such texts to exemplify only a small selection of artists. A more diverse set of examples might demonstrate a greater abundance of theoretically complex occurrences, including occurrences that might be considered dissonant.

Noted beforehand, research into the timbral qualities of metal is common. Indeed, many texts addressing metal theory are overshadowed by the study of distortion and/or heaviness, such as Virtala (2018). In Czedik-Eysenberg (2017), this is considered a solution to the dominance of sociological-based research. Given the ubiquity of distortion and heaviness in metal, this tendency is by no means a shortcoming. However, this general focus on the timbre of tonal features still risks over-looking metal tonality itself.

Notwithstanding, Biamonte's (2010) tonality-centred 'Triadic Modal and Pentatonic Patterns in Rock Music' supposes a historic 'problematic emphasis on pitch-based analysis' (Biamonte 2010: 95), arising from the lack of fixed measurement systems for features such as timbre. Hereby, there exists a struggle where researchers attempt to quantize timbre, yet perhaps understate the significance of sheer tonal quality, especially in contemporary metal.

Texts which address form and structure of metal are comparatively sparse. Berger (1999a: 56-65) overviews death metal form and compositional practice. Some examples, such as Pieslak (2007), and McCandless (2013), consider the large-scale effects of meter, and Gamble's (2019) 'Breaking down the breakdown in twenty-first-century metal' focuses on a particular meter-based element of formal structure. Again, this is no shortcoming, as it serves to demonstrate the significance of rhythm in contemporary metal. Nonetheless, reiterating

how research into tonality is generally concerned more with guitar distortion, form in metal literature is conversely preoccupied with particularities such as meter. Briefly, this thesis will consider the incongruity of metal songs where their holistic formal structures might be considered a dissonance type.

In light of the literature gaps highlighted, many of these are addressed if less-particular rock music literature is considered. Moore (2001) offers a comprehensive study of rock as music, covering many themes addressed above, including melodic (tonal) quality, formal structures, and the act of listening to rock music. Moreover, Martin (2002), and Holm-Hudson (2002) observe rock music's tendency to experiment, innovate, and resist anything mainstream. Whilst these studies make detailed analyses of a generalised rock music, they also demonstrate the need for more comprehensive studies of metal and the tendencies which transcend it; assertions about rock within these such texts are often even more profound in metal.

It is also worth considering the literature on recording and production values. Mynett (2017), and Herbst (2018b), note how technology is utilised in creating the essential feature of heaviness via distortion, along with using technology to attempt even greater heaviness, respectively. Mynett notes the challenge both performers and producers face in attempting to create highly precise, tangible products, yet retain the theme of authenticity. For this reason, the notion of 'precision' is largely synonymous with a concept of deliberation:

> When multiple performances are attempting to synchronise the same subdivision but without the requisite level of precision, this quickly results in a disordered mush of sound. Apart from confusing the listener, a mush of sound provides less sonic impact and is subjectively less heavy than comparatively more unified/accurately aligned transient energy. (Mynett 2017: 20)

This thesis will understand that for features of metal to be communicated successfully, including dissonances, they must be used deliberately. This deliberation is again supported by Mynett (2019: 300), who observes the lack of 'improvisatory methodology' in contemporary metal. Similarly, Berger (1999a: 59) notes how 'poorly performed' metal is not perceived as heavy.

Furthermore, Thomas (2015) and Leyshon (2009) document how technological developments have allowed widespread public access to recording-studio tools and functions. One effect of this is a greater facility for artists to experiment as they compose.

Since advancing technology allows for deliberation and experimentation in a genre already dependant on technology, acknowledgement of research on production and the consequent compositional values is made within this thesis. Nonetheless, a detailed analysis of production is not the aim of this thesis and will be used only as a reference in the overall argument.

2. 3 Perceptions and Applications

It may seem unusual to begin with a discussion of the flourishing global metal literature. Nevertheless, in parallel with perceptions of dissonance being culturally influenced, recent studies demonstrate how different cultures perceive and utilise metal differently, albeit with common underlying tropes and motives.

Berger (1999a), Laurin (2013), and Varas-Díaz (2015) have employed qualitative and quantitative analysis to demonstrate a universal sense of community within metal scenes. Further to this, Grant (2017) notes how metal communities apply the musical experience to their particular, contextual needs. Notably, emergent themes within global metal literature parallel many themes within mainstream metal literature, such as transgression and empowerment.

Although this thesis is concerned with Western metal listener-perceptions, significant metal themes are becoming increasingly transparent owing to global metal research. Moreover, future global metal research could be further enriched by extrapolating the study of dissonant-specific perceptions.

The growth of metal music psychology is a salient trend. Much of this development is facilitated by the *Metal Music Studies* journal, although even dedicated psychology journals, such as *Frontiers in Human Neuroscience* and *Qualitative Research in Psychology*, have made publications (Sharman (2015) and Hamilton (2019), respectively) concerning the psychology of metal.

In contrast to the prejudices of the Parents Music Resource Centre[1], as well as more recent discriminations[2], psychology tends that metal has a positive effect on mental wellbeing. From *Metal Music Studies* alone, Quinn (2019), Eischeild (2019), and Yavuz (2017) have noted the stress-relieving aspects of metal, particularly concerning the sense of community discussed beforehand.

Along with garnering greater and more open-minded academic interest, this subject of metal's emotional utility is in essence the objective of this thesis. In similar fashion to how metal was once considered holistically negative, dissonances may not be perceived as negative or incorrect but may contribute ultimately to the processing of emotions (Quinn 2019: 419) and catharsis discussed in metal psychology.

2. 4 Summary

This review has demonstrated metal studies as an increasingly multi-faceted platform. Metal is a vibrant ground on which to study culture and ideology, and more recently, is a promising means of understanding the human emotional experience.

Whilst a tension between social and theoretical studies of metal perpetuates, von Appen et al. maintain this as the very purpose of musicological study:

> musicological analysis is not necessarily an aim in itself, but a toolbox that can be used to address many different issues of broader relevance […] and not to 'prove' how some structurally complex songs are 'great' as works of art. Like a mirror ball, songs reflect their surroundings and that is part of what makes them attractive. (Appen, Doehring, Helms, & Moore 2015: 3)

In achieving this ideal, one must maintain a balance between the empirical and theoretical. This review has demonstrated slight favouritism towards extramusical values, which may also account for the sparsity of literature concerned with cons/diss. This thesis will begin by addressing this musicological gap. In turn, investigating the understanding of metal

[1] See https://www.rollingstone.com/music/music-lists/pmrcs-filthy-15-where-are-they-now-60601/ (Grow, 2015) for the vilified 'filthy 15' songs, the majority of which are hard rock and metal (Accessed 26.05.20).
[2] See https://www.vice.com/en_uk/article/qvnd55/america-is-still-afraid-of-heavy-metal (Kelly, 2018) for an incident where two metal fans were kicked-off a University campus due to their attire (Accessed 18.05.20).

sociology and psychology, and simultaneously analysing the nature and perceptibility of musical dissonance.

Chapter 3

Methodology

The objective of this thesis is to create a rigorous account of musical dissonance and how it is used and perceived in metal. The steps taken are:

(1) A detailed review of what is meant by cons/diss;

(2) a musicological analysis using these concepts;

(3) an analysis of how listeners perceive the concepts.

Metal is the chosen case study given the propensity for dissonance and transgressive traits. However, whilst the construct of music can be delineated with pure theory, any analysis supposing meaning or what a song sounds like with only one perspective is incomplete. Analysts are becoming increasingly aware of this; Tagg's notion of intersubjectivity (Tagg 2013: 196), and von Appen et al.'s claim, 'we cannot assert that from a different perspective the experience of listening will be the same,' (Appen, Doehring, Helms, & Moore 2015: 1) are foundational examples.

The wealth of internet-based references are therefore utilised. If it is agreed that any individual response to a composition is valid in developing an understanding of its nature, then online commentary offers an immense number of sources with which to do so. Writers such as Smialek (2008, 2015) and Kennedy (2018) have already taken advantage of this 'netnography'[3]. As the forefront of music reception, online references are especially valid in this thesis, which is concerned with perception.

[3] Netnography is 'a technique for the cultural analysis of social media and online community data' (Kozinets 2014, p. 262).

Chapter 4

Defining Consonance and Dissonance

The first result from a Google search, taken from Encyclopaedia Britannica, describes consonance as 'the impression of stability and repose', and dissonance as causing 'the impression of tension or clash' (Young 2016). These definitions are loosely opposites, and can be understood as a dichotomy; comparable perhaps to chaos and order.

Nonetheless, such definitions raise further questions. What is pleasant or unpleasant in music? Can pleasantness be conceptualised? More importantly, how does stylistic and cultural context influence cons/diss? This chapter begins to answer these questions, starting with what is meant by the nomenclature, consonance and dissonance.

4. 1 Taxonomy

In identifying what might be meant when using the words consonance and dissonance, a summary has been offered by Terhardt (1984: 282), where consonance can be taken to mean:

> 'Harmony: tonal affinity, compatibility, and functional-note relation. It is pertinent to pitch relationships.' [And,] 'Sensory consonance […] the more or less complete lack of annoying features of a sound; it is pertinent to such sensory parameters as roughness and sharpness'.

Immediately, a significant problem emerges in that consonance could mean one of two things. If it is possible for a chord to be harmonically consonant (i.e. made up of a compatible series of notes), and yet sensorily dissonant (i.e. produced on an instrument capable of great roughness), would this render the chord consonant or dissonant?

Another problem emerges if the subjectivity of these definitions is considered. Such that, does every listener perceive apparently compatible note groupings as harmonious? More strikingly, is every listener guaranteed to perceive a rough sound as annoying? Palisca, for example, suggests 'the roughness criterion' still demands a judgment from the listener. In experiencing the notions, 'tension and relief', Palisca asserts that 'familiarity with the

language of Western tonal harmony' is required (Palisca 2001). Such context-dependent factors are detailed in 4. 3.

The problematic subjectivity of cons/diss can be demonstrated by the historical definitions of the terms; Tenney (1988) has documented how the 'qualitive referents' of cons/diss have changed throughout time. He argues this is a consequence of the creative preferences of composers and can be divided into five time periods referred to as 'consonance dissonance concepts' (CDCs). Tenney's timeline is depicted in Table 1:

Table 1- Tenney's Cons/Diss Concepts

Concept:	**CDC-1**	**CDC-2**	**CDC-3**	**CDC-4**	**CDC-5**
Era	Prior 800 A.D.	800-1300	1300-1600	1600-1800	1800-
Summary	*Melodic*	*Simultaneous notes*	*Simultaneous notes*	*Functions in a chord*	*Timbre*

Via these concepts, cons/diss has meant:

CDC-1: The intervallic relationship between different pitches

CDC-2: The stability of pitches sounding together

CDC-3: The stability of combined pitches, but with leniency for 'imperfect consonances'

CDC-4: The stability of notes in relation to a chord root

CDC-5: The 'roughness' of any sound

It is important to note that each emergent definition does not invalidate earlier ones; the changing taxonomy of cons/diss is largely the acceptance of additional consonances. Within the CDC-1 era, Pythagoras determined the only 'permissible' consonances to be 'the octave, perfect fifth, and the perfect fourth' (Bowling 2015: 11155). However, by the CDC-3 era, Gioseffo Zarlino proposed the major and minor third, and major and minor sixth as additional consonant intervals, in part due to their increasing usage in the music of the time (Bowling 2015: 11155).

Concerning CDC-4, Tenney describes an unstable chord as dissonant due to the presence of notes not related to the root (1988: 96). Tenney goes on to claim such a dissonant chord

is generally required to resolve (1988: 97). Inadvertently, this emphasises Palisca's observation that tension/resolution requires familiarity with the musical language at hand. This, and the systematic addition of consonant intervals, suggests cons/diss merely obliges to what is considered pleasant or unpleasant in a given musical culture.

Nonetheless, the development of CDC-5, where cons/diss can be independent of any musical practice, would imply that cultural conventions are not a satisfactory definition of cons/diss. Although 'roughness' (the essential determinant of CDC-5 (Tenney 1988: 90)) is still a subjective effect, Terhardt (1984: 284) observed that 'evaluated consonance is minimal for that interval whose roughness is maximal, and vice versa.' Concerning *chords* made up of complex intervals, 'the roughness produced by a dyad of complex tones will tend to be consistently more pronounced than that produced by an equivalent dyad of pure tones.' Then, a corollary result, from a study by Popescu (2019) et al. indicates: 'that pleasantness and roughness ratings were, on average, mirror opposites; however, their relative distribution differed greatly across styles, reflecting different underlying aesthetic ideals.'

These studies would imply that for many listeners, cons/diss can be determined by a spectrum of roughness. Thus, despite intervals seemingly being deemed consonant in keeping with musical trends, there exists a more scientific basis for cons/diss. This begs a crucial question; if a natural basis of cons/diss exists, why have historical and stylistic definitions consistently altered?

An evaluation of cons/diss taxonomy has demonstrated that understanding the mere terminology is not sufficient. What can be deduced is that a more genuine definition of cons/diss exists somewhere between scientific and cultural factors. The following subsections explore science-based implications of sound, including roughness. Then, an understanding of how cons/diss can arise from the specifics of a given musical practice is developed.

4. 2 Conceptualisations

Science and music have long maintained a surprisingly close relationship. Insofar that until the 17th century, music (theory) was a branch of science within the mathematical quadrivium (Palisca 1961: 92). This subsection will begin with how mathematical ratios are used to conceptualise cons/diss before more detailed physical and biological research is assessed.

4. 2. 1 Ratios

Ratios are divisions (intervals) of a vibrating body, such as a string, where the numeric relationship to the body's total size is represented. The intervals deemed consonant by Pythagoras are illustrated in Figure 1 as proportions of a string:

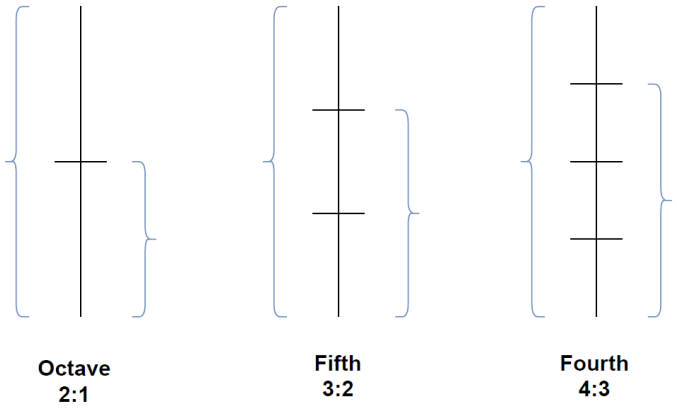

Figure 1- An octave, fifth, and fourth as ratios (Chatzis 2017: 3)

As can be seen in Figure 1, an octave $[2:1]$ represents a half. It is the simplest possible interval ratio, given no positive value can have a lower common multiple than 1. Recalling the ubiquity of the octave in musical practice, for example how the twelve musical keys of equal-temperament are equal divisions of the octave, and that octaves are typically perceived as among the most pleasant sounding intervals (Bidelman 2009: 13167), this validates ratios as a determinant of cons/diss.

As noted in 4.1, Zarlino permitted intervals of thirds and sixths as consonant. This is represented in Table 2:

Table 2- Zarlino's consonant intervals (Lilja 2009: 66)

Interval	Unison (Tonic Root)	Minor Third	Major Third	Perfect Fifth	Minor Sixth	Major Sixth
Ratio	1:1	6:5	5:4	3:2	8:5	5:3

It has been noted that Zarlino's consonances are 'very near' to contemporary, equally-tempered practices (Lilja 2009: 66). In reference to common Western scales, this appears to be true, such as in the natural minor (Aeolian) scale which consists of generally simple ratios. These are depicted in Table 3:

Table 3- Ratios of the Aeolian scale

Interval	Root	Second	Minor Third	Fourth	Fifth	Minor Sixth	Minor Seventh
Ratio	1:1	9:8	6:5	4:3	3:2	8:5	9:5

However, considering other contemporary Western scales, a problem emerges: intervals constituting complex ratios traditionally deemed impermissible are present in modern practice, especially in metal. Even a scale as mundane as the natural major (Ionian) contains a major seventh, of which the ratio [15: 8] has been regarded as dissonant by Persichetti (1978: 14), Lilja (2009: 62), and Gaona (2018: 185), and was not permitted by Pythagoras or Zarlino.

Considering Western scales common to metal, this problem is even more pronounced. The Phrygian mode, for example, contains ♭2, ♭3, ♭6, and ♭7 intervals[4], and the Locrian mode contains the same, with the addition of a ♭5. They are the only modes that contain the intervals ♭2 and ♭5, which consist of large ratios, [16: 15] and [45: 32], respectively. Persichetti has considered ♭2's to be a 'sharp dissonance' and ♭5's to be 'the least stable of the intervals', (1978: 14).

Ratios can represent which intervals are cons/diss with respect to proportional complexity. Still, this does not explain the empirical phenomenon of why dissonant intervals are

[4] The ♭ symbol means flat, or diminished, where a note is one semi-tone lower than its ordinary, diatonic position.

received as such. More importantly, why previously dissonant intervals become permissible remains unexplained. In answering what constitutes cons/diss perception, more understanding of sound science is required.

4. 2. 2 The Overtone Series

When a single note, or fundamental, is played, more notes than the fundamental sound. Jean-Philippe Rameau remarked that the most noticeable of these 'overtones' comprised of the octave, fifth, and major third intervals:

> this conclusion justified the appeal of the major triad and made consonance a direct consequence of musical ratios naturally present in tones. Dissonance, on the other hand, occurred when intervals did not easily fit into this harmonic structure. (Bowling 2015: 11156)

Joseph Sauveur soon acknowledged these additional overtones as intervals whose frequencies (Hz)[5] are 'multiples of the fundamental' (Bowling 2015: 11156); if the note $A4$ was played as a fundemental, vibrating at $440Hz$[6], each subsequent overtone would vibrate at an additional $440Hz$. Ergo, the second overtone would be $880Hz$ and is therefore the octave, $A5$, and the third overtone would be $1{,}320Hz$ and is therefore the fifth, $E6$. Following this trend, the fourth overtone, at $1{,}760Hz$ is another octave, $A6$. Lastly, $2{,}200Hz$ presents the major third heard by Rameau, $C\sharp 7$.

It is possible to follow the overtone series and discover intervals not present in a major triad. Returning to the previous example of an $A4$ fundamental, the next overtone would be an $E7$ at $2{,}640Hz$, a fifth. Next, at $3{,}080Hz$ is $G7$, a minor seventh. Whilst this does not entirely discredit Rameau's claim, since it was observed that the major third does appear early in the overtone series, it insinuates simple intervallic qualities are not a sufficient determinant of consonance because more complicated intervals also occur naturally.

[5] Hz, meaning Hertz, is the measurement of the number of oscillations (cycles) a sound wave makes in 1 second. Hertz can be used as a precise measurement of musical pitch.
[6] Recall that these examples are in equal-temperament tuning.

Each overtone also has an intervallic relationship to the overtone directly before and after it. Considering once more the overtones of an $A4$ fundamental, following the $3{,}080Hz$ $G7$ is an $A7$ at $3{,}520Hz$. In relation to the fundamental, this is of course an octave. However, in relation to the previous overtone $G7$, $A7$ forms a major second interval. Major seconds have been deemed dissonant by Gaona (2018: 185), Helmholtz (1954: 194-5), Lilja (2009: 62), and 'mildly dissonant' by Persichetti (1978: 14). Considering 'The interval sequence of the harmonic [overtone[7]] series is always the same […] the series results always in the same melody from the respective keynote.' (Saus 2018), this ostensibly dissonant interval is not only natural but likely quite abundant, dependant on sound timbre. This further weakens cons/diss as being based purely on natural occurrences.

Pertaining to Tenney's CDC-5, the development of compositional practices can include the discovery and acceptance of more complicated intervals found higher up the overtone series, via more powerful timbres. A relevant example of this is the ever-increasing level of guitar distortion in metal. It is accepted that

> distortion refers to an audio component altering the intensity of a signal's harmonics [overtones] […] distortion augments and intensifies higher harmonics related to each of those present in the input signal. These harmonics would otherwise be very weak or entirely inaudible. This means the guitar's harmonic series now extends further up the spectrum than otherwise (Mynett 2017: 10)

This demonstrates a possible way intervals can become consonant, simply by their natural occurrence becoming more noticeable in developing musical practice.

