An Analytical Methodology for the Investigation of the Relationship of Music and Lyrics in Popular Music

Thesis submitted in accordance with the requirements of the University of Chester for the degree of Doctor of Philosophy by Alex Dee.

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The material being presented for examination is my own work and has not been submitted for an award of this or another HEI except in minor particulars which are explicitly noted in the body of the thesis. Where research pertaining to the thesis was undertaken collaboratively, the nature and extent of my individual contribution has been made explicit.

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Abstract

This thesis details the conception and design of a new methodology for examining pop songs holistically; considering both music and lyrics and examining the synergies between the two. Central to this methodology is the application of a data extraction framework, which has been designed to mine information about musical and lyrical phenomena. This framework operates as a common source for producing data about two very different media, avoiding individual interpretation where this is possible. The methodology has been designed to address specific questions about the relationship between music and lyrics, but the main purpose of the thesis is to evaluate the usefulness of the endeavour.

In order to examine the efficacy of this approach, the framework was used to populate a dataset made up of a sample of 300 songs, which was subsequently explored and analysed through a series of case studies which investigate combinations of metrics concerned with music and lyrics for the whole sample, as well as analysis of specific subsets defined by a range of parameters. These case studies have demonstrated the various ways this approach might be used, as well as working as proof of concept.

The conclusion of the thesis reviews the various case studies in the context of presenting potential uses of the framework as a tool and the broader methodology by other scholars. There is also a consideration of how the overall data might be affected by the inclusion of genres and styles that are not included in the initial sample set.

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1. Introduction

1.1. Research Context

To study something about the nature of songs and the relationships between the elements of which they consist is to investigate the form that is central to popular music. As a performer of popular music who is also engaged in popular music education, my working life is spent playing, writing, discussing and listening to pop music. I am fascinated by the enormous contribution it makes to the zeitgeist of contemporary western culture. Pop's importance is in the universality of its appeal. Whether it is via records we play, playlists we compile, television and film, or in the background in cafes and shops, it is an art form that is experienced on a daily basis.

Roy Shuker (2001) writes: "Clearly the central textual form in popular music is the song, primarily reproduced as individual sound recordings" (p. 81). Pop songs can be cultural artefacts of enormous significance and as such there is a considerable incentive to describe, interpret, analyse and discuss their composition and the experience of listening to them.

Philip Tagg's assertion that: "studying popular music is an interdisciplinary matter" (1982, p. 40) provides a contextual starting point for this exploration. Tagg identifies the usefulness as well as the shortcomings of singular approaches to analysis, such as semiotic and structuralist methods stemming from linguistics as well as more traditional art music analyses and goes on to outline the need for a variety of approaches to be employed concurrently to analyse and fully understand popular music. Similarly, Hawkins writes: "the task of interpreting pop is an interdisciplinary task that deals with the relationship between music and social mediation. It is one that includes taking into account the consideration of the sounds in their relationship to us as individuals" (2002, p. 3).

The idea that social context should inform analysis of the creation and consumption of popular music is made clearly in the opening chapter of Allan Moore's *Song Means*

(2012). He articulates that the meaning ascribed by audiences to recordings and performances of popular music is informed by a complex set of factors.

Adam Krims (2003) writes: "the historical failure of music theorists and historians to engage seriously with 'unserious' music has left a vacuum happily filled by scholars from such disciplines as communications, sociology, media studies, area studies and geography, to name just a few" (p. 181). This thesis proposes a methodology that can produce data about musical and lyrical details of the sort that require a subject-specific level of understanding to perform the extraction, but whose outcomes, especially pertaining to the link between music and lyrics, can be useful in this inter-disciplinary academic context.

1.2. The Crucial Relationship Between Music and Lyrics

Allan Moore (2012) ascertains that "The defining feature of popular song lies in the interaction of everyday words and music" (p. 3). The starting point for this investigation is the consideration of this interaction; this relationship. This thesis considers the interdependent nature of music and lyrics in popular song, based on the assertion that a listener's experience of listening to a song is informed by the combination of these factors and that to analyse one element as separate to the other could fail to recognise this.

Although not necessarily universally, the act of writing songs in the idiom of popular music involves the often contemporaneous creation of musical and lyrical content. In the case of composer/lyricist songwriting teams (Burt Bacharach and Hal David, Elton John and Bernie Taupin etc.) the original content that constitutes the song is still created as one unified cultural artefact. This differs from the act of, for instance, composing settings of previously published texts. This process can result in many settings of the same set of lyrics, which is rare in a popular music context, where there is a not only a synergy between the two media in the experience of listening, but generally in the creative process as well. The framework introduced in this thesis could be applied to any instance of song – but its design has been principally informed by a desire to explore the relationship between music and lyrics that is central to the creation of pop songs.

1.3. Research Aims

1. To explore the inter-connected nature of music and lyrics in songs;
2. To develop a framework for extracting information about music and lyrics in songs. This will be concerned with musical and lyrical content, seeking to be as objective as possible;
3. To develop a methodology for analysing songs that considers music and lyrics, and the relationship between the two;
4. To identify and analyse trends and synergies between musical and lyrical elements of songs in a corpus.

These aims identify the themes that are central to this project. One of these themes is the use of a framework. The framework that has been developed and used in this research consists of a defined set of questions and criteria that can be applied universally to songs. The framework is used to extract information about the music and lyrics in songs that is then recorded in a database that has been designed specifically for this purpose. The rationale behind using a framework, and taking such a data-orientated approach was to find a way of comparing two very different creative art forms, as well as avoiding pre-existing assumptions affecting the outcomes of investigations in to the music-lyric relationship.

Developing a data extraction tool that can be applied universally creates a context where songs can be compared and contrasted based on the data alone rather than based on existing structures such as genre or era. These concepts are not unimportant, but the removal of some of the qualitative labels that can be attached to songs seemed to be a way of promoting the discovery of new findings. Part of this thesis is concerned with testing the usefulness of the approach, and this was genuinely a process of discovery. The need for objectivity is consistent with ensuring the robustness of this process of testing, but it also ensures that outcomes are achieved by interpreting the data, rather than the data being defined by a pre-ordained expectation of the outcome.

When seeking to be as objective as possible, the idea of a non-hierarchical approach to defining elements of a song has been important to continually consider. In particular, using specific terminology for structure and a method for defining song structure that does not rely on terms such as 'verse' and 'chorus' is fundamental to the framework - this will be expanded on in chapter three. It was important during the development of the framework to shape it in such a way that avoided hierarchical notions such as *complexity* and *qualit*y – replacing these ideas instead with notions such as *characteristics* and *feature*s that could be expressed by a quantitative value or as belonging to a certain classification clearly defined by the framework. As such there are certain streams of data within datasets established by this framework that are not universal. Certain classifications and definitions for harmony and structure have been devised for the purpose of this framework. Once the data has been extracted and analysed in context, the resulting trends ought to be able to be explained in such a way that can be understood more generally, even to non-specialists.

The next key theme is that of comparison. When this term is used it should be made clear that this does not refer to a comparison of music and lyrics, but rather the comparison of complete holistic analyses of songs (that include consideration of words and music). The point of developing a framework that is applied identically to each song in a sample field is to create individual streams of data (the columns of the database) that are directly comparable. The most important feature of the project is the statistical patterns and synergies that emerge after the framework has been used to extract information about a group of songs (see aim four above); this is where the higher-level analysis occurs. The clarity of the emergence of these patterns is aided by the comparative element provided by using a single method of data extraction that includes information about music and lyrics. The comparative element is crucial to the design of the framework, but it is a means to an end of addressing the research aims above, and the research questions below:

1.4. Research Questions:

1. Is it possible to develop a tightly-defined methodology that can examine songs holistically (considering music and lyrics together rather than separately)?
2. What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs? Furthermore, can this approach be used to explore characteristics of styles or genres through sample field choices?
3. How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics? How do these patterns relate to expectations about style and genre?

These questions will be referred to throughout the thesis and were used to continually guide the research.

1.5. Quantifiable Data for Qualitative Purposes

The framework that was developed in the first phase of this research sets certain elements of analysis aside. It certainly excludes the cultural theory element of analysing a song, and often also excludes elements of analysis concerned with performance. This is necessary in order to produce data that is as quantitative as possible, in order that it can be as statistically meaningful as possible when considered as part of a large dataset. The aim with the design of the framework was to produce data that was objective and relied on the interpretation of an individual as little as possible. This is easier to achieve with some elements than others, but the more objective and quantitative the data produced is, the more secure the foundation for analysis and discussion of the data.

The idea of attempting to quantify the often qualitative properties of music can be problematic, as William F Carroll (2015) states: "It is impossible to objectify a subjective like 'favourite'" (p. 586). However, it is possible to set appropriate parameters for analysis questions so that the answer can directly result in a figure, or so that the use of finite typologies can result in answers that are manageably comparable when referring to large numbers of songs.

This philosophy serves one of the intentions of this thesis: to seek out findings about trends, synergies and outliers in the compositional material of large samples of songs that can be subsequently used to inform broader discussions about those songs. It cannot be stressed enough that the purpose of this project is not to disregard the importance of more interpretation-led analysis. Neither is it to be considered an attempt at dissociation from the importance of cultural theory in analysing songs and popular music. To do so would be to fundamentally misunderstand the importance and power of song in society. The framework has been designed with the intention of producing quantifiable data for qualitative purposes, which could be used alongside or to inform other methodologies.

1.6. Considering Different Approaches To Analysing Songs

Nicholas Cook (1987) writes that methods of analysis: "ask whether it is possible to chop up a piece of music into a series of more-or-less independent sections. They ask how components of the music relate to each other, and which relationships are more important than others" (p. 2). As has been alluded to above, it is a focus on the relationships between elements of a song that is at the core of this research. In order to discover patterns and synergies in these relationships a formalist approach is necessary for the process of data extraction.

Writing in 1999, Andrew Edgar discusses how formalist approaches have:

> increasingly come into question. On the one hand, formalism tends to isolate the musical work from any extramusical context. Analysis refers to exclusively musical parameters, seeing no need to invoke the cultural or political context within which works are produced or reproduced. (p. 439)

With this in mind, it is important that the process of extracting data about songs that occurs in this thesis is understood as such. The formal approach that is applied at this stage is a means for deriving objective data. Once the data has been collected, the higher-level process of analysis and interpretation can occur, and at this stage the patterns and relationships that are identified by the data could be discussed in a variety of contexts, including cultural and political. As a process, this is distinct from the type of musical analysis that Mark Debellis refers to when he proposes that:

> a criterion for success in musical analysis is that the analysis convey just the information borne by the corresponding hearing. The analysis must be true to the hearing; it must convey how the piece appears from the point of view of the listener who enjoys that hearing. (1999 p.119)

This refers to analysis of individual pieces of music, rather than analysis of data extracted from a corpus. The systematic gathering of information about a sample of songs and the subsequent examination of that information is one of the original parts of the design of this thesis.