4. 2. 3 Chords and Harmony

Strictly speaking, all sounds form a chord, except for sine waves because they have no overtones (Saus 2018). Dissonance is sometimes defined as indiscernible noise, where 'in-harmonic' partials crowd the overtone series (Saus 2018). Since an ostensibly consonant fundamental creates a theoretically infinite overtone series, overcrowding as a

[7] Harmonic series refers to every tone present in a sound, whereas overtone series excludes the played fundamental note. The latter term is favoured here to better distinguish between the fundamental and overtone notes.

determinant of dissonance can be disregarded for now. Instead, this section will address inharmonicity.

It has been established that the frequency spacing between overtones is the same value as the original, fundamental note; the overtones are multiples of the fundamental. Concerning seemingly consonant groups of notes, the frequencies of each fundamental note in the group also share a common multiple. Oxenham (2013: 24) describes a two-note chord, made of the notes $A4$ and $E5$ as

> The interval of a perfect fifth, with F0s of 440Hz and 660Hz. All the components from both tones are multiples of a single F0- 220Hz- and so, according to the 'harmonicity' of account of consonance, should sound consonant.

Whilst this still only demonstrates a theoretical reasoning of cons/diss, it is at last possible to bridge into an empirical basis of cons/diss considering the implications of frequencies that are not multiples of one another. Given two notes in a chord with non-multiple Hz frequencies, many of their respective cycles per second will not coincide:

> consonances are pairs of tones which strike the ear with a certain regularity; […] the pulses delivered by the two tones, in the same interval of time, shall be commensurable in number, so as not to keep the ear drum in perpetual torment, bending in two different directions in order to yield to the ever-discordant impulses. (Plomp 1965: 549)

Non-multiple frequencies interfere with one another rather than coincide. These acute, incommensurable oscillations are detected by the ear. These interferences are now known as beats.

This beating of sound is a crucial component of roughness, mentioned in 4.1, where 'annoying features of a sound' referred to beats and was defined as a type of dissonance. Roughness is a quality of timbre characterised by 'rapid fluctuations in the amplitude envelope' (McAdams 2013: 55); the interferences of beats. Again, a relevant example of this is the enhanced overtone series in distorted metal.

Before beats and roughness are investigated further, there is more to be said about theoretical cons/diss arising from the respective overtone series within a chord. As well as the relationship between fundamental frequencies in a chord, each of these fundamentals of course generate an overtone series. Significantly, when fundamentals are played as a chord, additional overtones appear. These combination tones are unique to the chord at

hand and appear 'at the sum and difference of the fundamental frequencies' (Mynett 2017: 10). For example, if an $A4$ and $E5$ are played simultaneously as a fifth chord, a summation overtone at $440Hz + 660Hz = 1{,}100Hz$ $(C\sharp 6)$ appears. Recall that this interval is a major third, technically giving fifth chords a major tonality. Also, a difference tone can be heard at $660Hz - 440Hz = 220Hz$, as an $A3$.

The existence of combination tones has been attributed to combinations of notes generating additional vibrations in the cochlea (Gaona 2018: 177), giving the heard impression of new overtones. Importantly, combination tones appear to be dependant on timbre, i.e., the relative strength of the original fundamentals. It has been asserted by Walser (2014: 43), Lilja (2009: 111), and Herbst (2017a: 29) that the difference tone is dependant on distorted timbre. This makes difference tones highly relevant to metal, with Lilja even using the term 'distortion fundamental'. For clarity, the terms 'summation' and 'difference' tone will be retained.

Noting how the $660Hz - 440Hz = 220Hz$ difference tone is one octave lower than the $A4$ root note, it may be heard as the chord root instead of the actual played fundamental (Lilja 2009: 113). This unity renders the chord absolutely consonant[8], with Lilja (2009: 113) observing

> all the higher partials belong to the same harmonic [overtone] series, which is not the case with, for example, the minor triad. This is why the power chord[9] is […] the most consonant chord structure.

In short, the overtones generated by the fundamentals in a fifth chord essentially belong to a single overtone series. This is reflected in consonant fundamentals sharing a common multiple of Hz. It has been argued that this phenomenon renders consonance as bearing 'similarity to single notes' (McDermott 2010: 2). Conversely, non-multiple intervals are dissonant because more than one overtone series is being generated:

> the harmonics of two tones that form an augmented fourth[10], with F0s of 440Hz and 622Hz, do not approximate any single harmonic series within the range of audible pitches and so should sound dissonant, as found empirically. (Oxenham 2013: 24)

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[8] Also, see Table 3- *Ratios of the Aeolian scale*.
[9] Power chord is a colloquial term for a fifth chord, used especially in metal.
[10] Augmented, meaning raised, makes an augmented fourth interchangeable with flat fifths.

Therefore, the ear cannot discern a difference tone in the form of the lowest common multiple. In Oxenham's example, the difference tone $622Hz - 440Hz = 182Hz$ is not a multiple of either fundamental. Unlike in the example of a fifth chord, this difference tone cannot act as the chord root, since two incommensurable overtone series are being generated.

This would render clarity of the root (difference) note, having a discernible common frequency, as a definition of cons/diss. Lilja (2009: 147) has claimed, 'chords that conform to the lowest partials of the harmonic series of the root, produce a clearer sound than other structures.' As such, overcrowding as a definition of dissonance can be reconsidered; overcrowding can be taken to mean two or more overtone series obscuring the definitive root note of a chord.

Based on frequency relationships, a ♭2 and ♭5 interval are certainly dissonant but are nonetheless accepted in contemporary Western scales. Also, despite McDermott's (2010: 2) proposition, 'That consonant chords derive their pleasantness not from the absence of beating, but rather from their similarity to single notes […]', the issue of beating and roughness has been the subject of a vast body of research and warrants further investigation in properly defining cons/diss.

4. 2. 4 Roughness and the Critical Bandwidth

The human ear regulates frequency information via acute vibrations of the basilar membrane, within the cochlea. The cochlea is a coiled structure within the inner ear, depicted in Figure 2:

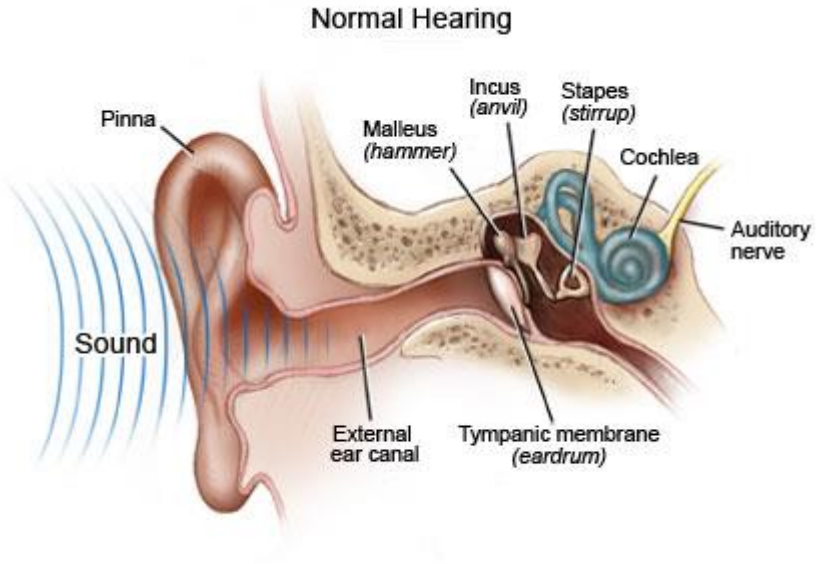

Figure 2- Structure of the human ear (Morlet 2014)

An uncoiled cochlea and basilar membrane are depicted in Figure 3:

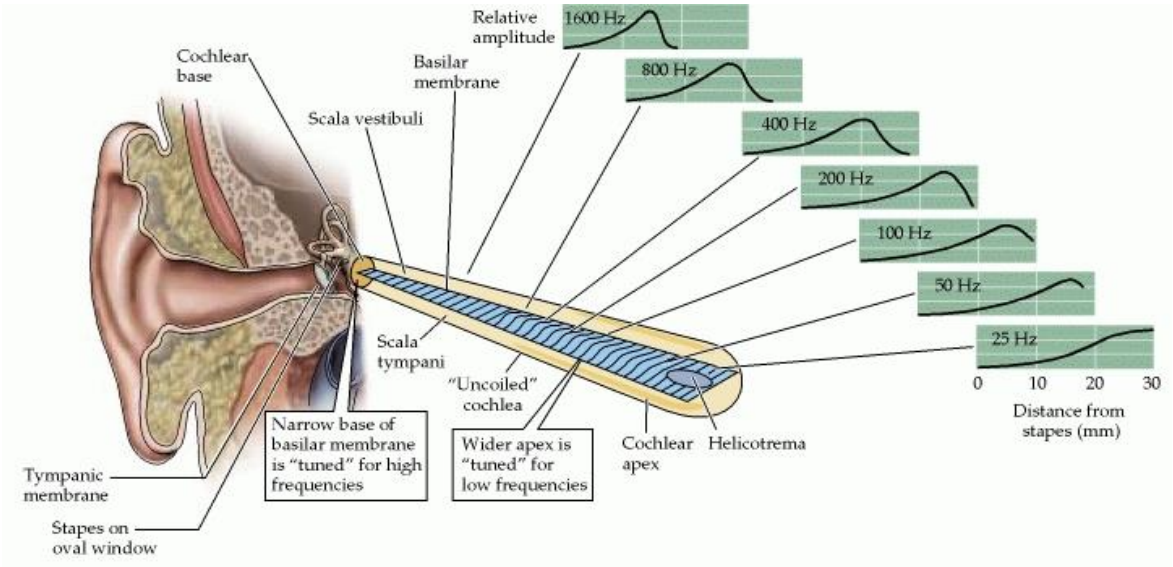

Figure 3- The basilar membrane (Purves 2001)

A notable feature of the basilar membrane is that different sections are adapted to detect given frequencies. These sections are called critical bandwidths. Twenty four critical band-widths divide the basilar membrane, with each division being called a bark. These are shown in Table 4:

Table 4- Frequencies (Hz) of the critical bandwidths

Bark	Bandwidth range (Hz)	Bandwidth size (Hz)
(Human Hearing Limit)		
1	20 - 100	80
2	100 - 200	100
3	200 - 300	100
4	300 - 400	100
5	400 - 510	110
6	510 - 630	120
7	630 - 770	140
8	770 - 920	150
9	920 - 1080	160
10	1080 - 1270	190
11	1270 - 1480	210
12	1480 - 1720	240
13	1720 - 2000	280
14	2000 - 2320	320
15	2320 - 2700	380
16	2700 - 3150	450
17	3150 - 3700	550
18	3700 - 4400	700
19	4400 - 5300	900
20	5300 - 6400	1100
21	6400 - 7700	1300
22	7700 - 9500	1800
23	9500 - 12000	2500
24	12000 - 15500	3500

Simultaneous frequencies falling within the same critical bandwidth produce roughness, and are perceived as dissonant (Plomp 1965: 548). Physically, this is due to the 'overlap in vibration patterns' obscuring the different pitches (Juslin 2011: 108). This would appear true in consideration of small intervals, whose frequency values are naturally close to one another and are therefore likely to excite the same critical band. Take for instance the semitone-valued $\flat 2$ interval, which typically is considered highly dissonant. With an $A4 =$

$440Hz$ (root), and $B\flat 4 = 466.16Hz$ ($\flat 2$), both intervals fall within bark five (400 to $510Hz$).

However, intervals of a greater distance than a semitone or tone were considered dissonant in subsection 4. 2. 1. Intervals likely to surpass critical bandwidths include seventh intervals, and also the $\flat 5$, which is a relatively wide interval. This conundrum can be answered by considering overtones. It has been asserted by Gaona (2018: 185) that: 'any note that is added (excepting the octaves) causes at least one of the fundamentals to fall into the critical band of another tone.' This can be exemplified with a major seventh interval with an $A4 = 440Hz$ (root) and a $G\sharp 5 = 830.61Hz$ (seventh). As fundamentals, these notes fall into barks five and eight, and so should sound consonant. However, it is only necessary to consider the first and therefore strongest overtone of $A4$ to discover a dissonance: $440Hz + 440Hz = 880Hz$ (first overtone), which falls into bark eight with the $G\sharp 5$ seventh. Noting how Persichetti (1978: 14) went so far as to call major sevenths a 'sharp dissonance', the critical bandwidth does appear to insinuate typical cons/diss definitions.

The critical bandwidth would suggest auditory beating and roughness are significant determinants of con/diss. Nonetheless, the issue of the acceptance of $\flat 2$ and $\flat 5$ intervals despite the roughness they produce persists. In the following subsection, more recent research demonstrates that roughness may be overridden by the biological acquisition of cons/diss.

4. 2. 5 Biological Acquisition

McDermott (2010: 4) has identified the inconsistency of roughness, where 'the beating produced by two notes depends on the note spectrum, and varies considerably across instruments.' In 4. 2. 4, it was shown that the dissonance of the major seventh is dependent on overtones. In accordance with McDermott, this interval could seemingly be consonant if played on an instrument with an especially subdued timbre. Furthermore, 4. 2. 3 demonstrated that note groups approximating a single overtone series are typically consonant.

McDermott has asserted that notes which do not resemble a single tone are dissonant due to the root obscurity as much as due to beating (2010: 5).

Moreover, 'participants with a weak consonance preference rated consonant and dissonant chords as being more or less similar,' supported by results that show, 'the strength of consonance preferences was not significantly related to the strength of aversion to roughness, suggesting that these two aspects of tone perception are independent' (Bowling 2015: 11157). Further separating roughness from cons/diss, Cousineau (2012) studied sufferers of 'congenital amusia'[11] and found that amusics were, unsurprisingly, unable to recognise typical consonances. However, amusics showed an apparently 'normal roughness perception', suggesting that variables other than roughness define cons/diss.

In accounting for this, neuroscientists have observed the similarities between consonance and the spectrum of the human voice. Schwartz (2003: 7160) has observed that the 'amplitude-frequency combinations' (intervals) within human speech approximate the intervals of a chromatic scale, and especially intervals typically considered consonant. A follow-up study by Bowling (2017: 217) suggested the consonance of chords is determined by their similarity to the sounds of human speech. Relevant to this, Bidelman has tested that

> brain activity elicited during linguistic tasks reveals that speech sounds are mapped […] according to phonetic rather than acoustic rules […] Neural representations for speech are thus organized to facilitate processing of discrete and in variant perceptual categories rather than continuous features of the acoustic signal. (Bidelman 2014: 212)

This perception of discrete sounds recalls the notion of cons/diss being determined by the clarity of the root note. The propensity of the brain to infer simple intervals has also been explored by Terhardt. Terhardt (1984: 288) describes a phenomenon of 'virtual pitch', where the auditory system attempts to hear a common root, or lower difference tone, within complex tones. The evolutionary reasoning for this resides in the need for humans to recognise speech simply and effectively.

[11] Amusia is a 'neurogenetic disorder characterised by abnormal pitch perception' and 'deficit in melody processing' (Bowling 2015: 11157).

Terhardt asserts that the brain will attempt to assign a 'virtual pitch' to discern dissonant sounds, but with little success. This was demonstrated in that the overtones of typically dissonant intervals do not approximate a single series. However, Gaona has emphasised that 'virtual pitch' disappears when intervals are presented dichotically[12] (2018: 189-9). Thus, 'virtual pitch' theory demonstrates the importance of root note clarity in biologically comprehending a sound but does not entirely detach cons/diss from the natural implications of roughness.

Nevertheless, Bidelman (2014: 211) acknowledges that non-auditory regions of the brain display activity under musical stimulation. This includes the prefrontal cortex, where the execution of logical and intellectual reasoning occurs (Fuster 2009: 905, Morecraft 2002: 11). Bidelman asserts, 'it remains possible that non-auditory regions play a role in establishing these neural correlates', or in other words, that cons/diss might partly be determined consciously.

Following the observation that consonance is acquired as a by-product of speech acquisition, Terhardt concludes

> that harmony is not entirely "hard-wired" in the auditory system but rather is heavily affected by […] a learning process which is performed by every individual in the speech-acquisition phase of his/her life. Hence, […] learning actually is involved in musical consonance. (1984: 294)

Indeed, Bowling has claimed that infants are not guaranteed a preference for consonance, and that, unsurprisingly, awareness of consonance and harmonicity is heightened following deliberate musical training (2015: 11159). Further emphasising the connection between learned speech and music comprehension, speakers of tonal languages[13] are considerably more likely to develop perfect pitch[14] than speakers of non-tonal languages (Monroe 2004).

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[12] Dichotic means the simultaneous stimulation of each ear by different sounds. Roughness arises from the crowding of critical bandwidths within the basilar membrane. Since there is one basilar membrane per ear, dichotic listening eliminates the possibility of roughness.

[13] A tonal language uses pitch to convey differing meanings, along with phonemes and grammatical structures. An example is Mandarin Chinese.

[14] Perfect pitch is a phenomenon where one can 'identify or produce a note without reference to any other note' (Monroe 2004).

This offers an explanation as to why dissonant intervals become accepted as consonances; if they become accepted culturally and in practice, listeners are entirely capable of comprehending and accepting them also. The remainder of this chapter focuses on cons/diss as a function of music, wherein it is malleable and dependant on context.

4. 3 Consonance and Dissonance as Cultural

The meaning of cons/diss, whilst fluid, has retained that consonance equates to pleasantness, and dissonance to unpleasantness. 4.2 suggested that despite the physical and biological definitions of cons/diss, arriving at a meaning of pleasant/unpleasant in music can be a conscious experience. Whilst individuals can assimilate new conscious definitions of cons/diss, it will likely be learned via the individual's culture. Popescu (2019: 2) asserts that cons/diss definitions 'are inextricably linked with subjective and cultural dimensions'.

It is useful to compare differing tuning systems with respect to cons/diss. Within Western musical culture, equal-temperament is the dominant tuning system. Recall that equal-temperament is simply the division of an octave into twelve equal frequencies. This facilitates fixed pitches, such as the frets of a guitar or the keys of a piano, and simplifies playing distinct intervals within a key.

However, equal-temperament is an artificial, albeit convenient representation of the harmonic series[15]. Equal-temperament does not match the natural intervals of the harmonic series; they are approximated to facilitate playable divisions. The tuning system which does follow the natural generation of frequencies is just intonation. Since the natural frequencies of the harmonic series are not equally spaced, each key is divided into differing sizes of interval in just intonation; it can only be tuned to match one harmonic series at a time. Whilst equal-temperament has the advantage of approximating the harmonic series

[15] See 7.

and thus allowing playability in any key, the two systems produce noticeably different sounds. These differences are depicted in Table 5:

Table 5- Ratio values of just intonation and equal-temperament for a minor scale

Interval	Just intonation	Equal-temperament
Unison (Root)	1:1	1:1
Second	9:8	56123:50000
Minor Third	6:5	118921:100000
Fourth	4:3	133483:100000
Fifth	3:2	149831:100000
Minor Sixth	8:5	7937:5000
Minor Seventh	9:5	8909:5000
Octave	2:1	2:1

(see Appendix 1 - Converting to ratios of a scale, for methodology). Clearly, the intervals of equal-temperament create complicated ratios, which have been considered dissonant. McDermott (2010: 2) has noted these intervals are 'somewhat less harmonic, and less devoid of beating,' than those found naturally. Since equal-temperament is comparatively dissonant, it seems odd when in Moran and Pratt's (1926) study participants had to adjust given frequencies to create intervals that they tended towards equally-tempered intervals. This supports cons/diss as ultimately being determined consciously; what is supposed to be cons/diss will likely arise via cultural influences, rather than from objective, natural definitions.

This is an embodiment of (natural) consonance and pleasantness being separate; natural dissonance is not necessarily unpleasant. Popescu (2019: 6) has supported this:

> listeners with more experience in music will have learnt to derive pleasure from music not merely based on its surface (acoustical) properties, but from several other dimensions […] such as structural cues and culturally or autobiographically relevant connotations.

Before dissonance as a function of metal music is considered earnestly, it is worth finalising the subjectivity of cons/diss across different musical practices.

A study by McDermott et al. (2016) observed how members of Tsimané, a remote Amazonian tribe, regarded consonant and dissonant chords as equally pleasant. Even still, musical cultures much closer related to that of Western equal-temperament have exhibited surprising cons/diss definitions. McGowan (2008: 69) and Popescu (2019: 3) have noted that it is not uncommon for jazz compositions to contain no consonant chords. What are

theoretically dissonant chords are considered 'idiomatic and contextually stable […] consonances in their own right' (2008: 70-1). McGowan argues that cons/diss means 'stable/passive and unstable/active […] within the musical grammar of a distinct cultural system' (2008: 70), and therefore not cons/diss in the physical sense discussed previously.

McGowan goes on to describe cons/diss as effectively existing on a 'continuum', and that 'the presence of more unstable intervals (in the sense of acoustic harshness) creates a more dissonant chord, but which is qualified by cultural criteria' (2008: 82). This is envisioned in Figure 4:

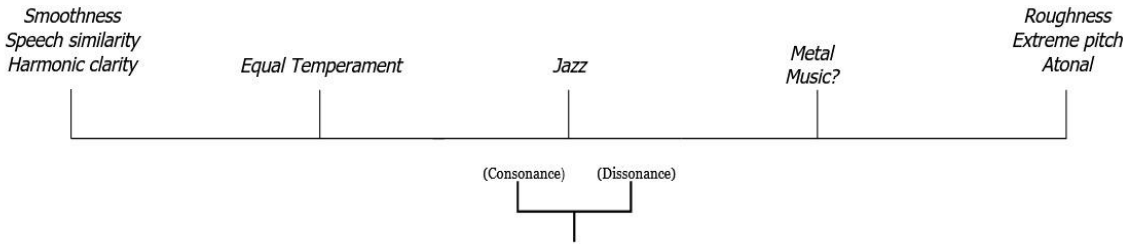

Figure 4- A hypothetical continuum of cons/diss

What qualifies as consonant within jazz (approximated by Figure 4's fork-like symbol, which could be moved anywhere along the continuum) will be dissonant for other musical vernaculars. This cultural criteria insinuates that consciously determined cons/diss definitions are likely to exist within a given musical discipline.

Currently, it would appear that cons/diss is a subjective phenomenon. However, despite a variable continuum of cons/diss, one feature underscores any discipline's definition of cons/diss; tension and resolution, or to McGowan, stable/unstable. Considering jazz once more, a consonant jazz chord may contain natural dissonances, such as beating from added notes. In arriving at this contextual consonance, it must resolve from some comparatively greater dissonance. Hence, throughout different musical practices there exists tension as dissonance and resolution as consonance, regardless of what cons/diss is taken to mean overall.

4. 3. 1 Harmonic Function

Throughout the world's music cultures there exist countless conceptualisations of tension and resolution. This thesis considers definitions within Western (equally-tempered) practice. Cons/diss can be realised as harmonic function within Western music, meaning a note or chord's effect within its compositional context. In this sense, 'an interval or chord is dissonant or consonant according to whether or not it requires a resolution […] their need for resolution is dependent on their placement within the tonal context' (Lilja 2009: 71). Reiterating the previous subsection, resolution is taken to mean a lesser degree of natural dissonances.

To have harmonic function, a chord must exist in a musical context where it can cause tension or relief. This includes the tonic (root) chord, which establishes the musical context and is expressed as (I) in Roman numeral. Along with the tonic, the most important functions are the subdominant and dominant, known as 'primary triads' (Lilja 2019: 361). These chords are built from the fourth and fifth scale intervals, respectively, and are expressed as (IV) and (V). Harmonic function works by chords deviating from the established consonance of the (I) chord, causing tension, and generally returning to the (I) as resolution.

Huron (1993: 169) has asserted, 'that tonality perception is determined by both structural and functional factors'. Where function refers to the relationship with the (I) chord, the actual structure of a chord is also a factor affecting tension/resolution. Notwithstanding the sound physics discussed previously, the selected notes from a scale are important in creating harmonic function. Considering that the tonic (I) is built on scale degree one, Figure 5 adapts Lilja's (2019: 361) depiction of the primary triads:

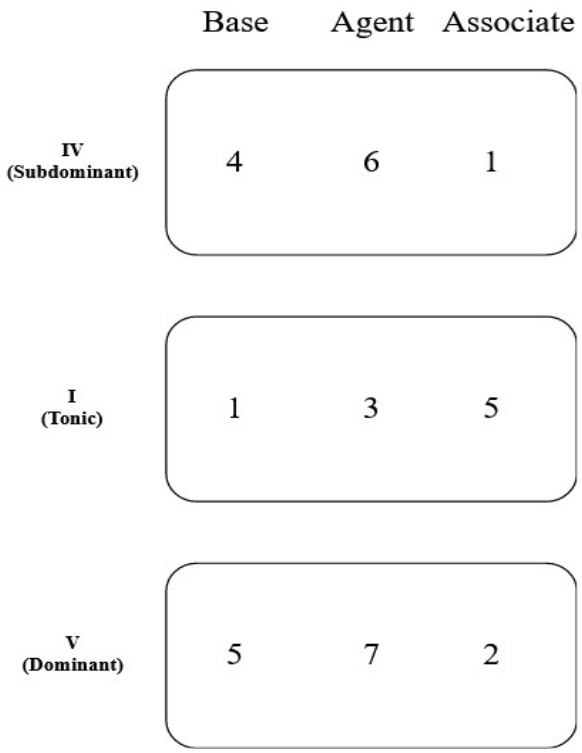

Figure 5- Functions of scale degrees in primary triads

As the 'three pillars of harmony' (Lilja 2019: 363), these chords are imperative to tension/resolution within Western harmony. Herein, all seven notes of a given scale appear and have a function within a primary triad. Where the 'base' simply marks the scalic starting point, the 'agent' creates the chord's identity, such as 'whether a primary triad is a major or minor chord' (Lilja 2019: 363). 'Associates', being distant from the identifying base, 'cannot express function on their own' (Lilja 2019: 363). Replacing 'associates' with notes from another function creates a 'characteristic dissonance' (Lilja 2019: 363), depicted in Figure 6, adapted from Lilja (2019: 362):

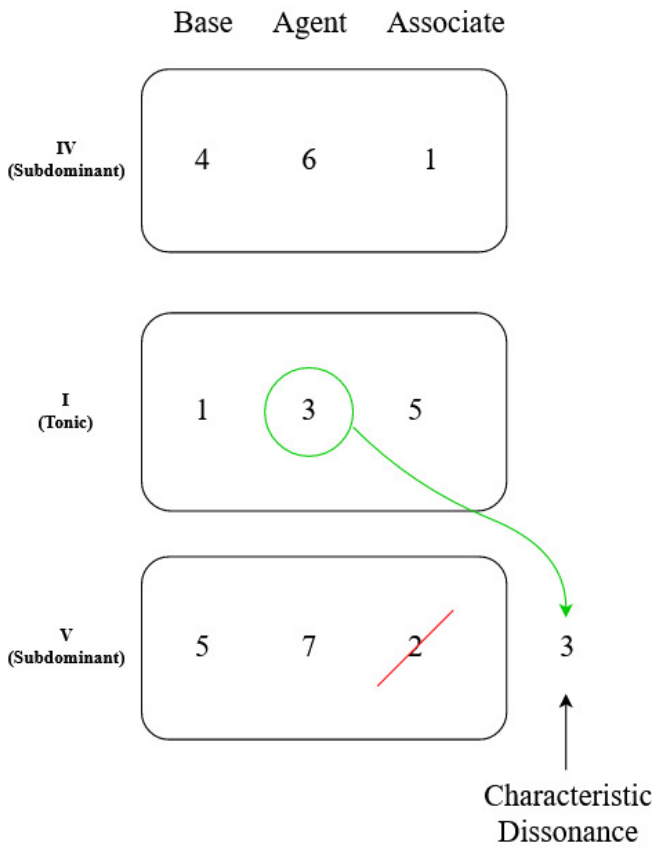

Figure 6- A characteristic dissonance

Also, a symmetrical relationship exists between these chords, as the (IV) chord creates a fifth interval below the (I), hence, subdominant:

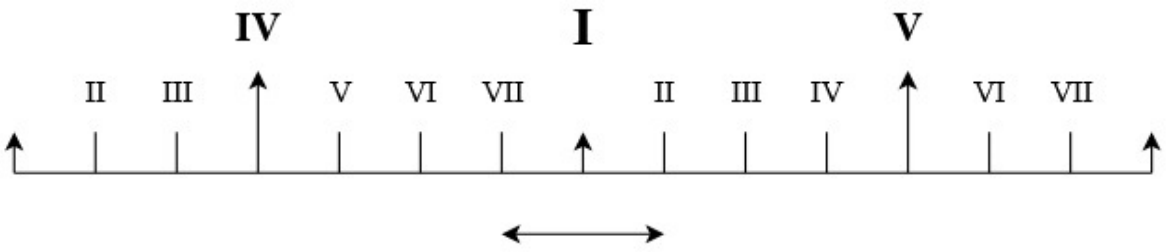

Figure 7- Symmetry of the Western scale

Relationship to the primary triads is a musical realisation of cons/diss. As can be seen in Figure 7, the primary triads are important intervals since they divide the octave equally, and act as consonant stepping stones. Obliging to these equidistant chords creates stability, and therefore consonance. Deviation creates disassociation and dissonance, and in the context of music, the sense that a note or chord must resolve to a consonant function.

4. 3. 2 Root Note Ambiguity

4. 2. 3 established the importance of root note clarity; the ear better comprehends those frequencies that resemble a single harmonic series. The importance of the root note can also be realised in the context of music. 4. 3. 1 demonstrated how functionality in Western music revolves around primary triads, meaning deviance from the primary triads can give the impression of dissonance.

There are undoubtedly infinite possible ways to deviate from primary triads. However, a study by Cook (1987) highlights the importance of memory in the application of harmonic function; 'For passages longer than 2 [minutes] listeners were unable to distinguish between tonic and non-tonic endings,' (Huron 1993: 156). Furthermore, 'auditory memory is disrupted by the occurrence of subsequent sounds,' (Huron 1993: 157). In passages of music that are especially long and/or busy, harmonic function becomes somewhat null. Whilst this does not remove the implications of acoustic cons/diss, the limitation of memory suggests music can be comprehended with an ambiguous tonic root.

Again, the structure of a particular chord or scale is important for harmonic function. Lilja (2009: 146) has said that 'chords built by equidistant intervals' with respect to guitar frets (i.e., the notes are simply an equal number of frets apart) are 'extremely dissonant [because] any member can function as the root'. With no discernible root, it is thereafter difficult to place any harmonic function. Western chords are derived from scales, meaning equidistant, or better, symmetrical scales create a similar sense of ambiguity:

> When the octave is not divided symmetrically, as in the major scale, it makes a noticeable difference where one stops and starts playing. With symmetrical divisions of the octave, one loses that sense of orientation. Any starting or stopping point seems comparatively arbitrary. (Smialek 2015: 166)

With no sense of harmonic function, Smialek details how disorientating a musical passage can be. This might be described as dissonance, where a chord or scale never reaches a satisfactory resolution.

Metal is increasingly described as lacking a key centre. Herbst has noted how metal's multi-layered guitar tracks can obscure the constituent notes within a chord (2018: 109). Mynett

observes metal's 'tendency towards atonality and dissonance […] through the use of chromatic progressions […] often resulting in the perception that the music lacks a key signature,' (2019: 307). Smialek favours these tendencies as 'highly chromatic rather than atonal' (2015: 167);

> the lowest open [guitar] string often functions the same way a tonic would in tonal music by frequently serving as a point of arrival […] and as a pedal point (being repeatedly struck as a reference point in many metal riffs. (2015: 167)

Whilst the abandonment of key signature removes harmonic function, metal retains something resembling a tonic root. Nonetheless, given the unconventional approach to key signature, this tonic may not offer a sense of resolution. That metal approaches cons/diss inversely wherein dissonance is not regarded as tension or unresolved is the argument central to this thesis. Before this is addressed, there remains a final musical realisation of tension/resolution.

4. 3. 3 Metrical Consonance and Dissonance

In music, cons/diss is finalised as tension/resolution. That is, a consonant norm is established, and deviations from that norm cause tension. Returning to the established norm serves as a resolution. In differing cultures, what is taken to be a consonant normality might vary considerably in relation to the physical basis of cons/diss.

This logic has been taken outside the domain of pitch, and into rhythm. Schillinger (1941) is credited with conceiving the terms 'rhythmic consonance and dissonance'. Rhythmic cons/diss is taken to exist since the strict pulse of most Western music can act as a consonance. Western music fits into clear rhythmic groups known as bars, commonly divided into four equal beats. Pitch attacks typically align with these beats, with this coherence supposing a 'rhythmic consonance'.

Congruently, rhythmic cons/diss is determined consciously. Krebs has noted how it arises from a listener's attention to strict pulse:

> Indirect dissonance exists because of our tendency as listeners to maintain an established pulse for a short time after it is discontinued in actuality […] there arises a brief but clearly perceptible conflict between the mentally retained first layer and the actually sounding second layer. (Krebs 2003: 45)

Before particularities are considered, it is important to establish Western rhythmic structures more clearly. A song will maintain a basic pulse level of even spacings of time wherein musical events occur. Above this, a song is divided into bars. The construct of a bar is determined by a time signature. For instance, $\frac{4}{4}$ is a time signature where the top digit dictates how many beats are in each bar. The bottom digit describes what type of note is considered as a beat. In $\frac{4}{4}$, there are four crotchet (♩) beats per bar.

Events concerning bars occur at the 'metric level'. Events spanning several bars occur at a 'hypermetric level'. Conversely, events within a bar affect the 'tactus level' (Biamonte 2014), although 'rhythmic level' is a more common term. Events of even smaller scale, i.e., subdivisions of beats, are within the 'subtactus level'. Krebs (1987) and Kaminsky (1989) adopt the term 'metrical cons/diss' over 'rhythmic cons/diss', given that cons/diss occurs with respect to a given meter, although 'rhythmic cons/diss' may still be used to describe events at the rhythmic i.e. sub-bar level.

Aforementioned above, consonance is supposed when musical attacks coincide. More specifically, 'the grouping levels are evenly divisible […] thus an attack point at a given grouping level is preserved at each faster-moving level' (Kaminsky 1989: 31-2), such that for every four beats in a bar, there might occur two attacks at the subtactus.

On the other hand, metrical dissonance can occur in two ways. Firstly, 'unequal or noncongruent layers of motion' (Krebs 2003: 12) effectively describes two (or more) rhythms occurring simultaneously and is commonly called a polyrhythm. Representing each embedded rhythm, polyrhythms can be described using ratios such as $4:3$. Figure 8 depicts one such polyrhythm:

3's:	x			x			x			x			x
4's:	x				x				x				x

Figure 8- A 4:3 polyrhythm

Here, the four-beat rhythm is taken to be dominant; see how after every bar of four, both rhythms re-align. Polyrhythms are supposed to be dissonant due to the discernable conflict

within the bar, which leads the listener to expect 'resolution' (Krebs 2003: 13). Resolution occurs simply by the disappearance of a conflicting rhythm, either immediately, or by 'dilution' (Krebs 2003: 111), where conflicting attacks are gradually abandoned.

The brief yet consistent re-alignment means that polyrhythms fit within a single time signature; Figure 8 would be notated as $\frac{4}{4}$. However, a similar metric dissonance can occur when the layers do not realign after each bar, in what is known as a polymeter. Figure 9 depicts a $\frac{5}{4}$ over $\frac{4}{4}$ polymeter:

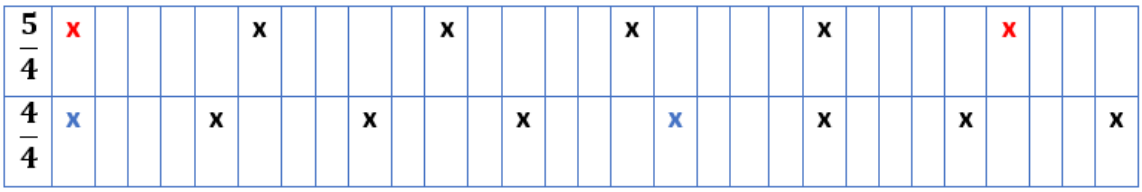

Figure 9- A 5/4 over 4/4 polymeter

With the first beat of each respective bar coloured, a polymeter clearly conflicts over a vast number of bars. Given the lowest common multiple of 5 and 4 is 20, this would be the number of bars before both meters realign.

Lucas (2018) has observed how one meter can be heard dominantly within a polymeter. If the $\frac{4}{4}$ in Figure 9 is taken to be 'dominant', then any $\frac{5}{4}$ accents would appear to be part of the $\frac{4}{4}$, merely occurring at different points in each bar. Lucas names this 'in media res' (2018). Taking this interpretation would eliminate the perceptual phenomenon of polymetric dissonance. However, clear pitch accents delineating one or both of the metres would cause a discernable metrical dissonance, where two differing meters cause accented conflicts.

It is worth highlighting that odd-numbered time signatures, such as $\frac{5}{4}$, are not considered dissonant in themselves as there is no conflict between rhythmic layers. Even still, Biamonte (2014) has described these 'asymmetrical' meters as comparatively unstable. It is common to perceive meters such as $\frac{5}{4}$ as being conjoined bars, in this case of $\frac{2}{4}$ and $\frac{3}{4}$. This can give the impression of 'indirect dissonance', referred to above, arising from the

conflict in the perception of differing meters. Of course, this means actual changes in time signature are (hyper)metrically dissonant.

The second metrical dissonance is 'congruent but shifted layers' (Krebs 2003: 12), commonly known as 'syncopation'. Given the coherence of each layer, syncopation does not affect the meter but occurs at the tactus level. This rhythmic dissonance creates 'interest and tension' (Biamonte 2014) rather than disruption, and particularly affects melody within a bar. Resolution can occur by the disappearance of one layer, or by adjustment so as constituent layers become coherent. Figure 10 depicts a syncopated $\frac{3}{4}$:

Syncopation:		x			x			x
Pulse level:	x			x			x	

Figure 10- Syncopation in 3/4

The intensity of syncopated rhythmic dissonances are determined by

> 'proximity to consonance; the more closely a given dissonance approaches a state of alignment, the more strongly dissonant it is […] since tight dissonances contradict the metrical layers more frequently, they are perceived as more intensely dissonant. (Krebs 2003: 57)

Interestingly, this parallels pitches being especially rough when their frequencies are in close proximity and suggests dissonance could be defined as constituent events not easily being told apart. Consonance, on the other hand, is clarity, such as rhythmic accents occurring coherently.

4. 4 Summary

This chapter has demonstrated the existence of cons/diss, both as a natural property of sound and as an interpretable function of music. Despite the clear physical grounding of cons/diss, it appears that listeners can realise it of their own accord. Typically, the realisation of cons/diss is enforced by a culture of music. Over time, this has led to differing perceptions of what is consonant or dissonant. In Western practices, intervals once supposed to be dissonant become regarded as consonant, in line with emerging musical practices.

This process of emancipation has developed to such an extent that music can be composed without harmonic function, void of any expected basis of cons/diss. The following chapter observes this phenomenon in metal, where not only is harmonic function largely disregarded, but physical parameters of cons/diss such as roughness are abundantly used. Metal reinforces the findings of this chapter; cons/diss are subjective, expressive tools able to be inverted so much that dissonances might function as a central aesthetic.

Chapter 5

Inverted Functions- A Musical Analysis

Metal has consistently used extremity in creating an aesthetic (Czedik-Eysenberg et al. 2017: 101). Early songs used dissonant tritones and the potential of guitar distortion to create a shocking, heavy product. With time, maintaining an extreme aesthetic has instigated increasingly complex music. In this chapter, examples of metal are analysed which demonstrate that manifestations of dissonance are not only present but perhaps the central aesthetic of metal functionality. The appeal of this dissonance relates, unsurprisingly, to the culture surrounding metal, explored thereafter.

This chapter is structured as to address increasingly abstract manifestations of dissonance. Beginning within the domain of pitch, and eventually addressing form and compositional structure, this chapter displays how dissonance is utilised in creating the aesthetics synonymous with metal.