In order to develop a methodology for examining synergies between music and lyrics it has been necessary to consider analytical approaches from varied disciplines. This has included considering crossovers between musicology and linguistics, not simply because of the focus on both music and words, but also because, as Powers suggests:

"many have been encouraged to think that analytical models of linguistic structure may be heuristically relevant for the analysis of musical structure" (1980 p. 7). More specifically, Nattiez (1973) discusses how the scientific nature of linguistics:

> can offer musical analysis a process of dividing up and delimiting the units with which traditional analysis does in fact work, but works inexactly. Why inexactly? Because it takes *as its starting poi*nt an ill-defined terminology: one looks for a *motif* or *theme* with an intuitive idea of what they are and *it is this preconceived idea which takes the place of a criterion for selection.* (p. 62)

The clear and consistent use of terminology, and the clear defining of parameters and definitions of various criteria is a recurring theme in the establishment of my framework and the discussion of the data its application helps to extract. As Nattiez goes on to point out: "analysis does not depend only on the validity of the methods by which it is elicited from its material, but also on the metalanguage in which it expresses its theory of the data analysed" (1973 p. 63).

Discussing music from a semiological point of view, Jean Molino (1975) makes an interesting distinction between three types of analysis that he refers to as 'Neutral', 'Poeitic' and 'Esthetic'. The idea is that music is a phenomenon that exists in different ways, and that methods of analysis should be selected appropriately. Music is a cultural 'object' (the neutral part of analysis) that is 'created' (Poeitic Analysis) and 'consumed' (the Esthetic). Nattiez (1990) uses the term 'Immanent' rather than 'Neutral', which is perhaps a more semantically appropriate terminology. Similarly, Debellis (2002) also proposes three types of musical analysis; explanatory, prescriptive and descriptive. The fact that the type of analysis that this project is concerned with is to do with what Molino would call the 'object' rather than its creation or consumption is not an over-simplification – it is to better understand how the object sits within this trichotomy. Mark Slater also talks about a 'tripartite concept' of 'contemporary poetics' (2011), explaining how Krims uses the poetic model to "formulate a meaningful analytical discourse based on a revised understanding of the term 'music theory'" (2011). In discussing his analytical model, Slater says that Krims replaces the term 'music theory' with 'theory about music': "to signify a vastly broadened scope that includes all theories about music from a range of disciplines" (2011 p. 365).

It should be understood from the outset that this research is concerned with the analysis of musical and lyrical detail, and the creation of a method for producing data about these details that might allow for different perspectives on musical and lyrical phenomena on one hand, and might be used to inform various forms of music research in the future.

1.7. Overview of Contents

The nature of this thesis is a reflection of the nature of the research itself. Chapters two and three contain the majority of the theoretical element, whereas the subsequent chapters are concerned with the practical application of the methodology.

Chapter two consists of a discussion of existing literature that provides the research context for this thesis. The research questions outlined above are used to frame this exploration, which covers a range of research disciplines. This review of literature features a discussion of approaches that have helped to inform the philosophy of this thesis, as well as coverage of analytical research, both quantitative and qualitative, that informed the design of the framework central to this research. This chapter also includes some consideration of literature concerned with the handling and analysis of datasets as well as sample field selection.

Chapter three outlines the approach that has been taken to address the research questions. This chapter begins by acknowledging that the approach taken to attempt to design a 'tightly-defined methodology' is allied to content analysis, and explains how and why certain song elements are chosen in order to 'examine songs holistically'. A significant part of this chapter describes the way the framework is applied to extract data from songs. The descriptive nature of this is important in informing the reader's appreciation of the analysis of the resultant data taken from an initial sample of songs, which is discussed in later chapters. This methodology chapter prefaces the range of approaches taken in chapters four to seven in order to address research questions two and three. Two sub-chapters (3a. and 3b.) supplement chapter three, taking the form of discrete examples of the framework being applied to individual songs. This is demonstrative of the process that was repeated to produce the sample dataset that is referred to in the subsequent chapters and provides a context for the data included therein.

The first part of research question two asks: 'What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs?'. Chapter four features a number of case studies that are led by the data itself and examines outcomes of combinations of data features when considering the sample dataset as a whole. Chapters five and six are comprised of case studies that examine subsets of the sample dataset organised by data features and provenance respectively. These case studies seek to address the second part of research question two, which asks if this approach can be used to explore characteristics of style or genre. Some of the case studies included in these chapters examine the data for certain artist subsets alongside existing analytical literature about these artists to address research question three which asks how the patterns and synergies that emerge as a result of this approach compare with expectations about style.

Chapter seven consists of some additional case studies that consider the potential impact of styles/genres that are not represented in the initial sample. This section also includes a discussion of the potential of growing a master dataset beyond the initial sample used for the purposes of this thesis. The final chapter draws together the various strands of the thesis with reference to the research questions.

2. Literature Review

2.1. Overview

Although primarily informed by popular music musicology, a range of disciplines have informed this research. The methodology developed here also draws on practice from the fields of poetic analysis, content analysis and Music Information Retrieval (M.I.R.). This literature review will give a sense of the starting point for this research as well as reviewing theory and practice that have influenced the framework and broader methodology that is used in this thesis. The chapter uses the research questions as over-arching section headings. These are further divided into specific topics discussing literature relevant to the overall philosophy of the research as well as literature that informs how specific elements of song are defined and dealt with in the methodology chapter that follows in order to explore the relationship between music and lyrics.

There is an implication in the first research question in the introduction - Is it possible to develop a tightly-defined methodology that can examine songs holistically (considering music and lyrics together rather than separately)? – that such methodologies do not already exist. Certainly, in the field of popular music studies, musicological analysis of songs has tended to come from one of two perspectives. The first is a structured kind of musicological analysis that uses tools developed to discuss the music as the only element for consideration. The second focuses on analysing the effect of songs on audiences, considering how the lyrics are understood and the social context of the song.

What is being proposed in this thesis is not necessarily a new strand of music analysis, but rather one that actively seeks to consider music and lyrics holistically. This research is centred around songs that exist in the canon of popular music, but the methodological framework that has been developed can work, in principle, to explore relationships between music and lyrics in songs from many genres[1]. The originality of this approach lies in the way elements of music and lyrics are considered as part of the same methodology, and original ways of exploring the relationship between them are made possible, rather than merely the consideration of the synergy between words and music in song.

In Kofi Agawu's essay on analysis of nineteenth-century lied, he outlines some ideas as to why song has "had a less than decisive influence on the development of music theory and analysis" (1992, p. 3). Although Agawu was writing almost three decades ago, the problem or challenges he points to remain relevant:

> The marginalization of song *as song* in the literature speaks to a very real problem, namely, how to account for the syntax of a genre that includes two nominal semiotic systems, music and language. A pursuit of the dynamics of that inclusion relationship cannot be simply reduced to a routine search for patterns of coincidence or non-coincidence between words and music. To embrace the theoretical challenge fully, we need to view song as a single genre and test its semiotic status. (1992, p. 3)

Here, Agawu makes an assertion that substantiates the first aim of this thesis: that the duality of words and music in song creates a challenge for researchers and analysts. However, one might argue that what he describes as a 'routine search for patterns' can be a valuable practice in interrogating song and the tendencies of songwriters when the parameters of that search (one could use the term *data extraction*) have been clearly defined. This thesis shows that such an approach can generate illuminating outcomes that can stimulate further analysis as well as producing data that can be used to contextualise investigations into the 'semiotic status' of song.

[1] The framework designed for this thesis can be used for English language songs only but could be adapted for other languages.

Agawu goes on to propose four competing models for song analysis with reference to scholarship nineteenth-century lied, however, the models could equally be applied to any song analysis in any style. The first is what he calls the 'assimilation model' where: "words function in a generative capacity to release a composer's creative energies; once this has been accomplished, the words disappear as *words* and assume a musical form" (1992, p. 5). The second "postulates an irreducible relationship between words…and music" (1992, p. 6). In discussing the application of the second model, Agawu expands on the notion discussed earlier with the mention of a 'routine search', by saying: "analysis cannot be content with a taxonomy of inputs" (1992, p. 6). I would tend to agree, and although much of this thesis discusses a framework that makes much use of what could indeed be described as a number of taxonomies of inputs, there must be a separation between that which constitutes data extraction and that which constitutes analysis. The process of generating data from songs is just that, the analytical elements of this thesis lie in the way that data is explored once it has been produced.

The third model Agawu puts forward is one where both music and words are considered as part of a composite structure, but where (viewed as a pyramid structure) music is at the base and words are at the top. The semiotic meaning of the words is the crucial element for the analysis, contextualised by its musical setting. The fourth model is one that explains song as a "confluence of three overlapping systems" (1992, p. 8). This model accepts that some elements of the lyrics and some elements of the music might be understood or discussed as separate to the song, whilst still recognising the song's identity as a phenomenon made up of the interaction of both facets.

Through my research I propose that even in the field of popular music analysis these four models could be said to represent the various hermeneutic approaches exhibited by scholars. Philosophically, I am drawn to models 2 and 4, in that they do not place either words or music above the other. The way that model 4 allows the flexibility to consider how some aspects might be understood separately from the song is appealing, but also comes with the implication that outside the cross-sections of words and music, there is some other part of 'the song' (see Figure 2.1.). I would propose a slightly different visualisation (see Figure 2.2.). The entire diagram is 'the song', which is made up of three non-hierarchical elements: words, music and the relationship between the two. Elements of lyrics and music that occur within the song as a composition can be discussed separately where appropriate, as can the way the two are related/affect one another. What we understand of the song is made up of an amalgam of these elements.

Fig. 2.1. – Taken from Agawu K. (1992, p. 8)

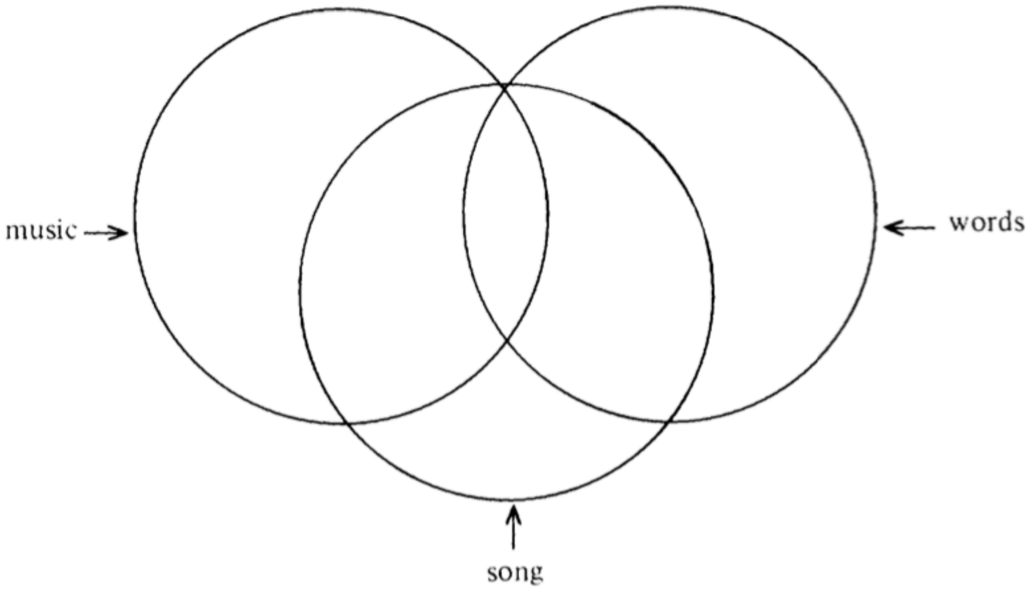

Fig 2.2. Elements of Song

Words	The relationship between words and music	Music

Agawu wrote – albeit 29 years ago – that: "theory-based analysis of song is notoriously lacking in models. The literature is dominated by individual 'readings'" (1992, p. 3). It seems broadly that this is still the case. This thesis proposes such a model, and the following will use the research aims and questions to frame a discussion of the literature that provided a starting point for the thesis, as well as that which was used to develop the approach outlined in the methodology.