5. 1 Dissonant Intervals

Intervallic relationships are the primary site of cons/diss. Whilst Chapter 4 demonstrated this is effectively due to the relationship between overtones, this subsection investigates how dissonant intervals are utilised compositionally. Early metal songs used $\flat 5$s due to their striking breakage of a major or minor scale. The $\flat 5$ was considered dissonant enough to be banned from medieval practice, where it was named '*Diabolus in Musica*… due to its apparent association with the devil' (Farley 2009: 82). Often considered to be the first metal song (Bardine 2009: 125), at least popularly, is 'Black Sabbath' (1970), depicted in Figure 11:

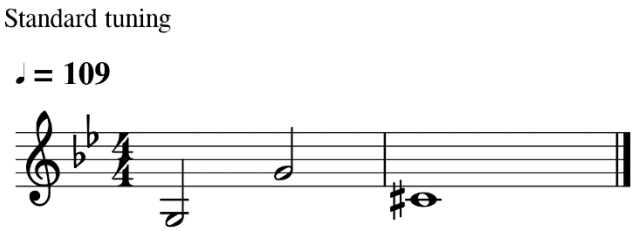

Figure 11- Black Sabbath (Black Sabbath 1970)

Even in such an early example, dissonance is a central feature. The minimalist riff consists of only two notes. After the tonic is established with two iterations in the first bar, the dissonant ♭5 is maintained for an entire bar before being resolved only when the riff repeats.

This practice of characterising a riff with a noticeably dissonant interval has retained since 'Black Sabbath', although different note choices are also common. The ♭2, belonging to the Phrygian mode, is frequently used. Walser has argued that the ♭2's proximity to the tonic creates a 'claustrophobic and unstable' (2014: 47) sound in musical practice. Figures 12, 13, and 14 demonstrate the appearance of ♭2s across several decades:

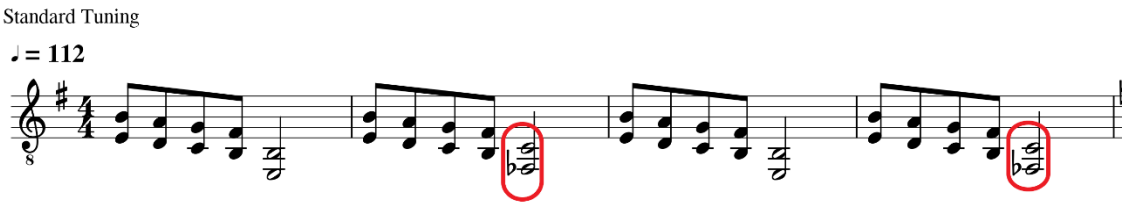

Figure 12- In my Darkest Hour (Megadeth 1989)

During this diatonic descent, the ♭2 acts as a point of great tension when every second bar comes to rest where a resolution on the tonic was previously anticipated.

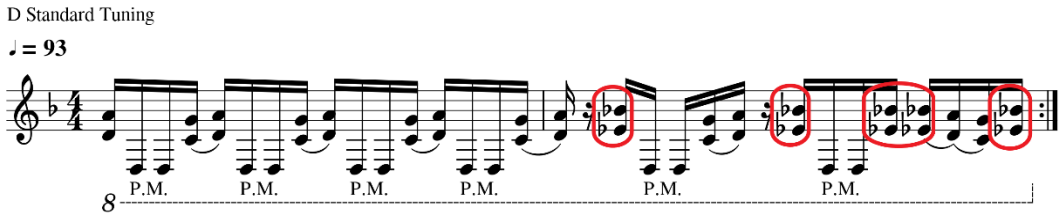

Figure 13- Blood and Thunder (Mastodon 2004)

Similarly, this repetitive riff undergoes little harmonic interest until the second bar, where ♭2s cause tension against the ubiquitous tonic bass note[16].

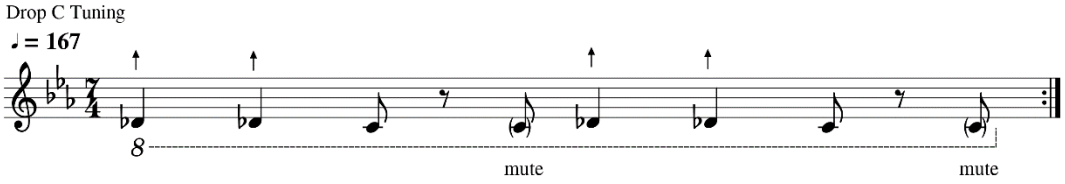

Figure 14- Infantile (Toska 2016)

In a more contemporary example, the ♭2s here take up most notes in the riff. Their clarity is further obscured with a fast string bend one semitone higher, and the tonic only indicated with brief quaver notes.

So far, the examples explored have obscured the fifth and tonic root of the Western scale, disrupting the sense of harmonic function. Unsurprisingly, metal songs have gone further than using only one dissonant note in a riff. It is not unheard of for guitarists to achieve this by combining entirely different scales, as in Figure 15:

[16] PM, meaning palm-muted, is when the palm of the picking hand rests on a guitar's strings close to the bridge. This shortens a note's sustain, emphasising 'both the lower frequencies and the very high overtones' (Mynett 2019: 307).

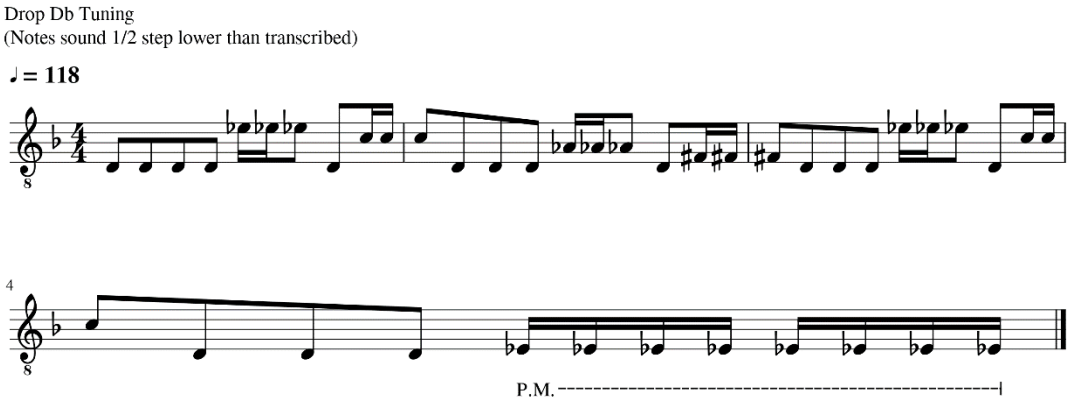

Figure 15- Addicted to Pain (Alter Bridge 2013)

In the first two bars, the Locrian mode is clearly established, with a tonic, ♭2, ♭7, and ♭5 being played. Interestingly, crossing into the third bar is a rhythm played on the major third, relative to the established tonic. Whilst the Locrian mode consists of dissonant intervals, they have at least been clarified throughout the opening bars. Introducing a note outside of Locrian causes further disruption, reducing the listener's chances of becoming acclimatised to the dissonant Locrian riff. Also, whilst the ♭5 establishes the Locrian mode (it being the only mode to contain this interval), the combination of a ♭2 and major third is reminiscent of the Phrygian Dominant mode, of which the wide intervallic gap is rare in Western music. Phrygian Dominant is fittingly characterised as non-Western sounding, and its reference further defamiliarizes the sound of 'Addicted to Pain'.

In the above examples, dissonance is not only a point of tension but largely the purpose of the riff. In the older examples, dissonances appear at points of anticipation, whereas later examples are inclined to disrupt throughout. Whilst these examples have been reserved to horizontal (melodic) structures, the phenomenon of dissonance being the central aesthetic is even more pronounced when considering combinations of notes.

5. 1. 2 Dissonant Harmonies

As a bridge between melodic and chordal playing, it is common for musicians to harmonise a melody. This effectively creates a chord, as more than one note is sounding simultaneously. However, each constituent note of the chord is played by a different musician, giving

them greater freedom to play complex melody rather than fixed chord shapes. Conventionally, musicians harmonise using consonant intervals, such as in Figure 16:

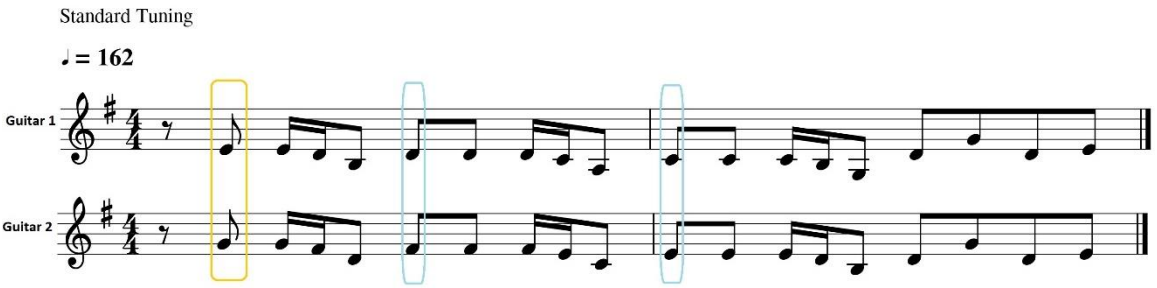

Figure 16- The Trooper (Iron Maiden 1983)

In this example, two guitars harmonise at intervals of a third in E minor. As has been highlighted, the consonant chord progression E minor, D major, C major is implied. By virtue of dividing these chords between guitars, a more detailed riff is possible with phrases interweaving each chord.

This practice has been applied in creating passages perhaps more dissonant than would otherwise be possible. New Jersey band, 'The Dillinger Escape Plan', are known for their dissonant and unpredictable compositions. Guitarist Ben Weinman has stated that 'Everything about Dillinger was incorrect, certainly in terms of theory, we went against everything' (Hannan 2018: 454). In attempting to create a deliberate sense of error, Dillinger have combined dissonant interval groups with lengthy and complicated phrasing, as in Figure 17:

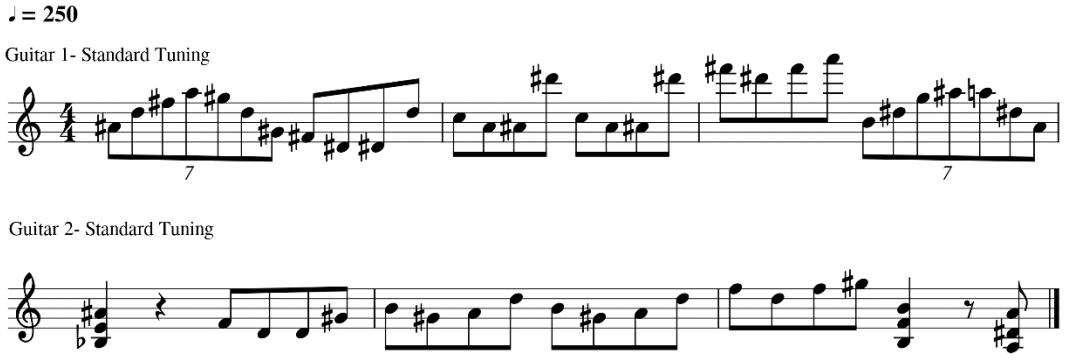

Figure 17- 43% Burnt (The Dillinger Escape Plan 1999)

From the third beat of the first bar, the guitars harmonise at a ♭2nd interval. From the fourth quaver of the second bar, this dissonant interval is maintained an octave higher by

the first guitar. The dissonant nature of a ♭2nd is by now well established. The beating created by this harmony only adds to the disorientating sound of the rapid tempo and wide intervallic gaps. Bookending this dissonant passage are uncommon septuplet groupings, which in the third bar is underscored with a B ♭5 chord. Given that Dillinger 'went against everything', the unmistakable and complicated dissonances in this passage were a deliberate expression of their transgressive aim.

5. 1. 3 Combined Dissonances

So far, it has been shown that metal uses dissonant intervals melodically, and in simultaneous notes as chords. These manifestations may be combined, arguably creating music with even more emphasis on dissonance. Whilst the previous subsection analysed vertical structures (chords) of only two notes, a naturally greater dissonance may be achieved in larger chords. Figure 18 demonstrates a riff containing multiple dissonant intervals:

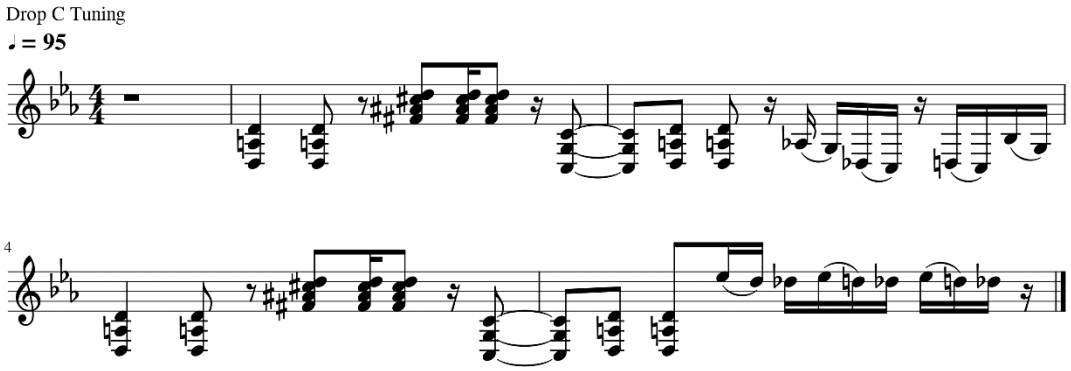

Figure 18- Chalk Teeth intro (Toska 2016)

The second chord-shape played shares only one note with the prevailing key signature[17], already creating dissonance with respect to harmonic function. From its F♯ base, the intervals within this chord are a minor third, a major third, and a minor second. As well as containing a highly beating minor second interval, this dissonance is exacerbated by two other intervals bringing their own harmonic series. This 'greater structural complexity,

[17] Despite beginning on a D5 chord, the proceeding sections of 'Chalk Teeth' are based around C minor or the relative E♭ major. Also, observe the sheer number of accidentals in Figure 18, making this introduction difficult to actually be heard in D with respect to the ensuing C minor.

indicating complex interval relations being more dissonant', has been observed by Herbst (2018a: 101-2).

Along with this vertical dissonance, 'Chalk Teeth' also contains several melodic dissonances. In bar three, a low D♭ briefly interpolates a legato-based fill as a Phrygian ♭2. Legato, meaning 'tied together' in Italian, is characterised by an even flow of notes. In this instance, however, the flowing notes only create further oddity in 'Chalk Teeth' with the inclusion of an abrasive ♭2. This effect of smoothly played yet dissonant sounding notes is also utilised in bar five. Following the D5 power chords, the riff jumps to a relatively high register and plays three notes chromatically. Whilst the proximity of chromatic notes already creates a dissonant effect, this fill is technically played as a chord; while the E♭ and D are played consecutively on the guitar's second string, the lower D♭ is played and then sustained on the third string. This creates a striking effect, not only in contrast with the lower sounding chords but as a functionless chromatic melody coupled with beating from the simultaneously sounding notes.

A simultaneous D and D♭ effectively creates a ♭2 interval. Such ♭2 chords are often played in a high register and have simply being identified as a 'treble register dissonance' by Smialek (2015: 106). Smialek has observed such chords as sounding 'out of tune', and carrying 'connotations of instability', with a striking contrast to metal's otherwise low register as seen in 'Chalk Teeth'. These 'treble register dissonances' are a common use of dissonance in metal, and are generally realised in one of two ways. Firstly, they may be used for sheer shock value, as in Figure 19:

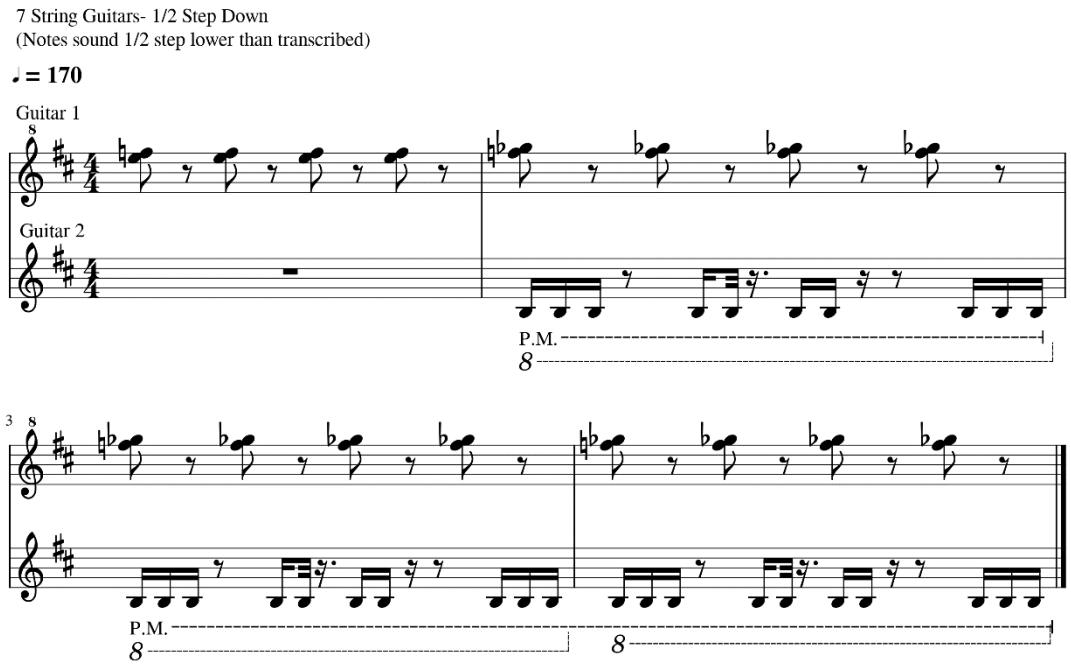

Figure 19- Future Breed Machine (Meshuggah 1995)

The staccato, high-pitched $\flat 2$s in 'Future Breed Machine' create a jarring, alarm-like effect. The suddenness of these staccato dissonances at the beginning of the song might make an unaccustomed listener jump. Further adding to their stabbing effect is their contrast with an extremely low-register rhythm guitar. At $58.27Hz$, the B$\flat$ rhythm is in the lowest bark of human hearing. Combined, both guitar parts create disorientation difficult for the ears to follow.

Secondly, 'treble register dissonances' can again lay beneath a lower rhythm, but with a droning, atmospheric effect. Given the unresolved beating of $\flat 2$s, an unsettling atmosphere is created, as in Figure 20:

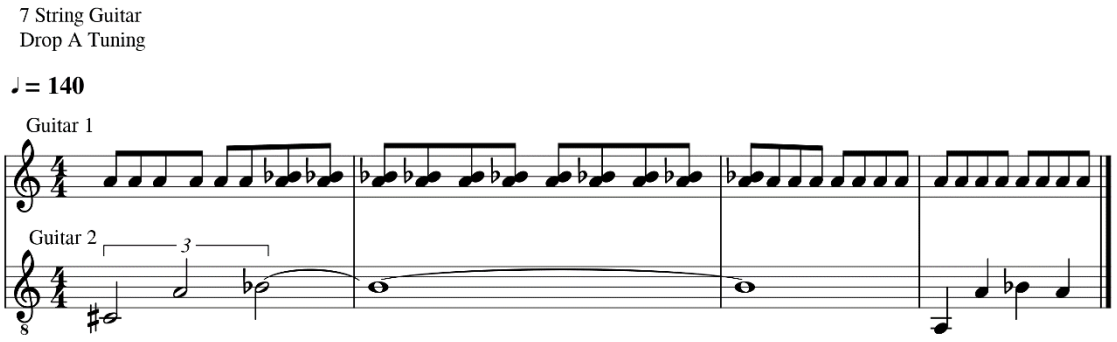

Figure 20- Reign of Darkness (Thy Art is Murder 2012)

Unlike in Figure 19, this dissonance is constant, suggesting unequivocally that a dissonant effect is the purpose of this passage. Like Figure 19 however, there is a stark contrast in pitch between both guitars, although 'Reign of Darkness' also contains ♭2s in the lower register.

Up until now, this chapter has shown how dissonances can be used and combined to create transgressive effects of sound. This has occurred by breaking the sense of harmonic function with accidental notes. However, it is worth recalling from 4. 3. 1 that dissonance can be created without breaking a key signature simply by enacting tension on an otherwise consonant chord.

5. 1. 4 Characteristic Dissonances

Metal is identified indubitably by guitar distortion; every example given so far is played with this timbre. Interestingly, as the methods with which transgression is achieved have become more complex, metal musicians have experimented with clean guitar sounds. It has been argued that a song does not qualify as metal music without guitar distortion (Thomas 2015: 111), although clean sections are used within songs that are otherwise typically metal. Clean guitar parts offer compositional dynamics, as well as a place to demonstrate greater theoretical prowess. Figure 21 depicts a clean section at 1:17 of Toska's 'Chalk Teeth':

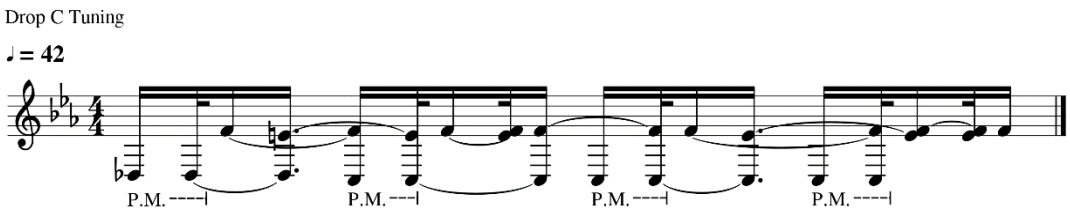

Figure 21- Chalk Teeth clean (2016)

Whilst notated in C minor (see 17) in keeping with the rest of 'Chalk Teeth', this short passage is emblematic of the Phrygian Dominant scale with its ♭2 and major third. Following the opening ♭2 notes, a C major triad is constructed. Notice there is no fifth-degree present, or in terms of harmonic function, no 'Associate'. Instead, this arpeggiated chord is

constructed from a C root (Base), E third (Agent), and F subdominant, acting as a characteristic dissonance.

Although Lilja (2019: 363) acknowledges that 'Agents' are the strongest signifier of 'functional meaning', Harrison has noted the relative strength of the subdominant fourth. Within harmonic function, the fourth only appears as the 'Base' in its respective subdominant function (see Figure 5- Functions of scale degrees in primary triads): 'Thus, 4 [the fourth] should be theoretically […] able to communicate subdominant function while appearing in any voice' (Harrison 1994: 48). Given the strength of the major third 'Agent', its characteristic dissonance arising from conjoining with a clear subdominant fourth may be regarded as particularly conflicting in 'Chalk Teeth'. Moreover, the close intervallic relationship ($\flat 2$) between a major third and fourth will give rise to beats.

Even when metal temporarily sheds its crucial guitar distortion, transgression is still achieved by dissonance. The use of more theoretically complex musicianship, not only via harmonic function but by alluding to combinations of scales, is well facilitated by clean guitar sounds where subtlety can be better achieved. This chapter has shown how dissonance is used in metal, either by deviating from harmonic function or by using characteristic dissonances within it. However, subsection 4. 3. 2 suggested how metal can be composed without harmonic function, and even without a tonic root in the conventional sense.

5. 1. 5 Pseudo-Root Notes

Following Smialek's suggestion that the lowest open string of a guitar functions 'the same way a tonic would in tonal music' (2015: 167), Mynett has described why this practice occurs:

> the repetition of single-pitch rhythmic patterns […] often centres on the use of the guitar's lowest open string, which refers to the lowest pitch on the guitar's register. Low pitch can be seen as vital to the overall sonic impact […], due to its deep and dark timbre. Additionally, the lowest open string provides an enhanced level of mobility for the guitarist's fretting hand, and therefore features highly in […] riffs, and key selection. (2019: 306)

Conveniently for metal guitarists, dictating riffs by the lowest string creates a heavier sound. In metal, the open string root is often played with chugging[18] to create a rhythm. Furthermore, a dissonant effect can easily be created when a riff is based on one pedal tone, such as an open string root. Figure 22 demonstrates:

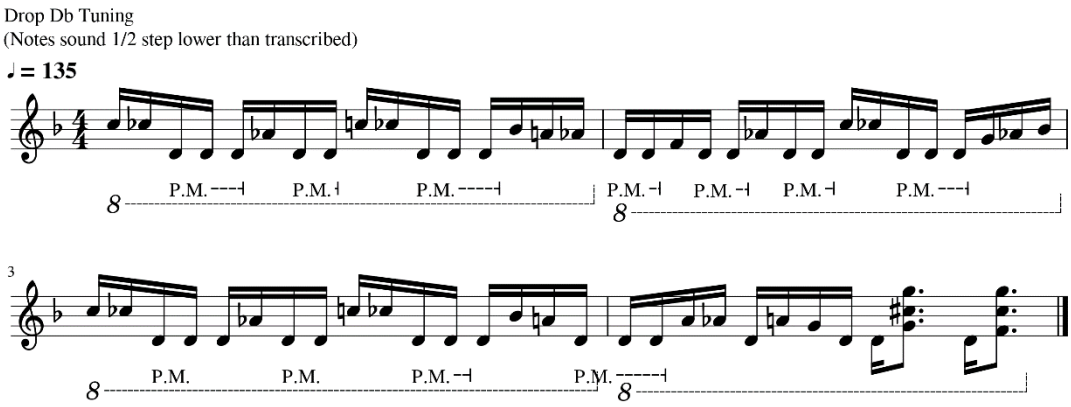

Figure 22- Vivid (Sikth 2017)

Where the lowest open note, D♭, underpins the riff as a pseudo-root pedal tone, the higher register notes create a site of dissonance. Whilst Figure 15- Addicted to Pain (Alter Bridge 2013) was also built from a pedal tone, the Locrian mode was clearly outlined, and the brief reference to the Phrygian Dominant scale still pertained to the tonic pedal. 'Vivid' is somewhat more obscure; it features both a minor seventh and major sixth, and both a natural and flat fifth along with a minor third. The chords in the final bar introduce a major seventh. Since no Western scale is insinuated, the open D♭ is likely being used as a base from which to play intervals that are dissonant between themselves. This effect is emphasised by the unusual placement of accents; eleven of the sixteen strong beats in this riff are marked by the pedal tone, with a higher-pitched melody note falling usually straight after. This creates a distinctly 'off-kilter' effect. Since no true key signature is played, this riff is effectively atonal. Persichetti has asserted that

> In atonal music, relations between tones occur without reference to a diatonic scale formation. There is movement to and from characteristic intervals but the central force is usually melody, and not a governing harmonic base […] The various elements in atonal music are tightly knit by extreme motivic concentration (1978: 261)

[18] Chugging is where a guitarist plays palm-muted notes (see 16) with a distorted timbre. This provides a tight, percussive sound, hence its use in creating rhythm over melody.

Between each semi-quaver cluster in 'Vivid', a melodic force characterised by dissonance persists. Conveniently, the basis of an open string creates the desired heavy metal sound. Then, notes with conflicting relationships to this pseudo-root and between themselves are played seemingly at random, creating an unpredictable and dissonant melody.

In creating a similarly arbitrary melodic effect, metal musicians have been renowned for using chromatic notes. Often, this is composed unequivocally, such as at 1:10 of 'Sweating Bullets', transcribed in Figure 23:

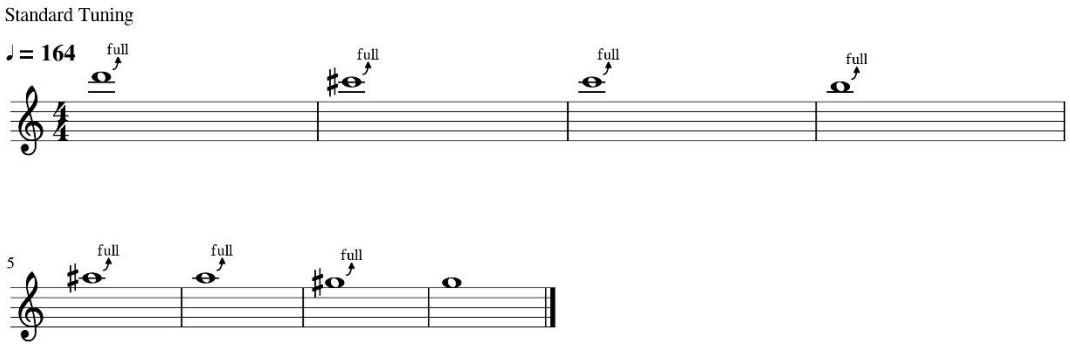

Figure 23- Sweating Bullets (Megadeth 1992)

Where chromatic notes follow one another with the same semitone interval each iteration, rather than with the varying intervals in a diatonic scale, this obscures any sense of a scale and tonic root, as described in 4. 3. 2. This disorientation is heightened by semitones being the same intervallic value as a ♭2, where the immediate proximity makes each interval challenging to differentiate.

Chromatics are also used in a more motivic sense, as described by Persichetti. For instance, 'Raining Blood' utilises multiple chromatics, along with a pseudo-root basis. This is shown in Figure 24:

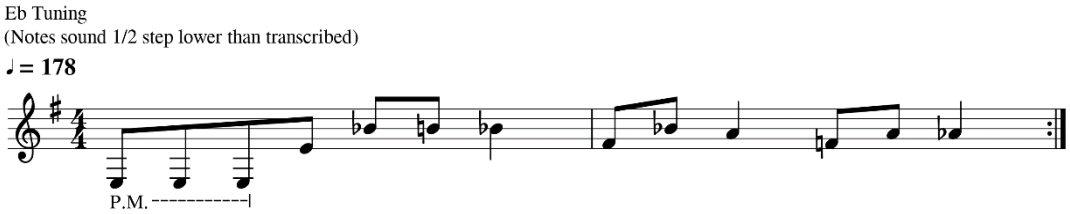

Figure 24- Raining Blood (Slayer 1986)

Whilst chromatic notes, beginning on the third beat, make up the higher melodic contour, they are also underscored by a lower descending chromatic. This lower motif begins with an E♭ on the fourth quaver and follows a chromatic descent from beats one (F♭) and three

(E♭) of bar two. The two chromatic motions do not pertain harmonically to the low E♭ 'chugs' that begin the riff. The central theme is a descending dissonance, verified by a lowest open string pseudo-root rhythm. Chromatics present a visual as well as sonic equidistance; they are effectively notes played in a straight line. This pertains directly to the equidistant and symmetrical intervals defined in 4. 3. 2. Chromatic intervals are functionally dissonant since there is no distinct relationship between any of the given intervals, and therefore no distinct point of resolution.

Although not a pseudo-root, a final way pitch dissonance is created in metal is with a similar disregard for root note functionality, that is, a lack of resolution. For instance, the closing riff in 'The Pot' clearly outlines the D Phrygian mode, as in Figure 25:

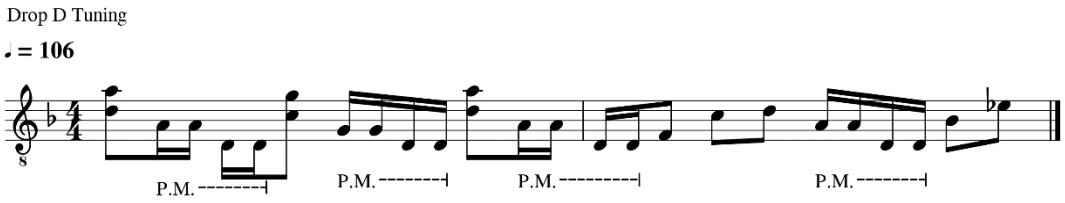

Figure 25- The Pot (Tool 2006)

However, the Phrygian mode is still centred functionally on a tonic root. Whilst the ♭2 belongs harmonically to this passage, closing the riff on the ♭2 is not merely an unsatisfactory ending, but highly dissonant in that the ♭2 is almost the tonic. A tonic ending would have been a consonant resolution, however, ending so close creates an almost tantalising effect. The listener is left with an impression of dissonance even after the song has ended, with no possibility of returning to the established root.

It has now been demonstrated how intervallic quality is used to create dissonance in metal. In essence, this dissonance is created by beating harmonies. Also, dissonance can be created through musical tension, especially when the functionality of the tonic root is obscured. Whilst the intervallic quality of metal has been demonstrated, an investigation of pitch in metal would be incomplete without analysing the genre's distinct timbre, and how the constituent sounds are captured.

5. 2 Technology

Metal is dependent on technology. Not only are amplified instruments essential in creating the appropriate sound profiles and volume, but metal (along with virtually all popular music) is disseminated via recording. Given this significance, technology has a crucial role in creating its central aesthetics.

5. 2. 1 Distortion

Recall that almost every guitar part in metal is played using distortion. Since distortion is so integral, analysing its harmonic content is equally as integral in understanding the tonality of metal.

In short, 'distortion refers to any situation in which a component of acoustic noise is added to the electric guitar's signal' (Berger 2005: 184). Instantiated in guitar amplifier technology, distortion creates additional harmonics when any note is sounded, or in other words, the harmonic series is extended to include more notes. In practice, this strengthened harmonic series creates a rich, warm, albeit aggressive timbre characterised by long note sustain. This strength of timbre has an 'unflagging capacity for emission' (Walser 2014: 42), as any single note is made to sound especially powerful.

Metal composition is often dependant on this potent, extended harmonic series. In Figure 26, additional notes are sounded purely from the advent of distortion:

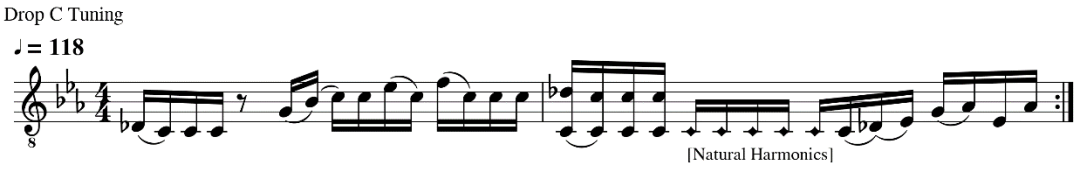

Figure 26- The Last Baron (Mastodon 2009)

Beat two of bar two features imprecise yet entirely audible pitches. These natural harmonics are played by running the fretting hand along the lowest open string. Distortion facilitates a sound dense enough to create entire harmonic series without the guitarist actually playing a precise pitch; they need only brush against the strings. Additionally, much of this

Phrygian riff is played with legato; the potency of distortion removes the requirement for plectrum attacks.

This highly utilised sound feature can be considered dissonant. Persichetti has observed,

> A tone produced on an instrument capable of generating high overtones recognizable by the ear can have a quality that is resonant and relatively dissonant because of the crowding of upper partials. (1978: 23)

In theory, such a tone should sound consonant, as there is no conflict of overtones series when only a single pitch is played. However, the overtones from a distorted note might be strengthened enough to generate their own separate overtone series. As in a chord, these multiple overtone series might not coincide, creating dissonance from beats and root obscurity.

This means that dependant on the level of distortion, any guitar sound within metal is technically dissonant. The powerful yet rough sound of a distorted guitar is well suited to the themes of empowerment and transgression prevalent in metal. Metal musicians appear to have increased the amount of distortion they tend to use over time, as well as emphasising bass frequencies (Herbst 2017b: 39) which pertain to lower critical bands. Once again, this would suggest that dissonance, as a crucial function, is desirable over consonance in metal. This is also a strong point of connection between the metal motifs of 'dissonance' and 'heaviness'; heaviness is created through spectral density, which also creates greater roughness as a result of their being more notes to clash.

5. 2. 2 Recording

With relevance to timbre is the facility with which these sounds are captured. The now widespread availability of digital software, specifically DAWs (Digital Audio Workstations) and more affordable hardware recording technology, allows 'amateur music makers the opportunity to record music with ease' (Thomas 2015: 1). The importance of this is an increased facility for amateur and professional musicians to capture, develop, and experiment with ideas. In this subsection, it is argued that improvements in technology allow the aesthetics of metal to be enhanced.

Digital recording brings the virtue of a 'practically infinite number of tracks' (Williams 2014: 50), unlike in old fashioned tape recording limited to a physical capacity. Usually, this facility is used to multi-track the same guitar lines, creating a denser and therefore heavier sound. Moreover, it has been suggested that musicians can 'use their home recording set-ups to flesh out ideas' (Thomas 2015: 216). For example, complicated multi-layered riffs, such as Figure 17- 43% Burnt (The Dillinger Escape Plan 1999), Figure 19- Future Breed Machine (Meshuggah 1995) and Figure 20- Reign of Darkness (Thy Art is Murder 2012) are likely built; one line is written and a demo recorded, with other ideas then built upon this through virtue of multi-track recording. Quoted in Smialek (2008: 98) Swedish metal band Meshuggah describe their writing process as, 'sitting down in front of the computer […] file-swapping parts'. This process is all too easy with a DAW, of which the display screen creates a 'visual representation of sound as frozen in time' (Strachan 2017: 99). Using this display, sound events can be cut, copied, and pasted, in effect 'infinitely re-configured' (Marrington, et al. 2019: 54).

The freedom of multi-tracking, now available virtually anywhere due to the availability of 'pocket-sized recording studios' (Thomas 2015: 5) (i.e. smartphones) makes it easier and faster to develop increasingly complex music. Consider the challenges that come with composing dissonant music; dissonance is typically a deviation from familiar domains such as diatonic scales and requires a certain level of creativity in working against the 'rules'. With the ability to not only multi-track but record wherever and whenever an idea occurs, musicians now have the facility to develop more dissonant and experimental ideas.

Improvements in technology facilitate which sounds are actually possible to record. Most crudely and traditionally, musicians would be recorded by playing in front of a microphone. More recently, 'there has been a monumental shift away from recording bands in a 'live' fashion (Thomas 2015: 273). Not only does this include multi-tracking, but advances such as recording to a metronome, or recording a song in pieces rather than one live take. With these benefits, it is easy to create precisely timed and mistake-free recordings. This sense of deliberation is important in achieving the sound of metal:

> Sonic clarity can enhance the energy, intensity, and impact of each and every sound in a metal production, collectively strengthening the power and drive […] Clarity can therefore be viewed as a valuable parameter of effective heaviness. (Mynett 2017: 19)

Unusual, dissonant sounds recorded imprecisely would simply be heard as mistakes. This has led to the nomenclature, 'cyber-genres', wherein precise musical characteristics are indebted to DAWs (Marrington, et al. 2019: 55).

It is also worth considering an alternate approach to recording which some metal musicians have taken. Namely, black metal artists strive for values that oppose those just described. Black metal is commonly low in sound quality and highly dissonant. Steinken (2019: 21) describes black metal as 'an extramusical performance of self-abjection in which the musical and personal lives of black metal musicians aestheticize and politicize abjection in congruent ways', with the consideration that the genre's abjection extends to the musician's life choices[19]. With such a commitment to the abject, it is unsurprising that these musicians use dissonance to such an extent that rather than record dissonant music in clear quality, the recording itself is dissonant.

For instance, Figure 27, below, would be challenging to record cleanly in any case; it is composed entirely of full minor chords under distortion. In 4. 2. 3 it was noted how chords that approximate a single harmonic series are deemed consonant due to their sounding like a single note. In comparison, minor chords evoke incongruous harmonic series (Lilja 2009: 113), and so when combined with the additive overtones of guitar distortion should sound especially dissonant.

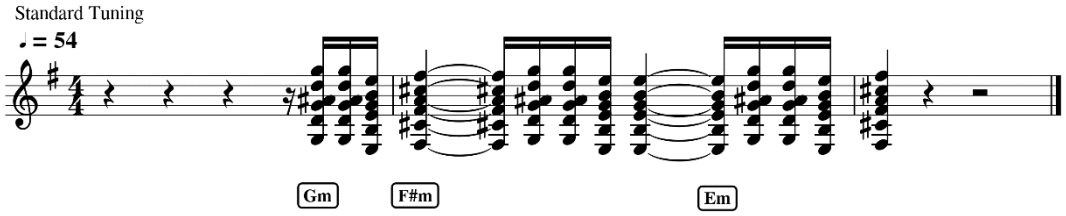

Figure 27- Dunkelheit (Burzum 1996)

Black metal artists go further than this. In recording the above example, composer Vikernes performed using a stereo speaker instead of a guitar amplifier and requested the 'worst microphone' available, which turned out to be a headset (Vikernes 2005). This is a

[19] Black metal musicians, specifically from the Norwegian 'second wave' in the 1990s, were notorious for committing acts of violence such as burning down churches. (Moynihan 2003: 31)

demonstration of how dissonance is deliberate in much of metal composition, even if the final product sounds as if it was recorded unprofessionally; the dissonant effect is of paramount significance. In one of metal's most extreme subgenres, the dissonance is so unmistakable as to encompass the entirety of the recorded sound, in what might be named spectral dissonance.

5. 3 Metrical Dissonances

Meter and rhythm are significant in characterising metal's aesthetics of power and transgression. This subsection will demonstrate metal's propensity not only to use 'fast subdivisions [and] subdivisional complexity' (Mynett 2019: 300), but also more complex approaches to rhythm in achieving a dissonant sound.