2.2. Research Question One: Is it possible to develop a tightly-defined methodology that can examine songs holistically (considering music and lyrics together rather than separately)?

The sub-sections that follow review literature from areas of research that provide a context for addressing this question. A discussion of analytical approaches that are concerned primarily with formal properties of music (as the framework employed in this thesis undeniably is) is followed by a section on literature on defining song elements. The next section: 'Analysis, Interrogation and Data Extraction' seeks to provide a philosophical context as well as demonstrating how the literature was instrumental in a process of defining the working terminology of the research. The framework considers various musical and lyrical elements. The discrete musical element that has been most discussed is harmony, and the following section explores existing frameworks and typology for categorising types of harmony and chord progressions. This is succeeded by a number of sections on how approaches from Music Information Retrieval are allied to this research in terms of developing the framework (part of the tightly-defined methodology), in relation to discrete musical elements, in terms of methodological approaches, choosing sample sets and exploring data. Finally, a section on the analysis of lyrics looks at existing techniques from poetic analysis, linguistics and content analysis.

The research question above is allied to research aims two[2] and three[3]. The framework for extracting data about music and lyrics referred to in research aim two can be seen as a part of the broader methodology referred to in research aim three and the question above. In order to design the framework it was necessary to explore what existing analytical methodologies might be either directly applied, or might inform this research.

In many instances, practices from a range of disciplines were considered, and were found not to be directly applicable. As such it has not been possible to simply build a data extraction process from a group of pre-existing discrete methods for describing and classifying elements of music and lyrics. This meant it was necessary to deliberate over how formal properties and song parameters were to be managed, and as such, a number of data extraction methods have been devised specifically and new terminology coined for this research project. Where these new approaches have been developed, this has been informed by literature concerning the discrete song elements.

The way that an inter-disciplinary approach has informed this research is exemplified by the variety of sources discussed. As well as various branches of musicology, there is a significant consideration of the burgeoning field of Music Information Retrieval (M.I.R.) The process of data extraction explained in the following chapters does not feature any automated processes, but it is clear from reviewing a significant amount of M.I.R. literature that many of these processes could be automated in the future, and much of the organisation of the framework and discussion of data that occurs in

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[2] To develop a framework for extracting information about music and lyrics in songs. This will be concerned with musical and lyrical content, seeking to be as objective as possible.

[3] To develop a methodology for analysing songs that considers music and lyrics, and the relationship between the two.

later chapters has been informed by a consideration of how data relating to music is managed in this field.

The nature of this research is necessarily concerned with form. Michael Spitzer (2017) makes the point:

> To tar an interest in musical detail with the brush of 'formalism and structuralism', as if it were a revenant symptom of a defunct ideology, would be unfair, not least because it begs a number of invidious questions. The main question is whether there is anything *wrong* with 'formalism' *per se,* particularly in a musical context – and whoever agreed that formalism is dead? It is also problematic to elide 'formalism' (whatever that might be) with musical *form* – as if songs didn't have form, and this form isn't rewarding to look at in technical detail. (p. 2)

Beyond Spitzer's robust defence of an interest in musical detail (which is expanded in this thesis to include lyrical detail), the broader intention of this research is to create a methodology that can be utilised to complement other methods of research.

Trevor Owen de Clercq places form at the centre of his 2012 thesis: "Sections and Successions in Successful Songs: A Prototype Approach to Form in Rock Music" in which he discusses formal properties of typical song sections described in the traditional manner of verse, chorus, bridge etc. in the context of cognitive science, building upon John Covach's (2005) typology of rock music forms and Eytan Agmon's (1995) work on functional harmony using frameworks from cognitive science.

2.3. Song Elements

In order to develop a tightly-defined methodology it was necessary to explore philosophies for determining the parameters of song itself, and strategies for examining discrete musical and lyrical elements that could be combined to produce a holistic methodology. In order to derive quantifiable data it seems logical to make the distinction between the data that makes up the song and the performance of the song.

Gary Burns (1987) makes a valuable distinction between what he calls the 'textual' and 'non-textual' elements of a performance or recording: "Songwriting involves mainly the manipulation of textual elements, whereas performing and producing involve mainly the manipulation of other, non-textual elements" (p. 2). In this context 'textual' refers to the whole song (as in Figure 2.2. above). Though Burns' distinction between textual and non-textual is relatively clear, the association of 'textual' with 'text' is potentially problematic. For instance, in the introduction to *Rock: The Primary Text* (2001), Moore uses the term 'Primary Text' to describe "that constituted by the sounds themselves as opposed to commentaries on them" (p. 2) – which he would describe as 'Secondary Text'. This is an equally logical distinction, but makes different use of the word text, which is different again to how one might refer to the lyrics as text, or the textual component of the song.

Another way of articulating the distinction between the compositional data of a piece of music and the method of performance is presented by Leonard B. Meyer (1989) who uses the terms 'Primary Domain' and Secondary Domain'. Those elements Burns would describe as 'textual' are primary domain elements, and those non-textual elements (performance/production/context) are secondary domain elements. In slight contrast to the immediately inter-disciplinary nature of much of popular music musicology, this thesis separates certain strands of analysis for extensive study, prior to inserting the results of this process into a more universal context. Having terminology that helps articulate the distinctions between different types of musical or lyrical elements is vitally important.

This concept of separating primary domain elements from secondary domain elements is not necessarily something that is directly referred to throughout this thesis. In fact, once the framework had been designed and was being put to use, then reference could be made solely to the data that it produced, and the focus, from a terminology perspective, shifted to reference to 'data features' rather than 'elements'.

2.4. Analysis, Interrogation and Data Extraction

'Analysis' is a term that can be potentially problematic, and it is necessary to separate what is interrogation and what is analysis. Analysis is a higher-level process. Take Nicholas Cook's suggestion that analysis is interpretative by its nature rather than an assertion of fact (Cook 1989). In this thesis a sample field of songs are subject to a data extraction process. This process requires the researcher to be musically literate and familiar with the process and the specific terminology and data extraction parameters used therein.[4] This process of data extraction is essentially a structured interrogation of the source material, and this enables the higher-level process of analysis that follows.

Where possible, the data extraction is governed by clearly defined rules rather than the interpretation of an individual, whereas the final stage of the project where the resultant data is analysed can rely much more on interpretation. Moore advises that "any system of classification has its deficiences, for raw data is never as neat as theory must consider it in order to perceive correspondencies within it" (1992 p. 76). The aim in designing the framework must be to limit such deficiencies to increase the meaningfulness of the data produced and the analysis performed on said data.

It is in considering the primary domain elements of songs that the aims of the project are to be successfully addressed, therefore it is pertinent to consider work that deals primarily with these elements, with a special focus on work that makes explicit use of clearly defined methodologies to inform the work that follows.

[4] This will be outlined in chapter three.

Harmony is an element that falls into this category. Work into classifying harmony must be considered in order to shape how this could be dealt with by the framework.

2.5. Considering Musical Elements: Harmony

The once widely-held notion that popular music is by definition less harmonically detailed than other forms of music has been challenged and somewhat refuted by the levels of variance found in Moore's "Patterns of Harmony" (1992). Moore outlines an over-arching method for categorising the functional harmonic content of a large number of popular songs. The level of detail in the appendices (where the various categories are listed) is substantial to the extent of being perhaps too detailed for use in a framework that considers many elements other than harmony. Nevertheless, there is an informative focus that this method places on the function of harmony, or the relationships between the chords used for a given section, and it is this emphasis that has been taken forward to shape a part of this thesis. Moore's categories are grouped into "classes" (1992, p73), based on the type of relationship the chords in a given section have to one another. Although governed by a different logic, and using a much smaller number of classifications, this concept of harmonic classification of groups of chords has been applied in this thesis.

A methodical model for describing harmony that differs from Moore's is that put forward by Lisa Hanford (1987) for describing 'Pitch Motion' as opposed to harmony and melody (or counterpoint) in isolation, which is concerned especially with voice-leading. Whilst it seems that the application of some of the methods discussed would lead to sophisticated analysis on a song-by-song basis, the outcomes rely heavily on interpretation and would not contribute directly comparable data.

Methods that seek to classify the chords used in a song in terms of their relationships to one another (their function) rely on the concept of a key, or at the least a tonic. Carl Schacter addresses this : "To hear something in a key, we have to be aware of a tonic note, a pitch that functions as a centre of orientation to which, directly or indirectly, we relate all other pitches” (1987, p. 296). Further, he adds:

> The 'tonic' is an expected centre that is never confirmed…When we use the word 'tonic' in analysis, we should do well to remember that it can represent quite different kinds of musical structure. We can quickly infer a tonic as centre from signals given by other pitches; neither the tonic chord nor even the tonic note need be present. (1987 p. 296)

This consideration is important for developing methods for classifying harmony that doesn’t rely heavily on cadences in the way that Schenkerian analysis might (Pankhurst, 2008). It follows that a logical approach is to identify classifications of chord groups that are differentiated by how closely related the chords used are in the context of a key or considering what the perceived tonic is. This is different to investigating complexity or detail, which are hierarchical ideas often with quality judgements attached.

Another of the facets of harmony that can be investigated is its density or colour in the vertical sense, for instance examining the difference between a G major triad and a G13 chord. The two may have the same function (as V in C major for instance), but there is a clear distinction in the way they sound and the stylistic meaning that is carried. Traditionally the term *dissonance* might be used in relation to this distinction, in the sense that G major would be described as consonant and the addition of the upper extensions of G13 would be considered dissonances.