5. 3. 1 Submetrical Dissonance

In metal's predecessor, rock music, syncopations (see 4. 3. 3) were considered performative, meaning they were not necessarily integral to a song's structure or identity. Temperley (1999: 38) suggests that with rock songs, the recording is not 'the definitive performance; perhaps it is simply one performance which happened to be recorded'. This is feasible considering syncopations do not disrupt the overall structure of a song, or even the delineation of a single bar. Syncopations can easily be implemented or discarded as stylistic embellishments.

In metal, the embellishment of syncopations, i.e., where they conflict momentarily with the established pulse, is perhaps more crucial to the identity of certain songs. In some instances, syncopations appear to be used to create an inherently unsettled ostinato, as in Figure 28:

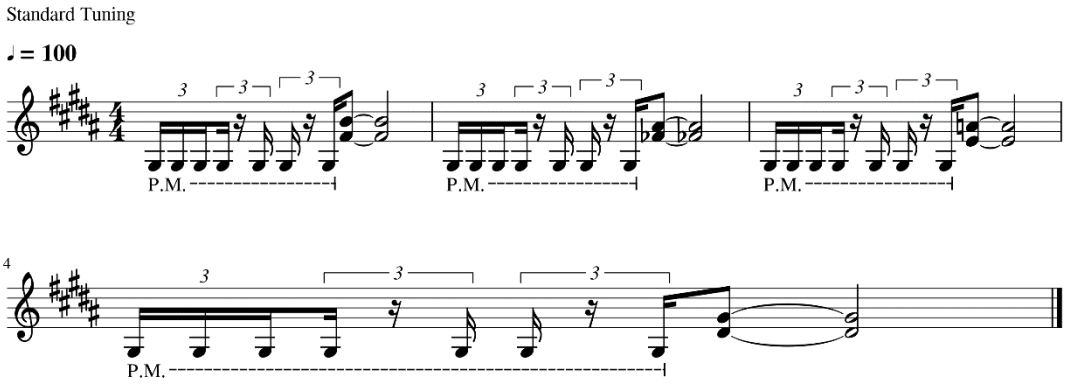

Figure 28- Psycho Holiday (Pantera 1990)

Whilst relatively minimalist in pitch, 'Psycho Holiday' is still able to create a dissonant effect simply by placing chord accents incorrectly. Relevant to the lyrical theme, this syncopation is more likely compositional than performative, given each bar contains a fixed rhythm character.

In more contemporary metal, rhythmic characteristics as small as syncopations are even more vital to compositional identity. Many modern songs contain breakdowns, a section that emphasises rhythm and heaviness. A breakdown is typically slower in tempo than other song sections and features few note changes to focus on rhythmic quality. Often, breakdowns feature some sort of rhythmic (and/or pitch) dissonance; this tension 'is the source of the breakdowns compelling energy' (Gamble 2019: 340-1). Figure 29 depicts a syncopated breakdown:

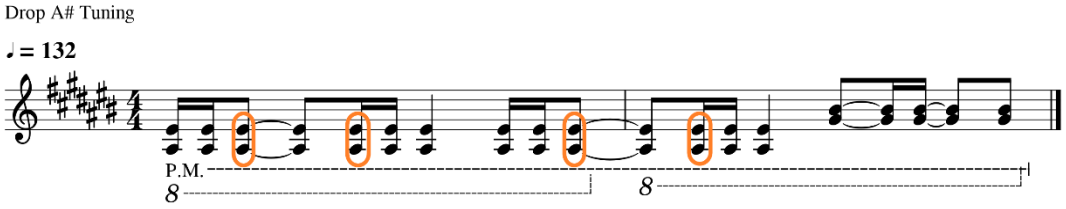

Figure 29- Deliver Me (Parkway Drive 2010)

Beginning with sixteenth-note pairings, each rhythmic cluster acts as what might be called a rhythmic anacrusis. Syncopation occurs where an eighth note is held across the strong beats, excepting beat three. These syncopations are anticipated by a rhythmic anacrusis from the sixteenth note pairs. Along with the obvious tension from the displacement of accents, the anticipatory effect of the sixteenth notes leading to the displacement

emphasises the rhythmic dissonance. Also, the lack of variation in pitch offers the listener little other than rhythmic character to focus on.

Conversely, breakdowns also use syncopation where the accent is delayed. Figure 30 demonstrates:

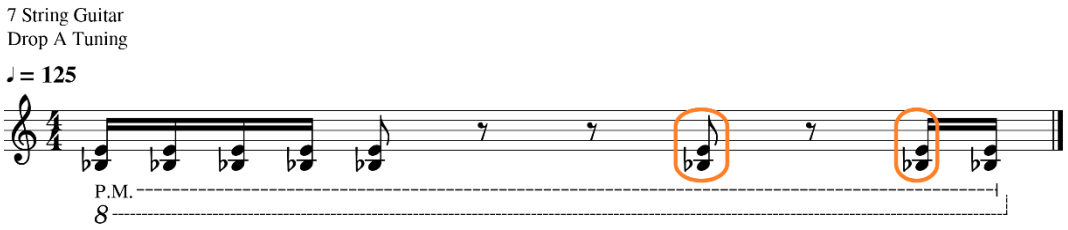

Figure 30- The Human Condition (Chelsea Grin 2010)

Whilst still creating tension against the strict pulse of a song, this syncopation type has less of an anticipatory effect. Instead, the delayed accents occurring after beats three and four sound somewhat lost. Since they are offbeat but not anticipated, they may be heard as somewhat random or even disturbed. This is emphasised by the unvarying use of $\flat 5$ chords in this breakdown. This sense of disorientation is appropriate to the song's existential lyrical theme, and despite being a small-scale feature, is a crucial component of the composition.

In metal breakdowns, syncopations are valued beyond being performative inflexions. Whilst they do not affect the overall structure of a composition, syncopations can be placed specifically for a crucially dissonant effect, emphasised more so when pitch variation is lacking.

5. 3. 2 Meter Level Dissonance

To restate, a method of creating dissonance at the meter level is by stacking different metres. When these meters realign every bar, this is a polyrhythm. Polyrhythms have a profound effect on structure, as different voices are effectively acting independently and in conflict. In their conventional form, polyrhythms appear in metal as in Figure 31:

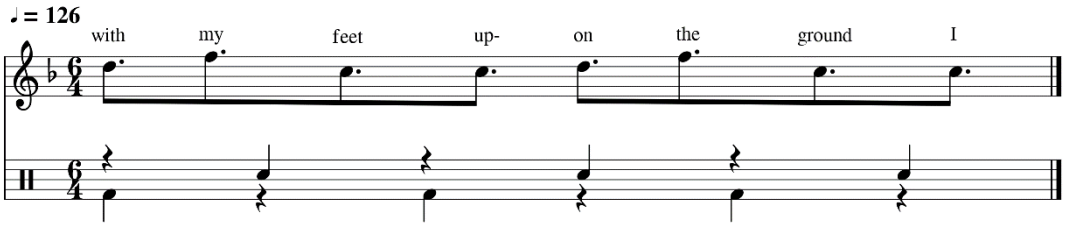

Figure 31- Lateralus (Tool 2001)

This is an 8: 6 polyrhythm, where eight notes in the bass are incorporated into the $\frac{6}{4}$ established by the drumbeat. The performative assurance of superimposing conflicting beats creates a powerful, groovy rhythm. The tension enacted at the points where accents do not coincide creates interest, as well as dissonance from what is effectively syncopation. Whilst these conflicting rhythms certainly create some degree of dissonance, a polyrhythm still resolves periodically. However, metal musicians have managed to employ the groovy effects of polyrhythms whilst further emphasising the dissonant effect.

The opening passage of Disturbed's (2000) 'Down with the Sickness' features a 3:2 polyrhythm (also known as a hemiola, or sesquialtera) superimposed over a $\frac{4}{4}$ pulse. Figure 32 demonstrates:

HT= High tom drum

BL= Bass drum and low tom drum

$\frac{4}{4}$	♩				♩				♩				♩			
HT	X			X			X			X			X			X
BL	X		X		X		X		X		X		X		X	

Figure 32- Down with the Sickness (Disturbed 2000)

The lowest common multiple of 3 and 2 is 6, meaning six beats are required to cycle this polyrhythm. Noting how $\frac{4}{4}$ does not evenly divide by six, it makes for an interesting compositional choice that the polyrhythm was imposed in this way; it necessitates a truncation to avoid becoming a polymeter where bar lines would have been crossed in retaining the pattern. Whilst the differing cardinalities of polyrhythmic layers are considered dissonant in themselves, this truncation demonstrates a manipulation of polyrhythm. Further rhythmic dissonance and an 'indirect dissonance' is created through the thwarting of an established pattern and listener expectation, respectively.

Meter-level dissonance can also be created via the relationship between neighbouring bars. Metal musicians often use odd-numbered time signatures. Although these technically are consonant in themselves (4. 3. 3), they are commonly used in a way that becomes dissonant.

What could be called tandem bars are utilised, often consisting of an odd then even count bar (which would always result in an odd total number) alternating around one another, shown in Figures 33 and 34:

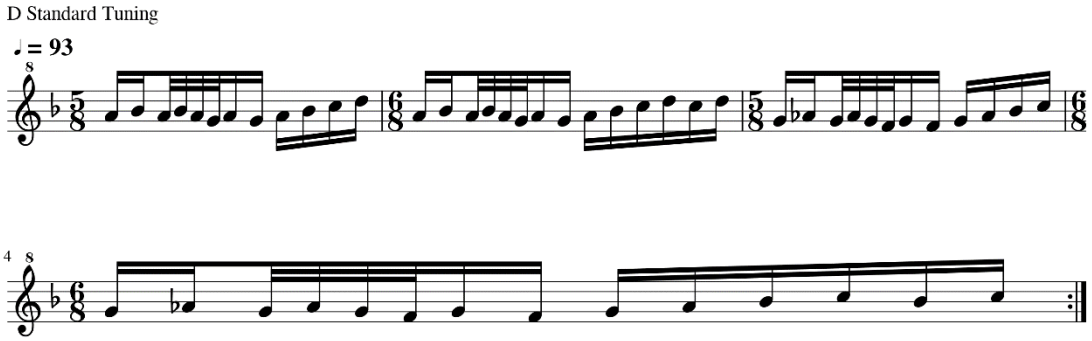

Figure 33- Blood and Thunder tandem (Mastodon 2004)

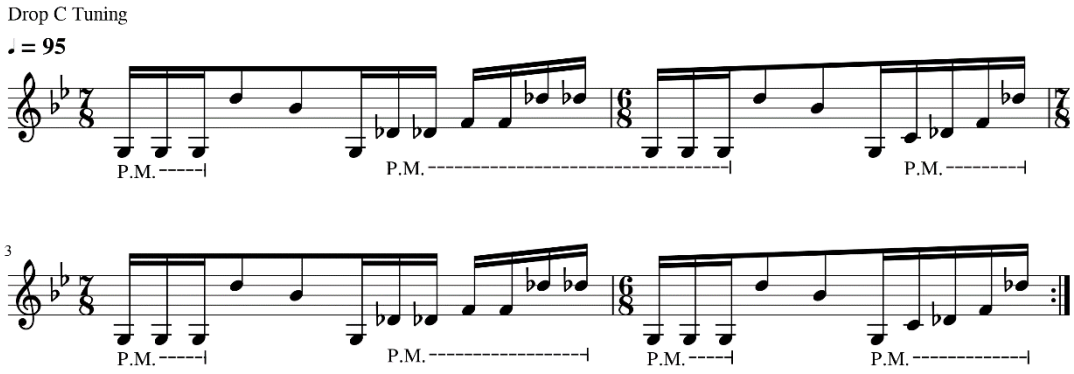

Figure 34- Chalk Teeth tandem (Toska 2016)

Tandem bars have the immediate effect of indirect dissonance on the listener due to the repeated, rapid-succession misalignment. This concept can also be more complex, such as in Figure 35:

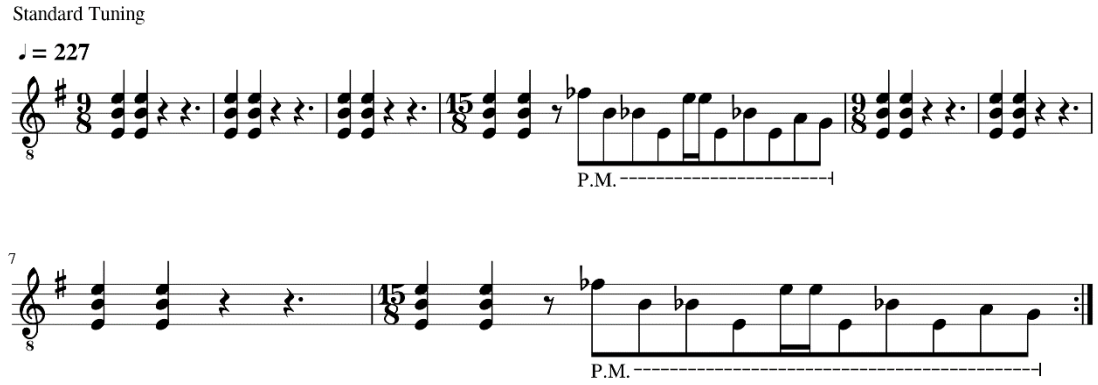

Figure 35- Beneath the Mire (Opeth 2005)

Here, tandem groups of bars alternate around each other, exacerbating the confounding effect.

Lastly, even more profound dissonances can be created when a pattern of three separate time signatures alternate, especially if some of the constituent signatures are grouped. Depicted in Figure 36:

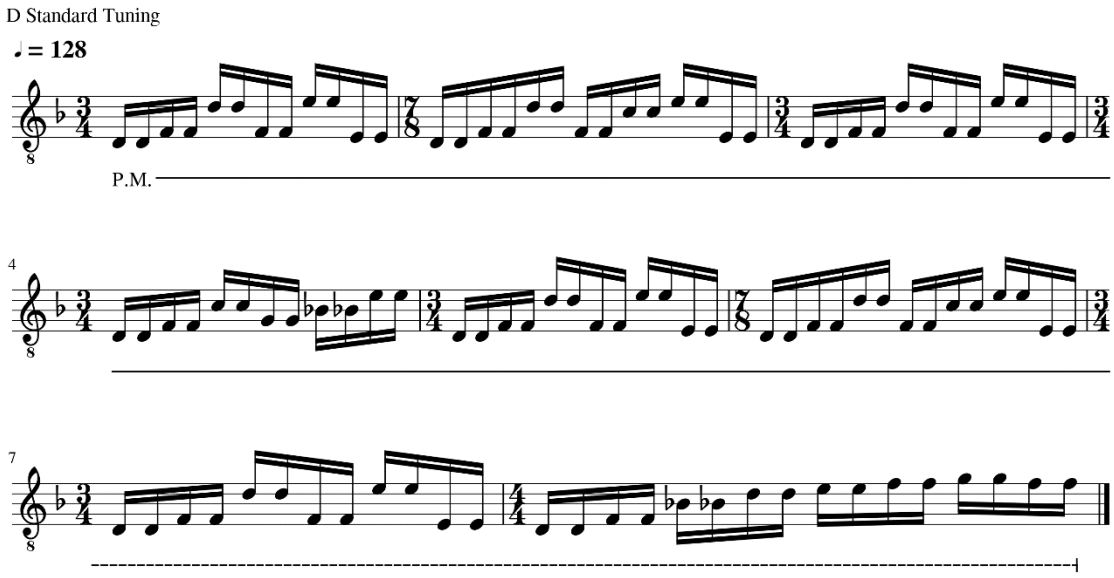

Figure 36- Megalodon (Mastodon 2004)

In 'Megalodon', $\frac{3}{4}$, $\frac{7}{8}$, and $\frac{4}{4}$ are played. The second iteration of $\frac{3}{4}$ lasts for three bars, compared with every other iteration which lasts only one. This embedded grouping adds further inconsistency, makes pattern less discernible, and thwarts expectation within occurrences of even the same time signature.

5. 3. 3 Hypermetrical Dissonance

This subsection will consider stacked meters which do not realign each bar. Krebs has argued that a determinant for the

> inherent intensity of grouping dissonances is length of cycle; the more pulses elapse before attacks of the constituent layers coincide, the more intense the dissonance. (2003: 57)

This is logical, given that pulse layers would be less congruent if they spend more time misaligned. Since a polyrhythm aligns every bar, it is only dissonant due to its internal disturbances. In the case of polymeter however, not only is there conflict within the bar, but each respective meter may not realign for a vast number of bars. This would render a polymeter inherently more dissonant than a polyrhythm, and arguably the most intense way of achieving metrical dissonance.

The concept of polymeter has been combined with other metrically dissonant concepts discussed previously. Swedish band Meshuggah are perhaps best known for their composition 'Bleed' (2008), which along with featuring polymeter, wavers between various time signatures. Drummer Tomas Haake maintains a $\frac{4}{4}$ pulse. With the guitar lines transcribed to match this meter the opening to 'Bleed' appears as in Figure 37:

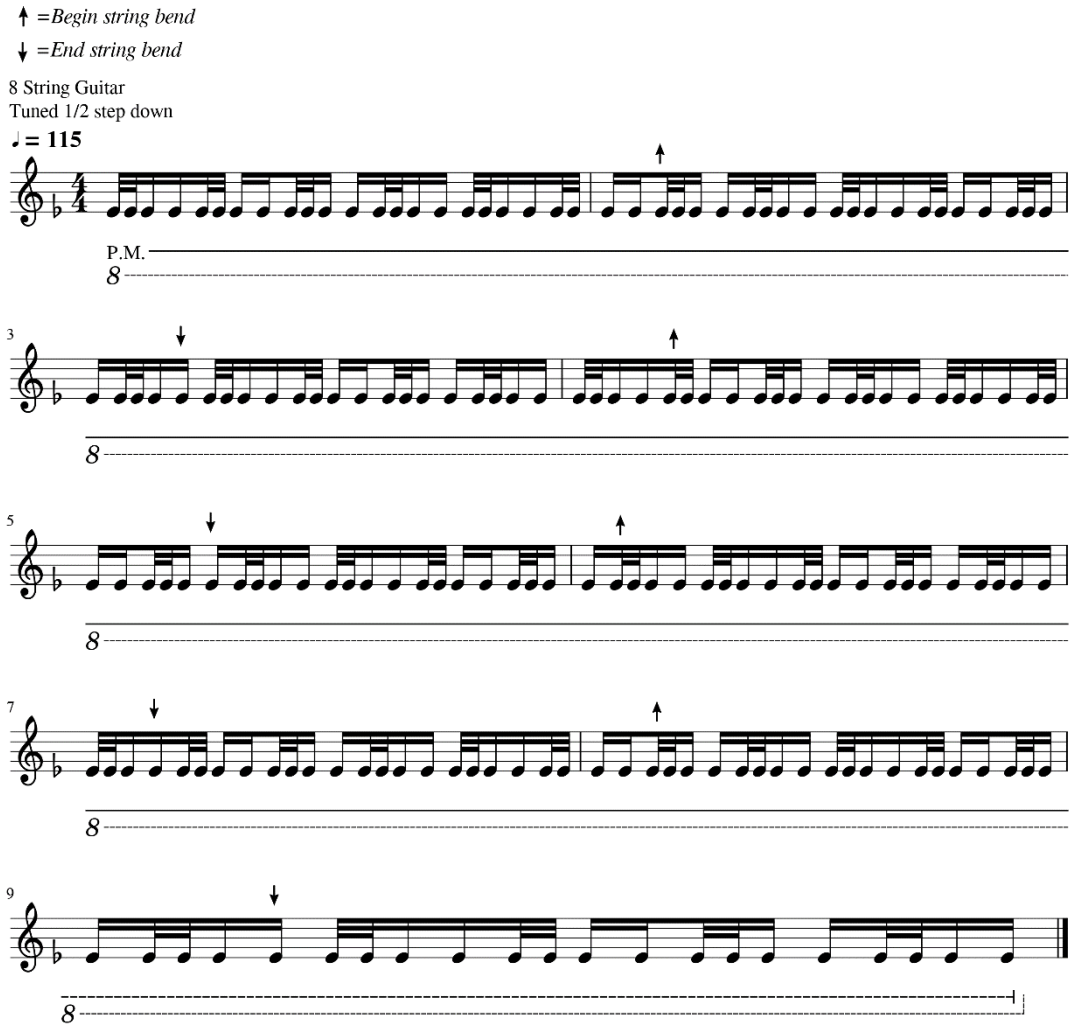

Figure 37- Bleed, 4/4 transcription (Meshuggah 2008)

Whilst this 'in media res' hearing is certainly valid, a closer analysis of 'Bleed' would suggest polymeter is clearly at play. The only differentiation within the guitarists' consistent rhythmic pattern (Figure 38) is the gradual, semitone string bend to and from the same E♭ pitch. The guitarists' process of beginning or completing a string bend is the only delineation of a section in an otherwise uniform riff. However, these string-bend marking points do not coincide with the $\frac{4}{4}$ bar lines.