The term is not completely unambiguous in its use however, as far back as 1942, Paul Hindemith noted: "The two concepts (consonance and dissonance) have never been completely explained, and for a thousand years the definitions have varied" (1942, p 85). Margo Schulter’s (1997) work in the context of Thirteenth-Century Polyphony refers to degrees of dissonance, rather than the digital sense that intervals are either dissonant or not:

> Two-voice intervals range along a subtle scale of tension from the most purely blending to the most strongly discordant. While such distinctions are often relative, the absolute distinction between stable and unstable intervals is vital:
>
> Stable:
>
> Purely blending (1, 8)
>
> Optimally blending (5, 4)
>
> Unstable:
>
> Relatively blending (M3, m3)
>
> Relatively tense (M2, m7, M6)
>
> Strongly discordant (m2, M7, tritone - and often m6) (1997, 2.1)

This is a substantial typology of dissonances between two notes, and clearly articulates the idea of a scale of dissonance (tension), but as a potential typology that could be implemented in the holistic framework discussed in this thesis, this is not useful for more than one reason. Firstly, and most pragmatically, these 'degrees of dissonance' refer only to relationships between two notes, so couldn't be directly applied for discussing, say, the chordal accompaniment of a melody. Secondly, this typology relies on a definition of dissonance that is at odds with other definitions of the term, whereby intervals/harmonies are either dissonant or not. When attempting to quantify song elements logically and unambiguously it would not be appropriate to implement a typology that is founded upon a contentious premise.

Again, with reference to dissonance as a concept, in George Russel's "Lydian Chromatic Concept of Tonal Organization" (1953), he describes how the tritone over the tonic might be considered consonant with reference to the harmonic sequence and also in the context of the use of more complex 'vertical' harmony in both jazz and impressionist music. This is another example of terms 'dissonance' and 'consonance' being used in a more conceptual way – rather than clearly and unambiguously defined. In the framework, the term 'dissonance' is used (in the context of a data feature: 'percentage dissonance') but the data feature it refers to, and the method for calculating the data, is unambiguous in context. As such, even if one might consider the framework's use of the term contentious, it should be clear that the validity of the data feature it represents should not be.

2.6. Considering M.I.R. in the Development of a Framework

During the process of drafting the framework, a shift in terminology led to song elements being frequently referred to as data features in this thesis. This was largely influenced by literature from the growing field of Music Information Retrieval (M.I.R.). Consideration of how other researchers have extracted data from music has been important in the methodology of this thesis, both in terms of establishing parameters for the framework but also in considering potential processes for extracting data.

For the sake of managing large amounts of data, there is a certain logic in striving to create a framework that allows data to be fed in and processed in a computerised fashion. M.I.R. is a vital source of potential methods for examining and organising data, and even investigating if programs exist that might make certain parts of the framework automated.

In their paper from the 2007 ISMIR[5] conference Mauch et al. write:

> Traditional musicology consists of qualitative studies using small data sets, so that it is not possible to ascertain whether the conclusions drawn from the study are representative of a broader corpus of music…Music Information Retrieval methods provide us with increasingly powerful tools that can be

[5] The International Society for Music Information Retrieval

> applied to strip some of such subjectivity from the analyses by quantitatively evaluating features over large collections of music. (2007, p. 1)

This is certainly a notion that chimes with some of the aims of the analysis framework being developed here, and therefore it is necessary to examine developments in the field of M.I.R. to investigate how they might be implemented to compliment some more traditional methods of extracting data from songs for subsequent analysis. Music research that involves computational logic is useful to examine because it provides excellent examples of methods of producing non-ambiguous labeling systems of elements of music. The more clearly defined individual processes are, the more meaningful the outcome of their application to a large data set.

2.7. M.I.R. Literature Concerned with Structure

One of the crucial components of the methodology outlined in the following chapter is the establishment of parameters for defining structure within songs. The notion of breaking pieces of music down into sections has been addressed by numerous researchers in the field of M.I.R.

Van Balen et al. (2013) have conducted research into chorus features in popular song, going beyond previous methods that relied on examining repetition to define choruses and part of a song's structure (which remains a logical and useful way to define and recognises choruses) to examine what other features contribute to 'Chorusness'. Related work using a content-based approach has been conducted concerned with 'structure-based audio fingerprinting' (Groshe et al. 2012). They write: "one goal of structure analysis is to split up a music recording into segments and to group these segments into musically meaningful categories, such as chorus or verse" (p. 55). Clearly, an automated process would potentially be able to achieve a basic level of segmentation, but applying a typology is a more sophisticated – not to mention contentious – issue that would not lend itself to automation.

As early as 2005, related attempts were being made to automate the process of assigning structural markers, although Bartsche and Wakefield reflected that: "generally, the system fails when a song does not meet our initial assumption that strongly repeated portions of a song correspond to the chorus, refrain, or otherwise important part of a song" (p. 103). The casual reference to the 'important' part of the song is revealing, as is their earlier assertion that "in classical music, a representative sample might include the introduction of a prominent theme or motif. Popular music though, is often based on a much simpler structure" (p. 96). When such general statements seem to be made in the introduction and conclusion of papers it suggests that regardless of the quality of the scientific or mathematical practice, the actual intention of the process could be flawed by a misunderstanding. Bartsche and Wakefield's 'audio thumbnail' approach seems to be founded on the expectation that popular music structures "alternate between verses and a repeated chorus" (2005, p. 96), the over-simplification of song structure aside, (which in fairness is only proposed as an example here) this does not account for sections that are recognisably repeated from a compositional stand-point but have different arrangement features (e.g. the first verse and chorus are just piano and vocals, and the full band and orchestra kick in on the second verse – this would be a dramatically different audio profile, but understood by an audience as a repeated section nevertheless).

From a data handling perspective, the idea of dividing songs into unnamed segments (the terminology used by Groshe et al.) in the first instance, without assigning other qualities to them (verse/bridge etc.) allows an analyst options in terms of how to organise and examine the data.

Other research that could potentially inform automated transcription of structural elements of music includes 'Rhythmic Pattern Modelling for Beat Tracking' such as that conducted by Kreb et al. (2013). Their work goes to the extent of investigating the implementation of probabilistic models of the expected rhythmic patterns (what they refer to as 'mean onset features') of specific dance styles. The ability to identify beats and in particular downbeats in the context of a rhythmic schema could make it possible to map bars of music automatically.

The concept of understanding structure, and in particular the experiential aspect of recognising a section of music when it returns - a process that is crucial to the aesthetic and the emotional aspect of listening - presents difficulties when considering audio rather than written or transcribed music. In an instrumental sense, we might understand that a section is being repeated (i.e. the second iteration of a theme) in spite of the fact that the orchestration, that is to say, the timbral profile of the audio could be dramatically different. It is possible to recognise the compositional integrity of a section of melody with the same accompanying functional harmony even if the texture, dynamics, tempo and key are altered.

Crucially, this experiential understanding of what constitutes the repetition or otherwise of discrete sections is made even more explicit when song lyrics are part of the equation. It is possible to establish a set of rules for ascribing structural parameters based on the repetition or otherwise of discrete sections of a song, but in order for these sections (and importantly, the data pertaining to these sections) to correspond in some way with the listener's experience, this process must be conducted manually, for now.

2.8. M.I.R. Literature Concerned With Harmony

Harte et al. have proposed: "a text representation for musical chord symbols that is simple and intuitive for musically trained individuals to write and understand, yet highly structured and unambiguous to parse with computer programs" (2005, p. 66). The application of models and frameworks used for coding and programming to the description of chords has allowed them to propose a system that is: "straightforward and capable of fully describing any chord within western music" (2005, p. 66). They propose a shorthand version that is intended to be more musically intuitive, whilst still linked directly to the properties of the 'flat text'[6] representation method. The result however, is a system that is slightly more visually convoluted than what they describe as the "typical popular music guitar style" (2005, p. 67). However, provided that there is a uniform approach to its application, this style is already capable of describing everything that the proposed shorthand does and could still be completely equivalent to the flat-text representation method necessary for parsing with computer programmes. Nevertheless, this sort of system highlights the importance of uniformity and the clear definition of parameters when establishing a framework.

In their work as part of the M4S project, Mullensiefen et al. use MIDI transcriptions of popular music recordings in order to inform their work on feature extraction and corpus-based musicology. They explain that:

> the decision to use symbolic formats for our studies lies in the fact that we are interested in objects of music cognition like melodies, rhythms, and harmonies, which seem to be mentally represented in a form comparable with symbolic encoding formats. (2008, p. 133)

The use of MIDI transcriptions allows researchers to programme automated searches of the database, for instance of specific harmonic functions or melodic sequences, building on previous corpus-based musicology projects – notably those by Steinbeck (1982) and Huron (2006).

In the case of harmonic analysis it is indeed the case that the application of this framework could at some point be aided by the application of deep learning programmes to audio to identify chords and increase the efficiency of the data retrieval process. Leading researchers in this field are reporting that improved chroma

[6] 'Flat text' or 'flat-file' refers to the type of labelling applied in a dataset. Some of the symbols and conventions typically used to describe chords can not be used in this type of labelling.

extraction methods are capable of achieving up to 80% rates of accuracy (Mauch & Dixon 2010 and Zhou & Lerch 2015).

Mauch et al. (2011) have also developed a method for extracting chord information in conjunction with pre-existing programmes that strive to achieve automatic lyrics-to-audio alignment, with similar rates of accuracy when applied to a limited sample field. This process yields a textual representation of the phonemes that make up the lyrics in alignment with their duration and placement within the audio alongside a visual representation of the audio file in wave form, as well as a textual annotation of the chord being played at that point.

Matthias Mauch and Chris Cannam have also written a plug-in called *Chordino* that is freely available to download and open in a host such as *Sonic Visualiser* or *Audacity.* Again, the potential usefulness of this programme as a transcription tool, or indeed as the first step in developing a method for automating the data retrieval process of chord sequences within the parameters of the framework being developed here is tempered by its current accuracy rates.

The decision not to implement some of the available automated methods for chroma extraction (chord transcription) is also informed by the level of harmonic detail that some methods are limited to. Korzeniowski and Widmer (2016) report that: "In practice, we can show that given chromograms derived from ground truth annotations, using logistic regression we can recognize 97% of chords (reduced to major/minor) in the Beatles dataset" (p. 38). Much of the methodological detail here is highly subject-specific, 'logistic regression' for instance, is a statistical model that is used as part of this specific method of automated chord extraction. A 'chromogram' is described as "a time-series of chroma vectors, which represent harmonic content at a specific time in the audio" (2016, p. 37). It is worth reiterating that it is not necessary to fully understand the computational methodology to ascertain whether or not the end result can be musically relevant. In this instance the crucial information for a musicologist is the fact that in spite of a high accuracy rate (97% accuracy could arguably be considered accurate enough for some big data applications) this is applied to a limited level of harmonic description.

At this stage, it seems that transcription by a musician remains the optimum method for determining the chords used in recordings for the purpose of this framework. Whilst it is more time-consuming than an automated process, it yields a higher level of accuracy and a wider range of potential harmonic descriptors. This is also recognised by researchers in the M.I.R. field: "although this topic has been extensively studied in the field of music information retrieval, the computers' ability of harmonic analysis is still quite limited" (Chen & Su 2018, p. 90). It is entirely feasible, however, that the harmonic transcription and subsequent organisation of this data could be automated at some point in the near future.

As part of his 2010 PhD thesis, Chris Harte produced a dataset that features time mapped chord transcription of The Beatles' 12 albums. This required a period of time being spent on aural transcription of a large sample field and in terms of informing methodology in the context of harmonic transcription he offers the following:

> In general, the chord labels in transcriptions correspond to the chord which would be written on a lead sheet for musicians to play from. That is to say, the melody line itself is considered to be separate from the harmony. For example, if the musical instruments are playing a C major chord with no sevenths or extensions but the melody line includes a B♭ (the flattened seventh) we ignore the melody and simply label the chord C major. (Harte 2010, p. 41)

This is a useful distinction to make. If one were to allow each individual melody note to constitute, for instance, a chord extension (in instances where full scales – perhaps chromatic scales – are accompanied with an otherwise static harmony) this would increase the amount of resultant information to such an extent as to make it unwieldy[7].

2.9. M.I.R. Research Concerned With Other Elements

Beyond harmony, considering elements such as specific melodies and rhythm, technologies are rapidly developing that are able to extract musically cogent information from polyphonic audio, in particular the symbolic transcription of individual melodies from an acoustic polyphonic texture. Researchers are working on programmes that use probabilistic approaches developed in other information retrieval disciplines to improve performance and accuracy:

> since music exhibits a fair amount of structural regularity much like language, it is natural for one to think of the possibility of improving transcription accuracy using a *music language model* in a manner akin to the use of a language model to improve the performance of a speech recognizer. (Sigthia et. al 2014, p. 53)

The symbolic representation of melody is achieved by establishing spectral templates that correspond to musical notes and decompose a spectrogram of an audio signal in respect to those parameters and whether each note is active or not at a given time.

There are examples of applications being developed where the end goal requires automated processes that could be applicable to the transcription process necessary prior to the application of the framework[8]. One such example is the programme *Song2Quartet:* "a system for generating string quartet versions of popular songs by combining probabilistic models estimated from a corpus of symbolic classical music with the target audio file of any song" (Percival et. al 2015, p. 114). In order to

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[7] In traditional harmonic analysis the concept of accented or unaccented passing notes would be relevant to this, but this relies on the type of interpretation that the design of the framework seeks to lessen.

[8] This will be outlined in chapter 3.

produce a four-part string quartet score, the programme uses an audio analysis module that: "estimates notable rhythms, chord voicings, and contrary motions between melody and bass by extracting the audio spectrum" (2015, p. 114). Once again, the level of accuracy that the programme is currently capable of in terms of audio spectrum extraction of various elements is such that transcription by an individual remains the best suited method for the data required for this project.

Research in this field that is ostensibly concerned with rhythm has been mentioned previously in the context of using probabilities to transcribe rhythms in dance music as a method of structural segmentation. Another example of M.I.R. research concerned explicitly with rhythm is Mauch and Dixon's "Corpus-Based Study of Rhythm Patterns" (2012). Beyond this paper's usefulness as a "valuable resource to obtain a quantitative view on rhythm and drum patterns" (p. 163), it is also a useful case study in setting parameters for a corpus-based study and also in selecting and applying elements of methodologies in an inter-disciplinary context. They discuss how it is necessary to select certain elements to disregard as features of a study in order to ensure the usefulness of the resultant data: "similar to linguists building text corpora from *stemmed* words with grammatical endings removed, we build reduced drum pattern models by applying five levels of abstraction" (2012, p. 163). The process of 'abstraction' they go on to detail serves as a useful model of how to formulate similar rule-making processes for the extraction of data concerning various musical elements from recordings.

2.10. M.I.R. Applications From A Methodological Perspective

Fundamentally, those working in the field of M.I.R. are driving towards an ability to streamline and automate many of the data extraction processes that will still be done manually as part of this project. As Papadopoulos and Tzanetakis (2017) write: "Manual annotation of the content of musical pieces is a very difficult, time-consuming and tedious process that requires a huge amount of effort. It is thus essential to develop techniques for automatically extracting musical information from audio" (p. 19). The only part of this assertion I would challenge is the notion that a manual data extraction process is necessarily tedious. From a musical perspective, there is a certain value in getting one's hands dirty with the source material, however this is not a useful perspective if the purpose of a project is primarily to analyse data rather than the sources of the data itself.

Papadopoulos and Tzanetakis also demonstrate a recognition of the complexity of music and the current limitations of computational methods:

> music audio signals are also complex from a semantic point of view: they convey multi-faceted and strongly interrelated information such as harmony, melody, metric, and structure…most existing computational models for music analysis tend to focus on a single music attribute. This is contrary to the human understanding and perception of music that is known to process holistically the global music context. (2017, p. 19)

A potential misconception about a field as computationally driven as M.I.R. is that researchers are concerned only with those musical features that are quantifiable: the tempo or the chord progressions for example. However, often researchers are concerned with producing some quantitative data for elements that are initially highly qualitative. Elowsson et al. (2013) have done work on the 'speed' of music, rather than tempo or rhythm – they look at a sample audience's perception of how 'fast' music is. In doing this, they look at tempo as only one of a number of factors that contribute to this perception. When discussing some previous related research they write: "it was found that note density (and not the tempo) was constant for a certain musical expression across different musical examples" (2013, p. 481). This type of work has a commercial application as part of increasingly sophisticated music recommendation services provided by streaming companies, but it is valuable to consider the broader potential application of such work in academia and in music education.

A challenge for a researcher from a music background wishing to ascertain the potential usefulness of specific methods being worked on in the field of M.I.R. is occasionally not being able to actually decipher how the mathematical or computational conclusion of a paper translates to something musically meaningful. For instance in Nakano et al.'s (2016) paper on 'Musical Typicality', they write that the "musical typicality proposed in this paper can help create an environment in which specialists and general users alike can know the answers to the questions 'How often does this occur?' and 'How many similar songs are there?'"(p. 695), but unfortunately the musical features that actually contribute to what are referred to as "feature vectors" (p. 695) are never fully explained. The only musical features that are ostensibly referred to in the methodology are vocal timbre and a mention that the "harmonic structure [is] estimated from the audio signal" (2016, p. 697). This is an example of a paper whose title suggests some shared practice, but whose terminology prevents a cross-disciplinary understanding (certainly for this researcher).

Reviewing numerous examples of research from the field of M.I.R. was extremely valuable in the process of drafting the framework and developing the broader methodology. Some of the examples given in this review demonstrate that various parts of the data extraction process could eventually be automated which would have an impact on the size of potential datasets. These examples are included here rather than in the methodology because, although they have influenced its design, they have not been assimilated into the methodology.

2.11. Analysing Lyrics

The majority of the emphasis of work in the world of M.I.R. is focused on exclusively musical elements and it is important to return to methods of analysing lyrics. As previously discussed, the most meaningful analysis of songs seems to take place when both music and lyrics are considered together and synergies between the two are examined. Take Stan Hawkins' (1992) analysis of Prince's 'Anna Stesia' as an example:

> The lyrics of the final verse, "We're just a play in your masterplan, Now my Lord I understand" are nourished by the impending sense of harmonic change. This is finally achieved by the unexpected A7 chord, which functions as a pivotal link. (p. 333)

The combination of musical and lyrical description in the discourse is indicative of the way the two elements support one another. The separation of various individual elements for extracting data that will occur when the framework is applied should be viewed as a kind of temporary measure. The intended outcome is always that the various streams of data that are generated are brought back together and compared. It is the discussion of the synergies and interconnectivity of the resultant streams of data that will be closer in tone to the sort of holistic analysis seen not only above in Hawkins' work but also in that of Griffiths (1988):

> …is there a way in which the rhyme scheme is supported and brought out in the music? Most overtly, in the rate of harmonic change, the song's harmonic rhythm. By this is meant simply that lines ending in 'a' rhymes are differentiated from 'b'-rhyming lines, in that the latter contain a chord held for two bars while the former, and the chorus, maintain a regular rate of change. (p. 30)

Beyond structural lyrical characteristics, those related to meaning are considered in the framework, for example, direct address.[9] With reference to direct address within a lyric, Dave Laing (1985) refers to the external level of communication and the internal level. This makes a distinction between the relationship between the performer and the listener (the external level) and that of the protagonist of the lyric

[9] The use of second person pronoun to directly address the audience.

and the character being addressed (the internal level). There is a difference for a listener therefore between the experience of hearing the lyric in Toto's 'Rosanna' (1982), where it is clear that 'you' refers to the woman referenced in the title and that of listening to Take That's 'A Million Love Songs' (1992), where the listener might possibly imagine that they are the one to whom Gary Barlow is singing. This distinction between levels of direct address (something which is already a quite specific facet of a lyric) is too specific to be included for consideration in a framework that seeks to extract information about many elements of a song, but it certainly reinforces the argument that there should be some consideration of the use or otherwise of direct address as a characteristic of a lyric.

Instinctively, it would seem that rhyme should be one of the more quantifiable elements of a song's lyrics. The creation of a typology of rhymes for use as part of the framework can be informed by established methods of description. Taking Geoffrey N. Leech's (1969) formula for a rhyme of Consonant-Vowel-Consonant, G.S. Fraser (1970) proposes 'six types of sound parallelism within pairs of syllables'. These are detailed as such:

1. Alliteration: *Consonant*-Vowel-Consonant. *Gr*eat, *gr*ow.
2. Assonance. Consonant-*Vowel*-Consonant. Gr*ea*t, f*ai*l.
3. Consonance. Consonant-Vowel-*Consonant*. Grea*t,* mea*t.*
4. Reverse rhyme. *Consonant-Vowel*-Consonant. *Grea*t, *graz*e.
5. Pararhyme. *Consonant*-Vowel-*Consonant*. *Great, groat.*
6. Rhyme proper. Consonant-*Vowel-Consonant.* Gr*eat,* b*ait.* (1970)

Not only is this typology useful for providing definitions, but it is also exemplar of an elegant and all-inclusive methodology for definition of a particular detail. Philip Davies Roberts (1986) offers some similarly useful definitions of rhyme alongside stress and meter in the context of analysing poetry. The list above is exhaustive in the respect that it covers all the permutations of Leech's formula for rhymes within a pair of syllables. The definition of 'rhyme proper' above can also be applied to double (dactylic) or triple rhyme by considering pairs of pairs of syllables and so on. One might also consider some facets of rhyme that are better understood through performance such as forced (oblique) rhyme.

Analysing the lyrics of a song is not the same, however, as analysing poetry. In the context of poetry, Derek Attridge (1995) writes: "English meter depends on the perception of beats, and when beats are felt in a stretch of language, a meter is present." (p. 9) Analysis of stress and elements of rhyme in poetry is connected to this perceived meter, whereas in song, the setting of the lyrics to music requires different sorts of consideration. In terms of stress and syllabic emphasis, in song these elements can be dictated by the melody. A single word might be set to a detached melody, or melisma (multiple notes sung on the same vowel sound) might play a part.

This must also be considered for rhyme scheme. In poetry, the visual element of punctuation informs how one might ascribe a particular rhyme scheme, whereas in song, the aural effect of a rhyme is emphasised by the relative temporal placements of commutative vowels within a musically rhythmic phrase. As such, this suggests that a consistent approach to recording rhyme structure and types of rhyme must be established based on how the lyrics relate to the musical phrase (to determine the difference between, say, internal rhyme, or simply perfect rhyme in a shorter scheme length), rather than the traditional method in poetry analysis that would simply use the author's punctuation.