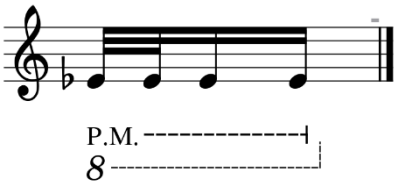

Figure 38- Consistent rhythmic pattern in 'Bleed'

Evidencing that 'Bleed' is polymetrical is guitarist Fredrik Thordenal's broken-English statement, 'It move', after guitarist Marten Hågström performs the riff (BloodyAkuma6, 2008). This suggests that the clear starting points of the riff move above the consistent $\frac{4}{4}$ of the drums, using separate time signatures. Transcribed independently of the drums, 'Bleed' may be heard as in Figure 39:

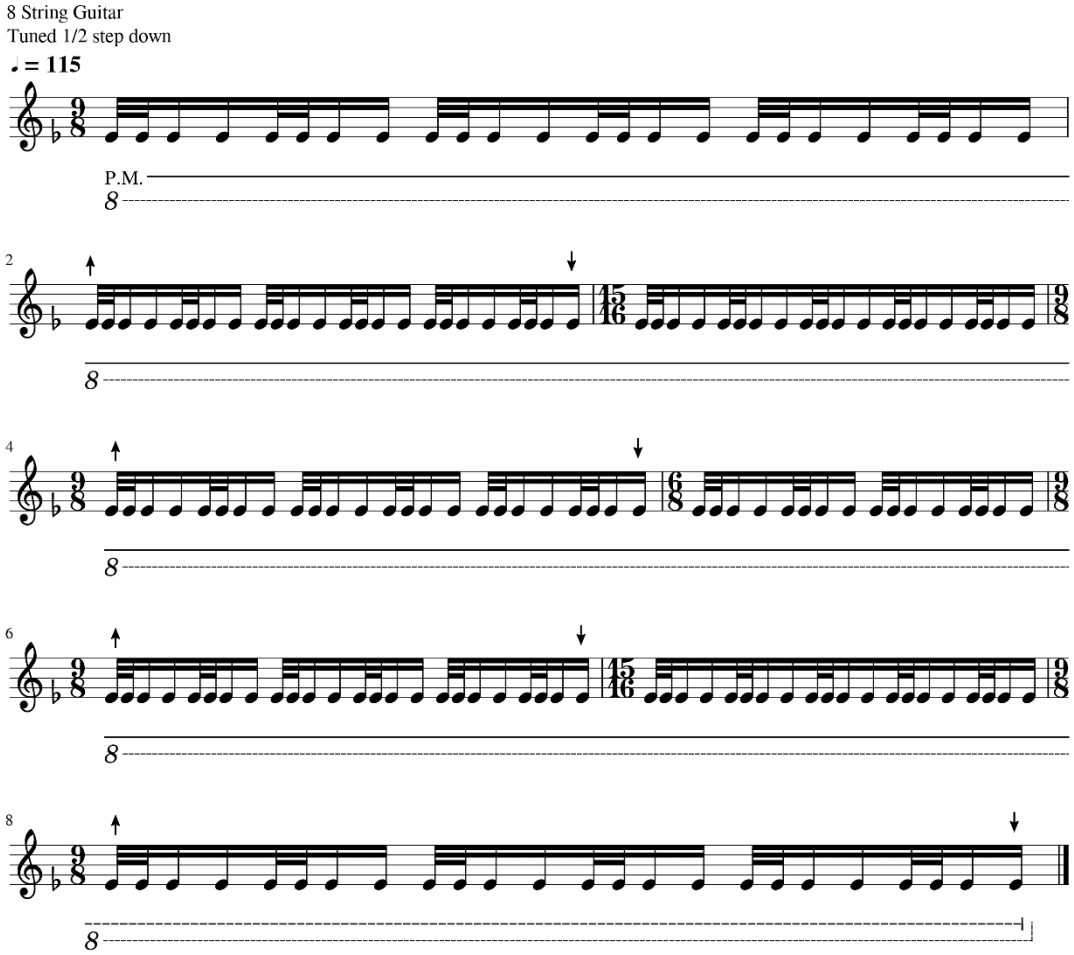

Figure 39- Bleed (Polymetric transcription)

Where bar lines are delineated based on the only audible discrepancy within the passage. As well as this conflict with the drums $\frac{4}{4}$ is the previously discussed 'indirect dissonance' of

conflicting subsequent meters. In the guitar part alone is an unusual combination of three time signatures creating little pattern between themselves. This renders 'Bleed' as not only metrically dissonant in that two separate voices pulse independently, but one of these voices continuously conflicts with itself. Lastly, it is worth highlighting the lack of melodic content, other than the difference of a semitone in the string bend, greatly emphasising the unusual rhythmic content. This is relevant to the argument underscoring this chapter, as the riff is effectively stripped of all content save for the (metric) dissonance itself.

5. 4 Form and Structure

In this subsection, an unconventional conception of cons/diss will be supposed. Given that non-improvised music must have a structure, it may be possible to infer a consonant structure if the song (a) adheres to an established stylistic convention, or (b) is structured in a perceivably logical way. A dissonant structure would be the converse of these. These concepts are subjective, especially (b). However, Chapter 4 demonstrated that cons/diss can be realised subjectively, largely due to cultural and stylistic context. So, whilst this subsection will not describe a cons/diss as objective as, say, critical bandwidth, cons/diss of song structure is nonetheless a viable interpretation.

It is not unusual to analyse compositions holistically; Berger (1999a: 60) has considered the obscurity of tonal centre and extreme tempo as a cause for heaviness. Similarly, Hannan has asserted

> A song or section of a song that is rhythmically difficult is harder to conceptualize and harder to remember. Another way of putting this is that it is harder to feel and understand the boundaries […] the song section metaphorically becomes 'bigger', bigger than the listener's ability to keep track of it. (2018: 444-5)

From the essay, 'Difficulty as Heaviness', this suggests how non-physical, metaphorical aspects of a song contribute to its nature. The difficulty that is structural dissonance can ergo be applied to at least two forms that subvert typical song structures.

Firstly is a melodic line or riff which is excessively long and/or complicated. Further to Cook's (1987) claim from 4. 3. 2, Moore (2001: 99) has argued that the memory of a listener fades after eight to sixteen seconds, causing them to 'lose orientation'. In riffs such as

Figure 40, which spans twenty-three seconds before repeating, the sheer length may cause a disorientating and dissonant effect:

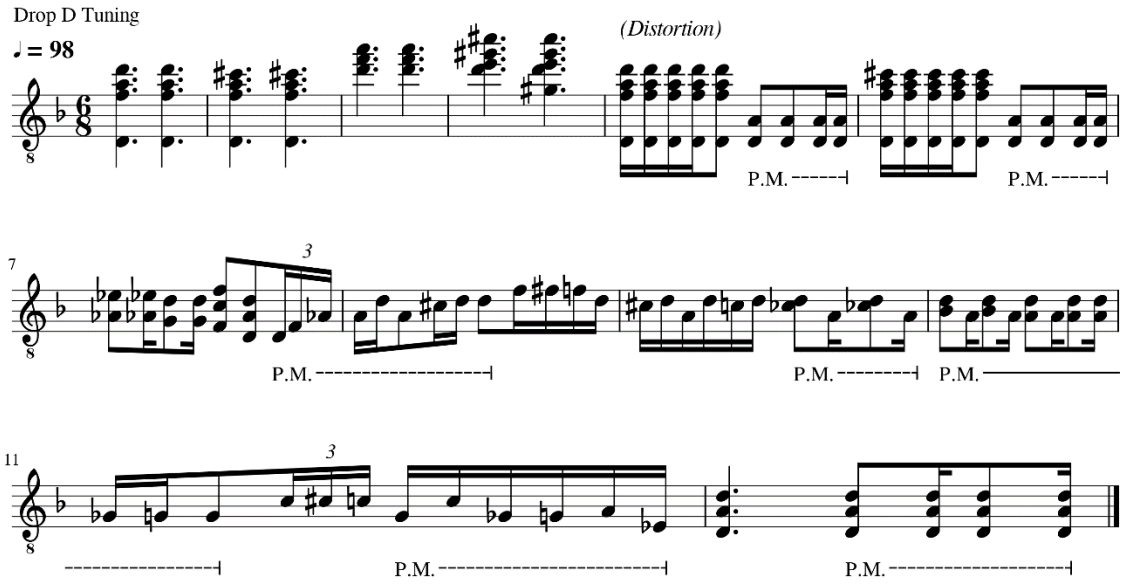

Figure 40- Ghost of Perdition (Opeth 2005)

The presence of accidental notes, as well as growled vocals, also contribute. Nonetheless, the size of this riff is analogous to the difficulty of comprehension described by Hannan.

Secondly, the structure of a song with regard to the relationship between its constituent sections may insinuate cons/diss. This is mostly dependant on whether or not a song obliges to its expected norms; most Westernised music takes advantage of repetition in some sense to create a structure. However, in many metal songs, there is an obvious and deliberate sense of structural instability. Figure 41 depicts a song that may be regarded as structurally dissonant:

0:00-0:19	0:20-0:33	0:34-0:50	0:51-1:42	1:43-2:00	2:01-2:36	2:37-3: 20	3:21- 3:50	3:51-4:23	4:24-4:40	4:41-4:54	4:55-5:24	5:25-5:47
Main Riff	Heavy Rhythm	Bright Chords	Clean	Offset Riff	Break-down	Solo	Cinematic	Tandem	Melodic Chords	Open string Riff	Closing Chords	Main Riff

Figure 41- Song map of 'Chalk Teeth' (Toska 2016)

Notable is the lack of repetition, and thus lack of any formal structure. This is not to say the structure is of poor quality; it may likely be heard as creating a narrative. However, the

ever-changing present offers no familiarity or point of rest, save for the single repetition bookending the song. Hence, this may be regarded as a dissonant song structure.

Whilst not all metal is composed with such an arbitrary structure, it is at least common for songs not to feature melodic choruses or similar consistencies. Adhering to the typically pop feature of having a repeating chorus may be seen as 'selling out'[20], and being 'less metal' than a distinctly dissonant song. Many of the dissonance types outlined in this chapter have been regarded as non-commercial. For instance, radio and mainstream audience-friendly songs are generally shorter in length and feature less rough-sounding guitar distortion (Vasylenko 2019), as well as generally using diatonic tonality. This may be taken as a final piece of evidence that dissonance is not only deliberate, but a crucial component of metal; the sacrifice of mainstream success would be too great unless using typically "incorrect" phenomena was not a primary aim.

5. 5 Summary

This chapter has demonstrated how dissonance is indubitably present in metal composition. Not only this, but the prominence of many of these dissonances would imply that they are the central aesthetic, such as there being no resolution away from the dissonance (Figure 25- The Pot (Tool 2006)), or no sense of harmonic function outside of dissonant, beating intervals (Figure 22- Vivid (Sikth 2017)). This is a subversion of the typical values of music, where dissonant features should be fleeting points of tension, resolved in favour of predictable and more satisfying consonances. In the following chapter, the problem just demonstrated is addressed earnestly; cons/diss are ostensibly so subjective that not only can relatively high levels of dissonance be a stylistic point of consonance, but dissonance may not be regarded as unresolved at all.

[20] Selling out is where compositions are made more appealing and generic in order to appeal to a wider audience, thus generating more income (Vasylenko 2019).

Chapter 6

Why Dissonance?

This chapter aims to define cons/diss, outlining various cultural and stylistic factors which in sum create the parameters of cons/diss. If dissonance is now taken to be a significant component of metal, then a crucial problem in defining cons/diss is to what extent dissonance is enjoyable, or whether listeners simply develop a tolerance to dissonant sounds and enjoy metal by other means. By analysing the sociology, compositional process, and perceived meaningfulness of metal it is hoped that the reasons why dissonance is favourable will appear, ultimately contributing to the definition of cons/diss.

6. 1 Authenticity

This subsection will demonstrate the great importance metal audiences place on authenticity. In metal, original and creative work is highly desirable. Metal musicians champion dissonance as one method of achieving authenticity. In this way, an authentic metal composition might be called transgressive. Similar to how metal revels in typically erroneous musical features, the truest metal songs are often the least appealing, at least commercially.

6. 1 . 1 Anti-Mainstream

As mentioned in 5. 4, metal musicians value their authentic sound over mainstream recognition. Momentarily discarding the particularity of dissonance, authors have noted that much of metal's appeal is found in distinctly unappealing features. This aesthetic is described by Farley; 'the symbolism, extreme lyrics and diabolical imagery are intended to shock and as such are a protest against the pervasiveness of societal norms' (2009: 83-4). In consequence of this anti-mainstream attitude, negative ideas are often seen as positive or complimentary in metal. This directly parallels metal's approach to musical dissonance. This notion of negative as a compliment has been observed by Smialek:

> technical death metal fans and musicians value when their music comes across as sounding "brutal," but that sense of brutality is achieved through complexity and meaningful disorientation [dissonant riffs] (Smialek 2015: 192).

Whilst this further affirms that typically negative phenomena are received positively in metal, it still begs the question of why these particular authentic traits are valued.

Most obviously, metal values authenticity because it seeks to be rebellious. By avoiding mainstream appropriation, metal has the virtue of creating 'other possibilities of cultural signification, opening a space of alternative meanings', (Partridge 2012: 73). By being authentic (i.e., not conforming to mainstream expectations), metal may be deemed more meaningful, interesting, and original; it is authentic for the sake of being authentic. This rebellious style was realised musically in the vast amount of dissonance in Chapter 5. Unsurprisingly, there are further reasons why authenticity is valued in metal, such as the genuine instrumental abilities of the musician.

6.1.2 Serious Skill

Along with having authentic motives and meanings, metal songs must be composed using skilful and genuine technique. The electric guitar, as the principal instrument, is complicated and challenging to play. It requires 'great manual dexterity [and] familiarity with a wide range of electronic gadgetry' (Weinstein 2000: 23). Mastery of the guitar is not only admirable to listeners but gives the guitarist a greater capacity to compose authentic music. A great amount of effort is desirable in many parameters of metal, such as the aggression and speed with which instruments are played. Also, the ability to break musical rules and compose convincingly using great amounts of dissonance requires a reasonable degree of instrumental skill. Recall for instance complicated riffs such as Figure 40- Ghost of Perdition (Opeth 2005), which as well as featuring various unprecedented notes endures for a great duration, demanding both theoretical knowledge and technical skill.

Emphasising the value metal audiences place on authentic ability and compositional skills, Reyes (2013: 249) has documented the egregious reception of the band Hellhammer. Hellhammer composed 'extremely basic, repetitive, and badly performed' songs. Supposedly, they became 'the worst heavy metal band to ever make a record', with this infamy tainting the future projects of Hellhammer members. This would suggest that a degree of

compositional complexity and performance precision (i.e., skill with an instrument) is highly desirable. This reverence for skilled musicianship is relevant to dissonance. If dissonance is taken to be the breakage of typical rules and thus requires extraordinary skill to perform, it is a creative tool with which to build an authentic product.

Thus far, the attitude behind why dissonance is valued as a component of authentic metal has been outlined. Dissonance pertains to values such as transgressing against predictable, mainstream practices, as well as showcasing skillfulness and genuine effort. Nonetheless, this discussion must still consider where the appeal of dissonant sounds themselves might derive.

6. 1. 3 Horror

The problem underscoring this thesis is that dissonance is supposedly a musical device that creates tension but must soon be resolved away from. It is unusual, then, that dissonance in metal is not only especially prominent (concerning guitar distortion, perhaps in almost every note), but often left completely unresolved. Where this begs the question, "why would anyone listen to this?" the answer may partly be answered by assessing the parallels between metal and horror films.

The connection between metal and horror is so strong that, at least thematically, horror may be responsible for metal's existence. As pioneers of metal, Black Sabbath are supposed to have said, 'isn't it strange that people pay money to see scary films? Perhaps we should start writing scary music.' (Farley 2009: 80). Indeed, the band and their first composition (Figure 11- Black Sabbath (Black Sabbath 1970)) are named after a 1963 horror film. As musicians, they had observed a strange fascination audiences have with things that should not be desirable. Most obviously, the manifestation of this inspiration was in Black Sabbath's transgressive, horror-themed lyrics. However, their music (as in Figure 11- Black Sabbath (Black Sabbath 1970)) is also transgressive. Dissonance deviates from normal expectations, being apparently unpleasant, and yet still has alluring qualities. These transgressions are a direct connection between metal and horror, and so it may be possible to infer much of the value of dissonance by turning to the psychological implications of horror.

Metal authors have observed this connection previously. For instance, Walser (2014: 160) has suggested horror is successful because 'it enables us to overcome safely the objects of our fears'. Turning to more specialist literature, this seems tangible; Fahyr (2010: 3) has observed the eclecticism of horror, where it often derives from other genres such as science fiction, thriller, and mystery. Horror is a way to explore many unknowns, although the common denominator is likely fear, as suggested by Walser. This pertains to the lyrical themes of metal, which explore fearful subjects ranging from nuclear war and murder to the devil[21]. Metal album art often resembles horror imagery, as in Figure 42. Moreover, the methods in which these subjects are presented in horror bear a close parallel to the compositional nature of dissonant metal.

Figure 42- Typical metal album art

Horror exposes grim realities and allows the audience to experience these realities in safety. It exposes the audience to sensory experiences, such as the sight of blood or the sound of screams. Whilst metal is limited to being an abstract reflection of such horror, these sensory experiences may be replicated in the sounds used by metal musicians. Sometimes, this is done literally, such as with the screamed vocals (which are themselves dissonant due to the vast number of overtones produced in a scream) commonly heard in

[21] Such as 'Rust in Peace' (Megadeth 1990), 'Dittohead' (Slayer 1990), and 'The Devil in I' (Slipknot 2014).

metal. Similarly, dissonant musical devices allow the listener to experience and come to terms with unpleasantness and the unexpected. Recall for instance the shocking ♭2 stabs in Figure 19- Future Breed Machine (Meshuggah 1995), or the evasive and off-kilter notes in Figure 22- Vivid (Sikth 2017). Of course, this experience is done through the safety of merely being music, yet it offers the listener exhilaration and a chance to experience that which, at least in theory, should not be enjoyable.

It has now been outlined why dissonance has a prominent place in authentic metal. Firstly, dissonance must be a deliberate act; composing a dissonant song is not so musically simple as following mainstream trends such as uncomplicated, cadential chord progressions, often composed to a formula. Furthermore, any dissonant ideas must be performed accurately to avoid sounding as if notes were merely being played inadvertently. This relates to dissonant composition, as the individuality and innovation required to create the examples from Chapter 5 often demanded near-virtuosic ability, or at the very least a sense of music theory. The last authentic value considered was the transgressive nature of horror and how this is closely tied to metal, including in its musically transgressive dissonances which create shock and, at least initially, a thrilling sense of outrage that can be experienced safely.

6. 2 Experiencing Dissonance

Now that a thematic framework of metal has been established, it is reasonable to take an emic approach in understanding how cons/diss is defined in context. In understanding metal internally (how listeners actually experience it), this subsection will describe the community, or scene, of metal listeners and how cons/diss pertains to the values therein.

6. 2. 1 The Scene

Developing any understanding of music beyond its sonic construct requires an understanding of its real context. The meaning of a composition, what it was attempting to express, and perhaps most importantly, how it is received, does not appear randomly. Where sonic

constructs were influenced by similar predecessors, the expression of music is absolutely relevant to a time and place.

It is interesting, then, that at least some metal branches originated from places of great struggle and frustration. Of course, an individual in their personal circumstance may receive music differently to others (explored in 6. 2. 2), however, this does not exclude the importance of community. Black Sabbath (founded in 1968) and Judas Priest (1969), for instance, both formed close to Birmingham, wherein they experienced a 'tough industrial upbringing' (Partridge 2012: 99). Where Cope (2010: 27) has asserted music is influenced 'by the pressures and dynamics of political and economic circumstances', the actual manifestation of this influence within music has been described as 'meaningful to audiences because its elements already hold cultural currency' (Partridge 2012: 79). In other words, some of the meaningfulness is in the semblance to its place of origin. Dissonant sounds, at least originally, were the noises of struggle, incongruity, and unresolved frustration, employed in such a skilful way so that the musician takes control of the dissonance and wields it expressively.