2.12. Research Question Two: What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs? Furthermore, can this approach be used to explore characteristics of styles or genres through sample field choices?

Research Question Three: How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics? How do these patterns relate to expectations about style and genre.

The following sections review literature that is pertinent to the questions above. Similar to the sections relating to research question one, which tended to focus on the analysis or discussion of the various discrete elements that need to be managed in order to develop a tightly-defined holistic methodology, the following sections deal with literature that provides research context as well as literature that has fed into the research in this thesis. The following sections deal with themes emerging out of these research questions, including:

- The music-lyric relationship.
- Studying a corpus (the sample field).
- Sample Field Selection
- Databases/Datasets
- Researching Trends

2.13. The Music-Lyric Relationship

This thesis seeks to explore, as much as possible, quantitative examples of the relationship between music and lyrics for the sake of exploring this relationship. Much of the existing literature views the music-lyric relationship in the context of another question. Take David Nicholl's essay on "Narrative Theory as an Analytical Tool In The Study of Popular Music Texts" (2007) as an example. Firstly, the reference to 'popular music texts' rather than 'songs' is indicative of the cultural theory perspective of the essay. Nicholls produces analyses of a variety of pop songs that highlight the relationship between lyric and musical setting in the context of a discussion on 'narrativity'. He writes that:

> narrativity (as a term, a concept, or an analytical approach) is rarely – if at all – mentioned in three of the most influential monographs dealing with the study of popular music…conversely, discussion or even mention of music is almost invariably omitted from books dealing with narrative theory and narratology. (2007, p 297)

He goes on to propose a typology of narrative levels that consider both music and lyrics in their definitions. This is a clear example of a discussion of the inter-related nature of music and lyrics in songs, but one that has a limited scope. The research in this thesis is allied to Nicholls' work here in the way that the music-lyric relationship is inherent and central to the work, and also in the way that a typology is developed to frame the discussion. Keith Negus' (2012) essay on "Narrative, Interpretation, and the Popular Song" offers a challenge to some of Nicholls' analysis – but, again drawing closely on how music and lyrics relate to one another in the context of another specific concern (narrative in this case).

The journal *Popular Music* has often featured insightful analyses that consider the relationship between lyrics, music and the social context that spawned a particular record or performance. One might cite Peter Winkler's (1988) work on Randy Newman, Dai Griffiths' (1988) study of Bruce Springsteen's 'The River', or more recently John R. Palmer's (2015) analysis of Yes's 'Heart of the Sunrise', as excellent examples. All of these essays are successful in articulating the importance of how lyrics, music and context can contribute to the construction of meaning and that the piece of music in question - and more importantly, the experience of listening to it - is a sum of these parts.

Similarly, in an article on Paul Simon's harmonic approach, Walter Everett (1997) elegantly weaves together analysis of lyrical and musical elements, discussing a particular lyric:

> This appearance of braggadocio is set with the defiant chromatic modulation to A major, and the (false) new stability is emphasized by the fact that the A major harmony at 2:50 functions as I, unlike the II of IV that had appeared at analogous places in verses 1 and 2 (as at 0:26). The independence from the original tonic of the final tonal center aptly symbolizes the singer's unpredictable mental and emotional state. (p. 126)

In this analysis, the interpretative assertions regarding the emotional impact of certain moments in the song in question are supported by more technical analysis of specific harmonic phenomena in their structural context.

Analysts that focus on specific works, or specific artists benefit from being free to move from one analytical methodology to another, as they deem necessary to derive some sense of meaning or support an argument through the process of analysis. In seeking to design a framework that allows potentially hundreds of songs to be compared in some sort of meaningful way requires the surrendering of some of the analytical freedoms so expertly exploited by the aforementioned group. The intended purpose of this project is that inquiry into music and lyrics will result in a number of streams of comparatively meaningful data, that can be used, in turn, as the supporting musical detail in analyses of the sort detailed above.

2.14. Studying A Corpus

A significant part of this thesis is concerned with the analysis of a dataset. The data that comprises this represents a chosen sample of songs, or corpus. The purpose of this corpus is to collect data in order to test the framework and its ability to answer the research questions through analysis. In the context of this sample field, ideas around genre and style are explored (this is relevant to research questions two and three) and as such it is pertinent to look to recent examples of research that have dealt with bodies of work, such as Carys Wyn Jones' (2006) thesis on canonical values in rock and Franco Fabbri's (2012) work on genre theory. Carys Wyn Jones' thesis discusses the idea of a 'Canon of Rock', describing canons as being formed:

> when potentially canonical works are supported by secondary material – including lists, but also in-depth articles, histories, biographies, anniversary celebrations, and anthologies that will be passed down by successive generations; over time this secondary material supports the work's position of importance, and helps ensure a continued presence in the canon. (p. 57)

Part of her work examines journalistic literature written about a corpus (ten albums selected from a '100 Greatest Albums of All Time' list published by NME in 1995) to examine how the value that is ascribed to these works via 'secondary material' affects a process of canonisation. Jones' work is primarily concerned with examining the music as a cultural artefact, and as such has little in common methodologically with the approach being discussed here, however it does deal with a body of work, and provides an example of how a body of work can be chosen for analysis.

Franco Fabbri's 2012 thesis that reviews his previous publications is concerned with genre definitions and exploring the usefulness of genre as a mechanism for grouping work within a larger corpus, defined by something other than genre. Fabbri says of genre:

> as far as I was aware, genre was not only used almost daily in literary and film criticism, but also used for practical reasons in most of the discourses about music I could think of. Why should a concept that proved to be so useful in current musical practice, and in other arts, be outdated in music theory? (2012, p.9)

The concept of genre and its usefulness or otherwise is a separate discussion, however it is clear that defining genre or style is a process that makes reference to trends and tendencies within musical practices. As such, it is logical to consider genre and style to be phenomena that are defined by the type of musical characteristics a quantitative study might investigate, rather than useful concepts in the shaping of such a study.

In terms of shaping research, it is important to consider what is being referred to as the corpus. In the context of studying a sample of songs, the songs themselves might be considered to be the corpus (in the sense of a 'body of work'), but from the perspective of data analysis, it is the data extracted from the sample (via the framework) that makes up the corpus. On this subject, Weiss et al. (2018) write:

> Besides methodological questions such as the musical characteristics under investigation (e.g. melodic, harmonic, or rhythmic aspects), also the way these characteristics are measured, evaluated, and presented matters. Moreover, the corpus itself plays a crucial role. Beyond its size and composition, the representation of the music data constitutes an important aspect. For example, the data can be given as a symbolic transcription, as a graphical score, or as an audio recording. (p. 416)

In fact, the processes outlined in the methodology that follows allow music-related data to be expressed in numerical or statistical terms via various processes of classification. As Weiss et al. point out, the ways that this data can then be analysed and discussed are inherently informed by the way the data is expressed. For instance, it is necessary to convert musical phenomena such as harmonic rate into some sort of metric to then produce a mean statistic.

2.15. Sample Field Selection

When considering how sample fields can be chosen, a valuable example can be taken from work in the field of Information Retrieval, considering in particular how the material that comprises some of the larger datasets is chosen. The *Billboard* Dataset is one of the best examples, featuring time-aligned annotations of harmony and structure of over 1000 songs chosen randomly from the *Billboard Top 100.* The random method of selection is important in the context of 'drawing broadly applicable musicological conclusions' (Van Balen et al. 2014, p. 2). The methodology used for the selection of material must be congruous with the aims of the project.

The volume of songs included in the work of Mullensiefen et al. for the M4S project is even greater: "Our 14,067 songs were selected from the full catalogue of the distributor in such a way as to be as representative as possible of the history of commercial western pop music" (2008, p. 133). In this case, MIDI transcriptions were commercially purchased from Geerdes MIDI Music. The musical features discussed in this work could be extracted using pre-existing symbolic representation of musical data, (in this case MIDI). If this is the case for a project, it undoubtedly streamlines the project and allows for very large corpora to be considered as part of the study. It follows that the broader the range of features considered by a study, and the more varied the methods of representing the data, the more difficult it is to make use of corpora of the size used by Mullensiefen et al.

In cases where the sample field is not so large, such as Chris Harte's work on Automatic Extraction of Harmony Information (2010), there is not necessarily a reason stated for the choice of sample material (in his case the albums of the Beatles) since the provenance of the sample material itself is of secondary importance to the principal purpose of the work – to demonstrate a particular process.

There is an argument for selecting sample material from a list of work published elsewhere, as Jones (2006) writes: "Although lists are only, at best, problematic shorthand manifestations of canons, they do serve as a microcosm of values" (p. 158). However, since the purpose of the framework is to be universally applicable, it seemed at odds with the intended non-hierarchical design of the framework to use a hierarchical system (such as a '100 Greatest Albums Ever Made' list) to select material for the sample field.

The concept of content analysis in the fields of linguistics and psychology (and indeed psycho-linguistics) is well established. It is vital to consider if computerised text analysis could contribute to this framework. LIWC – Linguistic Inquiry and Word Count (Pennebaker et al. 2007), a computerised text analysis programme is an extremely powerful tool. Pennebaker (the originator of the program) et al. (2008) used the program to analyse a collection of Beatles songs to produce the data in the table below:

Table 2.1 From Pennebaker, J. W., Petrie, K. J., Siverston, B. (2008, p. 198).

Linguistic Analyses of the Beatles' Lyrics, Collapsed Across Composer

	1960–1964	1965–1967	1968–1970	Effects[a]
Words per song	166.1	164.3	151.2	
Emotional tone				
Positive emotion	6.00	4.79	4.91	
Negative emotion	2.82	1.54	1.92	O, L[#], Q
Sexual words	2.65	1.47	1.17	O, L
Social/identity				
Social processes	18.34	17.70	15.37	O[#], L
First person singular	13.60	8.75	7.04	O, L, Q[#]
First person plural	0.48	0.73	0.90	
Cognitive processes				
Cognitive mechanisms	18.17	16.45	15.17	O, L
Words > 6 letters	6.44	7.52	9.17	O, L
Articles	4.11	5.44	5.81	O, L
Making distinctions[b]	0.57	0.12	−0.59	O[#], L
Time orientation				
Past tense	3.39	3.05	2.73	
Present tense	16.70	15.61	13.77	O[#], L
Future tense	2.98	2.13	1.48	O, L
Immediacy[b]	1.49	0.09	−1.27	O, L
N	49	73	63	

Note. All linguistic categories are expressed as percentage of total words, except words per song, making distinctions, and immediacy.
[a] Effects refer to the significance levels of between-subjects analyses of variance (ANOVAs) that are significant at $p < .05$, where O = overall ANOVA (3, 182 *df*), L = linear effect (1, 182 *df*), and Q = quadratic effect (1, 182 *df*). [#] indicates that the reported effect $p < .09$.
[b] The categories making distinctions and immediacy are factor scores computed on the weightings reported by Pennebaker & King (1999). Making distinctions is a marker of the degree to which individuals use words that are associated with making distinctions among categories and has been linked to greater cognitive work. Immediacy is a factor associated with use of present tense, simple words, first-person singular, and low usage of articles and suggests the state of living in the present.

The program is incredibly powerful, and able to analyse and categorise large amounts of text directly from a PDF file. Tausczik and Pennebaker (2010) detail the potential applications of LIWC, and explain how it was developed and how it is a valuable tool for the study of language in a psychological context. If anything, the volume of data this program produces is at a level beyond that which is manageable within a framework that also includes other elements of lyrical inquiry as well as musical. DeWall et al. (2011) articulate the limitations of the LIWC program, pointed out that while:

> it is a valid and reliable tool for linguistic analyses, it is not designed to analyse complex linguistic processes. It simply counts words and therefore neglects characteristics such as sarcasm, hidden meaning, and other complex communication processes inherent in many song lyrics. (p. 6)

Whilst LIWC is undoubtedly an excellent resource, the needs of a data extraction framework considering text in the context of song lyrics will require a bespoke combination of methods.

2.16. Datasets and Databases

There are a number of databases/datasets currently online that feature information about Pop Songs. A number of these are largely concerned with industry-related statistics. The Database of Popular Music (dbopm.com) for instance, features information about songwriters and the year of composition or first recording) and links song titles to recording artists, along with information about chart placement, format and the record label. Similarly Musicbrainz.org is a "community-maintained open source encyclopaedia of music information" (accessed 2020). The information available in these databases could be valuable cross-referenced with a database of compositional information to provide cultural context.

AcousticBrainz.org is a project that looks to democratise Music Information Retrieval by crowd-sourcing acoustic information. Their website explains that:

> this acoustic information describes the acoustic characteristics of music and includes low-level spectral information and information for genres, moods, keys, scales and much more. The goal of AcousticBrainz is to provide music technology researchers and open source hackers with a massive database of information about music. (accessed 2019)

Their 'Essentia toolkit' is an open source toolkit available to download. The algorithms can then be run on users' music libraries to extract data which is then submitted back to the main AcousticBrainz dataset.[10] This produces a set of what is described as 'low-level information', such as the key, the 'chords key', the bpm, the number of beats in the recording and a metric for 'danceability'. There is also a set of 'high-level information' extracted by applying classifiers to the low-level information submitted by users, which have been trained on sets of songs annotated by researchers.

The high-level information is expressed as a combination of binary variables and category variables. The binary variables are listed here:

- Timbre – dark/bright
- Tonality – tonal/atonal
- Danceability – danceable/not danceable
- Voice – voice/instrumental
- Gender – male/female
- Mood: Acoustic – acoustic/not acoustic
- Mood: Electronic – electronic/non-electronic
- Mood: Relaxed – relaxed/not relaxed
- Mood: Sad – sad/not sad
- Mood: Party – party/not party
- Mood: Happy – happy/not happy
- Mood: Aggressive – aggressive/not aggressive

The category variables come from different groups of music technology researchers and can give genre classifications, as well as a category developed by some researchers from ISMIR that can identify certain dance styles (cha cha, jive, quickstep etc.)

[10] The size of the dataset is greatly increased by this crowdsourced approach, and whilst the data collection conducted as part of this thesis has been done by a single researcher, it is conceivable that such an approach could be considered for extracting data by applying the framework in the future in the interest of having a larger dataset to work with.

Because the algorithms used are based on probabilities, it is not certain that individual inputs are accurate. The front page of the website invites you to look at the 5 most recent submissions, and at time of writing one of these was Elvis Presley's recording of 'I Can't Help Falling In Love With You' (1961) where the gender was described as 'Female'. A binary gender classification would clearly be insufficient if the record in question is a male/female duet or an ensemble recording. Similarly, the ascribing of moods to music, without any reference to lyrics is perhaps not an example of particularly meaningful raw data. It would appear that the information collected in this dataset is most useful in the context of big data, that is to say, considering the various data streams in their totality or in groups, rather than viewing them individually. The bigger the dataset gets, the more negligible the inaccuracies become in terms of establishing trends and the automated nature of the data extraction makes it possible for this dataset to grow rapidly. Nevertheless the shortcomings of AcousticBrainz as a music data extraction framework are the absence of any lyrical data, and the fact that regardless of the size of the dataset it is hard to get away from the oversimplification of describing songs as 'happy' or 'not happy' or 'party' or 'not party'.

These and other datasets such as Million Songs and the M4S Pop Song Database have numerous potential applications, perhaps the most economically and culturally pertinent being listener suggestions – the development of complex algorithms to generate predictions of new music a consumer might enjoy based on what they are currently streaming. In Ellis and Repetto's (2008) project proposal to LabROSA for their work on Data-Driven Music Audio Understanding they articulated a vision for "a future in which the big record labels no longer act as intermediaries between musicians and listeners, but instead anyone can obtain music matching their particular tastes directly from individual…musicians" (2008, p. 2). Whether or not the democratising process foreseen by the authors has occurred within music distribution, it is certainly the case that in the intervening years, related artist or track suggestions have become a normal part of a listener's experience when using Spotify or Apple Music.

From a systematic point of view, it is worth considering how the format of musical data has an impact on the applications of a database. In their work as part of the M4S project, Mullensiefen et al. (2008) use MIDI transcriptions of popular music in order to analyse specific musical features from a large corpus. In the context of their work, MIDI is an ideal way for musical data to be expressed. Computational analysis of the corpus can be achieved by parametrically defining MIDI events in such a way as to describe melody and harmony. However, Mauch and Dixon's work on chord identification (2010), and also that of Percival et al. (2015), was concerned with extracting data from audio files, therefore the formats used would clearly be either m4a, aiff or .wav, but in this case the platform (the player) used is important, as the process of extraction in their work is achieved via the use of plug-ins made available for specific audio file players such as *Sonic Visualiser* or *Audacity*.

An excellent example of a music database that features great levels of musical detail expressed as data is the Weimar Jazz Database (2017) produced as part of The Jazzomat Research Project hosted at The University of Music Franz Liszt in Weimar. The database includes data features that have been extracted by a combination of automated and manual processes. Part of the reason a level of automation has been available for use in this project is the focus on melody. All of the information collected is to do with the single line melody of a solo (contextualised by the accompanying harmony). Detailed transcriptions of the solos have been produced manually, but then the melodic elements of these transcriptions can be expressed as midi data, and a variety of automated processes can then be applied to this data.

For each solo included in the database, a score-based transcription in lead sheet form is produced as well as a visual pitch-class representation derived from the midi data. There is a level of similarity between the Weimar database and the dataset that has been produced as part of my project, in that a range of methods have been applied to produce the data features. There are examples of purely statistical representations of musical phenomena that are described by terminology specific to the dataset such as 'event density' and 'syncopicity'. There are also examples of discrete classifications specific to the dataset such as 'tonality class', where not only is the data feature a word rather than a number, but there is a level of interpretation required to produce this data feature. This combination of approaches compiled in one dataset appears to be a sophisticated way of capturing a sense of many different elements of a solo in a way that can be directly compared to other solos in the database as well as producing a meaningful corpus.

2.17. Researching Trends

The framework used in this thesis is implemented to generate a dataset. The analysis of this data can be interpreted in many ways, but one of the primary objectives is to use this data to address research questions 2 and 3. Trends, patterns and synergies that have been found between various data features, either in the context of the whole dataset or discrete subsets, are tangible outcomes of this research. There are a number of examples of prior research that have generated easily-explained or singular trends in popular music which have been generally reported in the press. In May 2018 the Mail Online published an article with the headline: "Today's Pop Music Really Is More Depressing Than 30 Years Ago", reporting that researchers had found "songs are less happy and 'bright' than they used to be, based on a mathematical formula judging elements such as pace, rhythm and major or minor key". (2018) The lead author of the research paper published in The Royal Society Open Science journal, Natalia Komarova, is quoted in the Mail article as saying: "The whole reason I started this study was because I was listening to the songs my teenage daughter played and thinking, what on earth has happened to music?" (Accessed 2018). The press reporting of the research presented in the original publication is vastly over-simplified and includes a lot of the journalist's own, rather imaginative, interpretation of the paper itself. Komarova et al. (2018) used the Acousticbrainz Essentia algorithms and ran them on recordings sourced from the top 100 charting songs on The Official Charts Company database from January 1985. They reported that: 'overall, 'happiness' and 'brightness' experienced a downward trend, while 'sadness' increased in the last 30 or so years' (2018) amongst many other findings in what is an in-depth analysis of the data collected. This particular trend formed the basis of the aforementioned article, but was not necessarily presented as the main conclusion of the original paper.

It has been mentioned previously that the AcousticBrainz software extracts information based on the audio, with no analysis of lyrics. As such, it is possible to argue that the finding regarding 'brightness' is perhaps less contentious, since the parameters of what constitute the timbral makeup of a piece of audio can be more objectively defined. A concept such as happiness or sadness is more contentious given the reservations articulated earlier in this chapter. Komarova et al. do make reference to a related linguistic study by DeWall et al. (2011) that made a related finding. They used the LIWC program mentioned previously to analyse the top ten selling US singles between 1980 and 2007 "to determine whether lyrics in popular U.S. songs changed over time in a manner that mirrored documented psychological changes across the same time period" (2011). According to the parameters of the study, they found that the dataset generated suggested that U.S. song lyrics became more self-focused, more socially disconnected, more angry and anti-social and contained less positive emotion over time. Komarova et al. draw a comparison between the apparent downward trend in the number of songs being recorded as 'happy' by the AcousticBrainz Essentia software and the downward trend of songs featuring 'positive emotion words' in DeWall et al.'s study.

In both cases, the researchers are realistic about the limitations of the methodologies they use (the lack of lyric analysis with AcousticBrainz, the purely content analysis approach with LIWC). This suggests that some level of interpretation at the data collection phase might be valuable for certain characteristics of lyrics. Similarly, a semantic typology that can be applied by the researcher to the use of general semantic fields might allow for hidden meanings, implications or sematic themes to be recorded in such a way that a program such as LIWC can not.

Another approach to answering a question about trends in song lyrics was proposed in Colin Morris' (2017) online paper on 'lyric compression'. Morris takes the idea of applying the Lempel-Ziv algorithm to song lyrics:

> It's a lossless compression algorithm that powers gifs, pngs, and most archive formats (zip, gzip, rar…)…The Lempel-Ziv algorithm works by exploiting repeated sequences. How efficiently LZ can compress a text is directly related to the number and length of the repeated sections in that text.

Those songs whose lyrics have higher size reduction percentages are, by definition, most repetitive. A problem with the wording of Morris' paper (and as a result much of the press coverage and online discussion that followed it – the article was widely shared on facebook) is that he frequently equates his findings about the lyrics of pop songs with pop music in general. The tone of Morris' essay implies that it is intended to be entertaining, however, the significant dissemination of his TEDx talk on the essay makes a robust critique of the work worthwhile.