Metal is rarely happy. From its origins in post-war industrialism, it expresses seriousness and frustration by exploiting dissonance, as well as other transgressive themes such as loudness and horror-like content. This transgression is a currency circulating the metal scene. Concerning the scene itself, the communal values of metal are explicit not only in the contextually relevant expressive values but also in the discourse of its participants. As a whole, the metal scene favours authentic, abrasive, even aggressive notions not dissimilar to its musical dissonance. This includes scene members often being heavily pierced and tattooed, with performers making 'muscular moves' as they play machine-like instruments (Bayer 2009: 24-27). Along with the graphic album art demonstrated above, the visuals of metal as a whole usually depict 'angularity and thickness […] a menacing, armour-breaking mace or saw-tooth appearance' (Weinstein 2000: 28), particularly concerning band logos, as in Figure 43:

Figure 43- Typical metal band logos

The metal scene offers a place of belonging for the transgressive. The psychology of this community is addressed in 6. 2. 2. Along with being a site in which to explore negative sound structures, metal provides a place for individuals to express themselves in transgressive ways, such as with the dress senses in Figure 44:

Figure 44- Metal attire

These notions have been objectified as forms of capital, such as 'subcultural capital' which is the merit of being 'in the know'. Subcultural capital might include 'fashionable haircuts' and 'current slang' words (Kahn-Harris 2007: 121), as well as wearing appropriate attire. This sense of being 'in the know' must include having some appreciation of dissonance, along with other abrasive musical tropes such as heaviness and loudness, and the transgressive visuals depicted above. Whether this discourse, specifically the acceptance of dissonance, is learned (perhaps even just tolerated for the sake of involvement in the scene) or retains a genuine appeal is addressed in the following subsections.

6. 2. 2 Catharsis

Transgressive conventions have now been demonstrated as relevant to metal as a whole; metal encompasses a scene with many transgressive extramusical attributes. This analysis will continue exploring the extramusical, now turning to the psychology and individual meaningfulness of metal in completing a definition of cons/diss. This subsection will explore how catharsis is achieved through experiencing metal, with reference to psychology-

based texts which suggest the aggressive features of metal are a method through which to purge negative emotions.

One broad form of catharsis obtained from music is, recalling 6. 2. 1, that elements of music might be meaningful to listeners due to a similarity to their own culture, background, and experiences. This idea has been touched upon by Quinn, who describes catharsis in this respect as occurring through 'narrative therapy'. Quinn asserts that experiencing a 'narrative' with others (other scene members) has the benefit of 'outsider witness', wherein:

> listening to and relating to metal music [is] supporting an alternative narrative about the *recognition* and management of emotions and around outsider witness in the wider metal community. (Quinn 2019: 421. Emphasis added.)

With listeners sharing their experiences collectively via the music. This virtue would seem believable in light of the clear communal values demonstrated within metal, and with how the music may be an item for listeners to have in common with one another since it bears semblance to a time, place, and attitude. Moreover, another study has argued that 'the metal community seems to master stress pretty well […] Fans might find relaxation not only within their music but by belonging to a specific group (Eischeild 2019: 146). Dissonance might be relevant to these points of finding catharsis both in the music, and in the sense of belonging, in that musical practises which are undesirable to outsiders might help demarcate the metal scene.

This 'narrative therapy' can be taken further when considering how individuals might experience a relatable narrative in the metal music itself. Along with sharing their experiences *via* music, individuals may be thought of as sharing their experiences with the music:

> metal's insistence on bringing chaos to awareness is a complex affirmation […] of the power to confront those forces in the imagination, and of the power to transcend those forces in art. (Weinstein 2000: 38)

With the key concept being imagination. As Weinstein asserts with the term 'power', metal is far from bland and tame. Chapter 5 should have demonstrated enough the intricacies and differentiation that metal offers. Where metal captures the imagination, it is empowering and crucially, might offer the individual a vicarious experience. Similar to how metal functions in social contexts, Morris has observed that

> The emotional satisfaction of the metal concert is not compensatory but empowering, for it allows the fans to express their rage against their social powerlessness […] The imagined

> empowerment of fans within the scene is connected to their ability at concerts to get in touch with "something greater" (Morris 2015: 300)

The 'imagined empowerment' with 'something greater' offers a vicarious expression of the aggression, angst, and transgression so obvious in the sound of metal. The vicarious listening experience of metal has also been observed more literally:

> the active listening practises of death metal fans are especially suited to recordings with multiple twists and turns that reward repeated listenings, allowing fans to eventually anticipate and evade each phenomenological "trap" as though they were playing along to the music in their own minds. (Smialek 2015: 153)

Wherein metal is often highly engaging, such that listens can achieve a cathartic effect by engaging in 'active listening', often to the extent of being vicariously hypnotised by music that is in many ways highly relatable to them.

Much of the metal-psychology research indicates that the breakdown section of many songs is a primary source of catharsis, and might be an apt demonstration of the psychological experience of metal music. Breakdowns were demonstrated in Figure 29- Deliver Me (Parkway Drive 2010) and Figure 30- The Human Condition (Chelsea Grin 2010), and their focus on rhythmic dissonance appears to cause much physical catharsis at live concerts. Along with exploring negative emotions communally through transgressive music, breakdowns are a heightened catharsis (which may explain why they are often at the climax or closing of a song) to the extent that they 'provide gratifying opportunities for experiencing violence as both giver and receiver' (Gamble 2019: 347). Like how horror-like themes are experienced safely through metal, breakdowns allow the (mostly) safe exploration of violence in mosh pits.

Mosh pits, pictured in Figure 45, are a 'direct physical expression of the kinetic energy in the music' (Gamble 2019: 347), where audience members push and pull at each other, often shoulder-barging and running in stampedes in a process known as moshing. However, there are no instances of serious, harmful violence, such as punching or kicking. It is an unwritten rule in moshpits to help up anyone who falls, as to avoid them being trampled.

Figure 45- Mosh pits

Moshpits are a communal activity where violence is explored in the safest possible manner. They are an immense source of catharsis, facilitated by the tension of rhythmic and sometimes pitch dissonance. Breakdowns have been described as getting 'your aggression out' and as 'an aggression releaser' (Gamble 2019: 347), which is unsurprising when considering the adrenal release of participating in what might be likened to a contact sport. The aggressive desires of anger can be realised separate from their causes, without the negative implications of causing actual harm.

Similarly, screamed metal vocals (again, which are themselves dissonant) have been described as 'an expression of strong, almost animal-like emotions such as anger or rage' (St-

Laurent 2016: 93). Especially in a live setting, metal offers an opportunity to return to one's less orderly instincts such as screaming, growling, and violence, albeit in a safe manner.

Metal is cathartic, not only in 'narrative therapy', but through empowerment where negative emotions can be shed through controlled violence. With its strong linkage to natural human traits, it suffices to say metal contains a genuine appeal for audiences. This is not least due to the perceivable tension created by dissonances. The real artistic value of dissonance is hereafter addressed.

6. 3 Artistic Value

This thesis has found that the meanings of cons/diss are changeable, with more consonances gradually being accepted in musical practice. In metal, where typically negative traits such as dissonance are desirable for expressive purposes, the gradual acceptance of consonances might explain metal's process of becoming heavier (Herbst 2017b: 39) and more dissonant to maintain transgressivism. This subsection considers the artistic implications of striving for greater dissonance and how the creative process of metal, among other genres, might define cons/diss in the future.

6. 3. 1 The *Jamais Vu* of Dissonance

The requirement for authenticity in metal has been discussed, wherein rebelliousness, skilfulness, and the showcasing of aesthetics that are supposedly unlikeable are culturally rewarding traits. These traits have been loosely labelled transgressive. In creating this authentic transgressivism, however, metal must maintain a balance. For as much as metal musicians wish to transgress, they must resist imploding the genre and retain at least some familiarity as they create genuine metal. Defining, empirical features of metal have been outlined, such as distortion, power chords, and dissonance, which instigate this required familiarity. What is easy to overlook, nonetheless, is metal's more abstract feature of requiring the addition of something new and authentic to these factors.

As was alluded to in 6. 2. 1, familiarity and innovation have been reified by Kahn-Harris:

> Genres are sites of both innovation and of stable creativity within strict limits. Within the extreme metal scene these very different views of creativity and innovation are negotiated in the context of the tension between the instability rewarded by transgressive subcultural capital and the homogeneity rewarded by mundane subcultural capital. (2007: 131)

Where genres are sites of tension, members of the metal scene are rewarded for their dedication to and maintenance of their genre (mundane subcultural capital) and rewarded higher if they can transcend this and bring along something new (transgressive subcultural capital). Herein, metal listening might be likened to a feeling of jamais vu[22]; a revered song is familiar and recognisably metal, yet synchronically novel, and a fresh insight into the possibilities of sound. Walser states that

> musicians are ceaselessly creating new fusions and extensions of popular genres. Yet musical structures and experiences are intelligible only with respect to these historically developing discursive systems. (2014: 27)

By way of this genre development can be found the development of cons/diss definitions; there are no radical, unintelligible jumps in what is consonant or dissonant, only gradual shifts as new, authentic sounds are desired. Eventually, these new sounds become accepted as consonances. Of high noticeability in testing genres such as metal, new dissonances are experimented with, acting as a tension not just within particular songs but against the genre as a whole. With time and mundanity, these dissonances are resolved, opening space for new, ever more innovative creative ideas.

6. 3. 2 Challenging Listening

It has been contended that metal, among other genres, has innovated and transgressed so much that in some cases, it is not intended to be listened to in any conventional, recreational way. This is unsurprising; metal has long since been distinguished by its overbearing, dissonant sound, something that is undesirable in mainstream music. This transgressivism

[22] Jamais vu, a French borrowing, describes experiencing something known and familiar and yet perceiving it to be novel and unfamiliar.

has compounded so much so that metal might purposefully be challenging to comprehend with this challenging listening itself becoming an aesthetic of metal.

This aesthetic might have originated with music that demanded active listening, first noted in 6. 2. 2, rather than challenging listening per se. Moore has observed:

> The use of obscure and changing time signatures by various progressive rock bands was, perhaps, the clearest indication that this music was intended to be listened to, for it made dancing difficult. (2001: 90)

The moshing observed in 6. 2. 2 could be likened to dancing and might suggest metal is simple music, created to be felt rather than to listen to. Recall nonetheless, that breakdowns enact tension, and are often not rhythmically simple, with audiences enacting this tension through chaotic (albeit limited) violence. Moshing is unlike dancing, in which the motions are generally organised and follow straightforward rhythms. Moreover, not all subgenres of metal are suited to moshing but instead, demand contemplation.

Active listening is usually concomitant, unsurprisingly, to complex, detailed music. Moore describes that

> as we know from the difficulty we have in picking out a particular voice in a crowd, in order to listen to one particular set of sounds more is required of us. Indeed, in order to give a musical work existence, the conjunction of the sound and the listening mind is required: as listeners we need to internalize the music. This means the act of listening is actually a creative act. (2001: 24)

For complicated and quasi-unpleasant music, the act of listening might demand enough of the listener to be a genuine challenge. Smialek has noted that complex, dissonant music is 'an acquired taste' and 'may take a few listens to truly get or appreciate […] but it is very much worth the *effort*' (2008: 112-3. Emphasis added). Music such as Meshuggah's effectively rejects any sense of familiarity, other than that the timbre and instrumentation is

clearly metal. This was observed in the incongruity of Figure 39- Bleed (Polymetric transcription), for instance.

Aspects of challenging listening have been observed by Lucas at a Meshuggah concert:

> The affinity between music and math is a longstanding one […] The "nerds" in the balcony use embodied cognition of the music for the pleasure of processing the rhythmic patterns as they go by, while preferring to keep the motion in their minds. (2018: 55)

Herein, listening to such complicated music is pleasurable as it might be likened to trying to solve a musical puzzle; the reward is in solving it and coming to understand the music by means other than its surface-level sound. This is a vital artistic implication for dissonant music, as that which is perhaps most dissonant concerning the definitions in this thesis is not intended to be heard in a conventional sense at all.

6. 3. 3 Emancipation

Dissonance in contemporary music can be understood as desirable not only for the sake of transgression but as a rewarding dimension of listening. Moore has claimed that 'true art makes people work' (2001: 92). Dissonance in metal must either be tolerated in some way or understood by its theoretical underpinnings to be appreciated as an art. This is a vital defining of cons/diss; the musical features themselves are indifferent, it is always the act of listening which defines cons/diss. Especially in contemporary metal, the resolving might be done by the listener as they come to understand and surpass the deliberate challenges of the music.

The contrasting possible definitions are not mutually exclusive; cons/diss will always be defined unconsciously simply by the prevailing practices of a time and place, but can also be defined consciously by individuals and their subcultures. The act of conscious listening requires effort, with its aesthetic pleasure being the reward of some greater understanding. Those who seek conscious definitions of cons/diss are in a perpetual state of breaking

generally accepted definitions, and perhaps, this transgression drives what will eventually be accepted as a consonance.

Efforts to transcend prevailing cons/diss parameters have not been limited to metal. In much of the discussions in this thesis, it has been argued that an unconventional, almost inverted approach to cons/diss is taken wherein dissonance is ultimately enjoyable in some capacity. 5. 1. 5 observed how metal can even operate outside of harmonic function. This compositional attitude, where dissonance is emancipated such that cons/diss is effectively moot, has been experimented with in practices such as Serialism (Rahn: 1980). Under Serialism, Schoenberg's 'twelve-tone technique'[23] assigns each chromatic note equal importance, removing any intervallic tension/resolution. Whilst an in-depth assessment of other theoretically innovative genres is beyond this thesis, it is worth noting that the emancipation of dissonance is not limited to metal.

Returning to metal, this process can be witnessed by consulting online commentary (see 3). Taken from a discussion titled 'Extreme metal, Dissonance, and the future of Metal' (accessed 15.03.20), users have noted anti-mainstream practices, and how such music requires a developed tolerance:

> I think part of why parts of the metal community go deeper into the extreme end of the pool is not because catchy songs, clean vocs, and memorable choruses are disappearing, but because they've become sings [sic] of commercialization. Pretty much all those things can be found on whatever genre of metal gets the attention of mainstream press […] enjoying something like Gorguts does require some tolerance, like you can't go from alcohol to heroin straight away, you have to smoke some weed and develop [a] meth habit first, otherwise you'll overdose and die. Shitty analogue, I know. (Imperator 2015)

One user then observes the cycle of emancipated dissonances outlined above:

> There's a mentality in the underground where melodic vocals and song structure are equated with "commercial shit," while stuff is not seen [as] "true" metal unless it's 100%

[23] Promulgated by the second Viennese school, this ruling of tonality demands that each of the twelve chromatic notes be played once in a chosen series, and cannot be repeated until the next bar, or 'row' (Music Matters 2019).

> harsh vocals and non-linear arrangements. Even stuff that was extremely not-accessible at the time (i.e. Pantera) [is] now regarded as somehow mainstream. (Dr. Fisting 2015)

In this respect, metal can be seen as a struggle to outstrip the emancipation of dissonances, although ironically is one of the genres fuelling the very assimilation of new sounds.

Going forward, metal musicians approach cons/diss in increasingly abstract ways, such as the musical puzzle of complicated rhythmic structures. One such abstract example has been observed by Smialek:

> [Meshuggah] has been apparently striving to worship the pure form, the polyrhythm in its naked state, so that the riff is not as important as the pattern itself, taking away the melody of it. (2008: 117)

In Meshuggah, the use of pitch is mostly static. In this way, the riff is left as little but whatever theoretical characteristics define it. Perhaps, this is the next conception of cons/diss, where theory is embodied and abstract structures which are not surface-level listening are a new method of creating dissonance. Hitherto, it would certainly appear that cons/diss is not quite irrelevant, but at least emancipated, and that new 'dissonances' are now desirable.

Metal is a pursuit not only for greater heaviness but in conjunction a maintenance of abjectness and transgression. A necessary component is musical features that are authentically dissonant, to transgress against the more common Western practice of harmonic function style cons/diss. The inevitable emancipation of dissonances means metal will strive constantly for new realisations of cons/diss whilst maintaining recognisability, rendering it a truly creative yet perpetually comprehendible artform.

Chapter 7

Conclusion

In light of the presented findings, cons/diss is a process. A fixed consensus that defines cons/diss has not been maintained, although the gradual acceptance of new consonances has. Chapter 6 would suggest that most tangible forms of dissonance are currently perceived in a manner that ought to describe consonance. This is why metal is innovative by nature; if dissonance is an essential feature, metal must itself innovate to keep pace with this emancipating feature. Also by this logic, more contemporary subgenres of metal must be highly dissonant to obtain subcultural capital and meet the criteria of the metal subculture. To not do so would render them indistinguishable from subgenres already created. For these reasons, those who are genuine fans of metal cannot perceive dissonant sounds as inherently negative. Rather, dissonance may retain a genuine appeal. This is also true of abstract dissonances such as pure rhythmic oddity; audiences hear deeper into music than mere theoretical parameters such as consonance and dissonance. It is reasonable to find pleasure and gratification in music by means more personal and more elusive than theoretical ramifications.

With regards to the body of literature reviewed, the general problem of imbalance has now been addressed. A rigorous account of cons/diss in metal has been made with respect to the literature, which spans across disciplines such as music, science, and psychology. As this thesis has been an overview, future cons/diss research could address specific metal subgenres, or alternatively specific dissonance-types, for instance. Nonetheless, it is supposed that this thesis has contributed in that metal is a prime example of how cons/diss can be learned (sub)culturally, and furthermore, that music can be listened to as if its theoretical values were a puzzle to be solved, rather than for overt aesthetics which come to resolve themselves. In summary, this thesis has begun to address the nascence metal music has in understanding and refining concepts of music theory.

Ultimately, this thesis has contributed to cons/diss literature by demonstrating the ongoing adaptions of cons/diss definitions, as was overviewed by Tenney (1988). In focusing on

metal as a research lens, it was possible to demonstrate how these adaptions are fuelled largely by the demands of culture. Also, the analyses of metrical dissonances have demonstrated the significant implications of this cons/diss type. Not only in the abstract yet innovative musical puzzles of polymetric dissonances, but on the smaller scale and less documented, yet no less significant submetrical dissonances. Such subtle dissonances were seen to have a profound impact on song-form. Lastly, other abstract areas have been considered under cons/diss, namely song structure, timbre, and the overall recorded spectrum of a composition. In finding empirical concepts that are, in effect, consonant or dissonant within these less likely areas it is hoped that further research will continue to address the ubiquitous significance of cons/diss and how it can be used as a gateway to a deeper understanding of music reception.

It is hoped that the contributions of this thesis are not limited to music theory. In overviewing the vast study of cons/diss, music culture and psychology have also been touched upon. Music theory is relevant to these areas. Most overtly, in ways such as the metal culture vying dissonance as desirable, in contrast with the general norms of music. Music theory is hereby a bridge to many other cultural ideas, including the psychological implications of music. Studies of metal psychology note the significance of a sense of community, with this thesis noting how dissonance, and its implications such as moshing and challenging listening, are significant in delineating this communal sense. Understanding the emancipation of dissonance seen in metal may also contribute to the emancipation of metal in wider culture; the essential contribution of this thesis is that phenomena which appear conventionally undesirable are subjective, and might be perceived differently by those with contrasting worldviews.

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Appendices

Appendix 1 - Converting to ratios of a scale

Octave divisions as decimals:

Unison	1.0000	1.0000
Minor Second	25/24 = 1.0417	1.05946
Major Second	9/8 = 1.1250	1.12246
Minor Third	6/5 = 1.2000	1.18921
Major Third	5/4 = 1.2500	1.25992
Fourth	4/3 = 1.3333	1.33483
Diminished Fifth	45/32 = 1.4063	1.41421
Fifth	3/2 = 1.5000	1.49831
Minor Sixth	8/5 = 1.6000	1.58740
Major Sixth	5/3 = 1.6667	1.68179
Minor Seventh	9/5 = 1.8000	1.78180
Major Seventh	15/8 = 1.8750	1.88775
Octave	2.0000	2.0000

Convert decimals to ratios and simplify:

$$Minor\ Seventh = 1.78180 = \frac{178180}{100000} = \frac{17818}{10000} = \frac{8909}{5000} => 8909:5000$$

$$Minor\ Sixth = \ 1.58740 = \frac{158740}{100000} = \frac{15874}{10000} = \frac{7937}{5000} => 7937:5000$$

Etc...