The 'most repetitive' lyric from the Billboard Top 100 dataset of over 15,000 songs is found to be 'Around The World' (Daft Punk, 1997) with a size reduction of 98%. An image of the song's lyrics (The phrase 'Around The World' repeated many times) gets a good laugh. Unfortunately, the humour derived here demonstrates a lack of stylistic nuance that is problematic because of the talk's failure to distinguish between lyrics and pop music in general. 'Around The World' and 'The Rockafeller Skank' (Fatboy Slim 1998) are examples of electronic dance music, whose compositional style would not ordinarily be discussed as 'songwriting' in the traditional sense. Indeed the lyrical content of 'The Rockafeller Skank' consists of iterations of a sample from a recording of a live gig introduction: 'Right about now, the funk/soul brother'. One aspect of the record might be repetitive, but this is not necessarily a reflection on the holistic form – especially in its stylistic context.

Morris' work is a good example of a creative method for expressing something specific about song lyrics that can contribute some meaningful and interesting data to discussions about lyrical content. However, some of the conclusions that are seemingly drawn by this work are far too general.

Another example of the media appetite for an equation for 'success' in pop music is Adam Sherwin's article in The Independent dated 17 December 2011 under the title: "Your parents are right, modern music is getting louder and more repetitive" and the vital sub-title: "And scientists discover exactly what it takes to make a hit record". The project in question, led by Dr Tijl de Bi at The University of Bristol (widely published in journals on data mining, machine learning and M.I.R.) can be found at scoreahit.com, where they detail their 'Hit Potential Equation'. The methodology shares some similarities with the AcousticBrainz Essentia software. Songs ranked based on their positions in the UK singles chart were scored based on whether the following characteristics are present in the audio:

- Harmonic Simplicity
- Non-Harmonicity
- Loudness Variation
- Beat Variation
- Danceability
- Loudness
- Mode
- Energy
- Duration > 8m 45

- Duration 6m15s-8m44
- Duration 2m 17s – 6m 14s
- Duration < 2m 16s
- Complex Time Sig
- Binary Time Sig
- Ternary Time Sig
- Various Tempi groupings in bins of 20bpm

By analysing the resultant data in relation to the date of release, it was possible for the scoreahit.com team to produce a 'Hit Potential Equation' for different eras based on the trends in the data.

One of the really successful graphic representations of this data is their 'Time Machine' video that shows to what extent various characteristics are present at various times, as well as their positive or negative impact on whether the song was a hit or not (correlation between the characteristic being present and the song being a 'hit' or 'not-hit' based on the project's criteria). Unfortunately at the time of writing, the link from the website to the accompanying research paper is dead, so some of the parameters of various characteristics are not fully explained ('loudness' for instance, what is the average output of the audio for it to be characterised as 'loud' or 'not loud'). This time machine graphic shows some trends over time that correspond with certain expectations. The number of 'hits' that have a duration between 6 minutes 15 seconds and 8 minutes 44 seconds spikes during the seventies. The popularity of Prog Rock, the expansive compositional nature of hit songs by Queen and Meatloaf and the popularity of extended singles in the disco era would contribute to this data outcome. Similarly, loudness variation (dynamic contrast) seems to increase during the seventies (presumably alongside the increase in quality of in-home Hi-Fi systems and advances in analogue recording technology and practice) before fading away to almost negligible levels in the late nineties onwards, with the advent of radio-ready compression becoming a feature of the majority of mainstream releases.

One of the key findings picked up by Sherwin's (2011) article in The Independent is that: "music is getting louder". The reference to societal tropes regarding parents complaining about the volume of music demonstrates a misunderstanding of the data. Clearly the number of decibels emanating from a speaker is in ultimate control of the person with the volume dial – the 'loudness' in question is to do with the nature of the audio files being analyzed by the algorithms. There is an economical and mechanical reason for this increase, simply put, the vast majority of hit records will have been produced in such a way that contemporary (often expensive) mastering techniques will have been a part of the process. Over time the process of increasing the 'loudness' of audio files has evolved (alongside overall compression) to ensure a level of sonic consistency across different listening platforms.

The scoreahit.com website states:

> we do not take into account factors external to the audio, such as marketing budget used to promote the song, the music video, the prior popularity of the artist or band, social factors, lyrics, etc. Of course these factors are extremely important, so not including them will inevitably limit the accuracy of our equation. (Accessed 2019)

This is a crucial caveat that informs how this data can be used. This research product has presented a statistically meaningful and data-rich dataset based on a tightly-defined methodology. Bringing this data back into the context of those areas that were disregarded in order to produce it, as has been done very briefly above, is the route to making it universally meaningful.

2.18. Informing the Methodology

The research reviewed here provides a context for this thesis. The discussion on literature pertinent to research question one gives a sense of some precedents to the type of tightly-defined methodology described fully in the next chapter, as well as a sense that these have tended to focus on specific musical or lyrical elements. A number of methodologies have been critically reviewed and this process has informed the methodology that follows. For the most part, it has not been possible to build pre-existing methodologies into the framework, but the process of considering their suitability was crucial in setting the parameters of the framework while this was being drafted. Similarly, consideration of a number of articles from M.I.R. has informed the method of data extraction but with the caveat that many of the processes involved as part of the data extraction could be automated at some point in the future.

Reviewing literature pertinent to research questions 2 and 3 gives a sense of bodies of work that deal with the relationship between music and lyrics, but in a highly interpretative and often qualitative way. Conversely, there are a number of examples of data-rich research (in the sections on Databases and on Researching Trends) where the quality or integrity of the individual data inputs is compromised. The methodology that follows has been developed seeking to draw on the relevant elements of this research, producing meaningful data features that populate a dataset that can be analysed to determine trends and synergies.

3. Methodology

3.1. Methodology Outline

This chapter will discuss the research approach that has been taken to achieve the research aims and address the research questions established in the introduction. As discussed therein, the principal aim of this study is to explore the inter-connected nature of music and lyrics within song. The second research aim introduces the idea of developing a framework for extracting data about music and lyrics in songs. A framework has been devised to determine what data should be mined (for both music and lyrics) and that this is completed in such a way that the data itself is clearly defined, so that subsequent analyses of that data can be meaningful. A significant part of this chapter is devoted to explaining why the framework has been designed in the way it has, but the framework is only part (albeit a large part) of the tightly-defined methodology referred to in research question one. The parameters for extraction set by the framework are described in detail in this chapter. A case study is included as an addition to this chapter that demonstrates the data extraction process as applied to the song 'Seven Years' (2002) by Norah Jones. This case study complements the information in this chapter to give a thorough appreciation of how the data discussed in subsequent chapters has been mined when this process was applied to a 300-song corpus.

Subsequently the streams of data produced have been examined to look for patterns and synergies between them[11], both answering research questions and testing the framework. The inclusion of information pertaining to both music and lyrics in the data extraction process means that there are numerous permutations of data streams that might be considered alongside one another to explore and interrogate the inter-connected nature of music and words in songs. These are not explored exhaustively,

[11] Chapters 4-7 explore various ways the data might be examined.

rather a number of case studies are included in subsequent chapters where analysis of the data is framed in various ways to address not only research questions two and three, but also discrete parts of these research questions.

These questions refer to trends and relationships between music and lyrics and patterns and synergies emerging out of objective data analysis. It is necessary to discuss the broader methodology used in this research to address these questions. In summary, the following chapter consists of:

- An overview of the elements of song analysed in this research, a reflection on how this research is allied to content analysis and a description of how the data is stored.
- An explanation of the design of the framework, detailing the discrete data features it consists of.
- A description of the data extraction process and sample field selection.
- A discussion of how various data analysis case studies have been selected and grouped to address the research questions at the centre of this thesis and to test the potential of this approach. The outcomes of these case studies are not the headlines of the data analysis chapters, rather they are offered as proof of concept.

The overall shape of this methodology – design a framework, collect data, analyse the data – is not original in itself. However, the framework itself is the original part of this research, both in terms of the number of data features concerning both music and lyrics that it consists of, but also in the way that many of these discrete data features are comprised of original methods (in their specificity) of expressing elements of song. As such the outcomes, both in terms of content and the way they are expressed, can be said to be original as a result.

3.2. Analysis of Song Content/Content Analysis

When examining a song for the purposes of extracting data, the framework is concerned with those musical and lyrical elements that constitute the content of the song, rather than performance or arrangement elements. A researcher applying the framework makes use of a single source recording - ideally the earliest recording of the song - and a transcription that is sufficiently detailed for the purposes of the framework (what 'sufficient detail' entails will be clearer once the parameters of the framework have been outlined). This single recording is used as the source text for the sake of establishing a kind of control measure. As a result there are certain metrics contained within the framework that pertain more to statistical information about the source recording (the length of the track for instance) , whereas others are more concerned with information that might be better expressed through the use of a transcription (the number of bars that make up a section).

A process of establishing the preferred terminology to express certain ideas was important during the initial phase of drafting and shaping the framework, and determining the rules that govern how data is extracted from songs. In order to create the tangible parts of this project, defining the terminology to frame the initial discussions and reflections that lead to them was vitally important.

The framework used in this thesis relies on clearly defined parameters in order to extract comparable data about various elements of music and lyrics that make up songs. As such, certain elements are necessarily disregarded. This is not to question their importance in terms of a listener's experience, rather this is a pragmatic course of action. Timbre, for instance, is not considered. This is partly because timbre can be considered as 'Secondary Domain' (Meyer, 1989), and to do with the arrangement, orchestration or performance of a song rather than the song itself. However, to be pragmatic, it is also because timbre is rather more difficult to describe in musically objective terms. Isabella van Elferen (2017) writes that: "timbre evades description, its sonic excess of precise signification refusing to be caught in the restrictions of linguistic signifiers. Timbre, in summary, is a compositional, performative, and aesthetic joy, but a music epistemological problem." (p. 483) This 'problem' is in the context of music – other disciplines might classify timbre quantitatively, as van Elferen goes on to say:

> psychoacoustics, for instance, has developed useful empirical methods to measure quantitative attributes of timbre such as sound waves, frequency spectra, and timbral envelopes, such physiological descriptions do not touch on the intricacies of enjoying timbre as a compositional and orchestrational parameter. (p. 484)

Essentially, the framework determines sets of parameters that allow data to be derived from the content (be it musical or lyrical) of the song. In this way, this methodology could be described as a kind of content analysis where the song content (the elements present in the source recording that might be expressed in a transcription) is the text. Klaus Krippendorf's (2004) definition of content analysis is consistent with the tightly-defined and objective elements of the research aims of this thesis:

> As a technique, content analysis involves specialized procedures. It is learnable and divorceable from the personal authority of the researcher…research techniques should result in findings that are replicable. That is, researchers working at different points in time and perhaps under different circumstances should get the same results when applying the same technique. (p. 18)

For the purposes of this thesis, all data extractions have been performed by the same researcher, but the tightly-defined nature of this process means that it is replicable and could be done by others. This creates the potential for a much larger dataset. The bigger the dataset, the more statistically reliable wholesale data analysis of the dataset can be.

Content analysis generally refers to a *text,* the musical and lyrical content that makes up a song could be described as *text* according to Krippendorf as he says the term is: "not intended to restrict content analysis to written material…in content analysis works of art, images, maps, sounds, signs, symbols and even numerical records may be included as data – that is, they may be considered as texts" (p. 19).

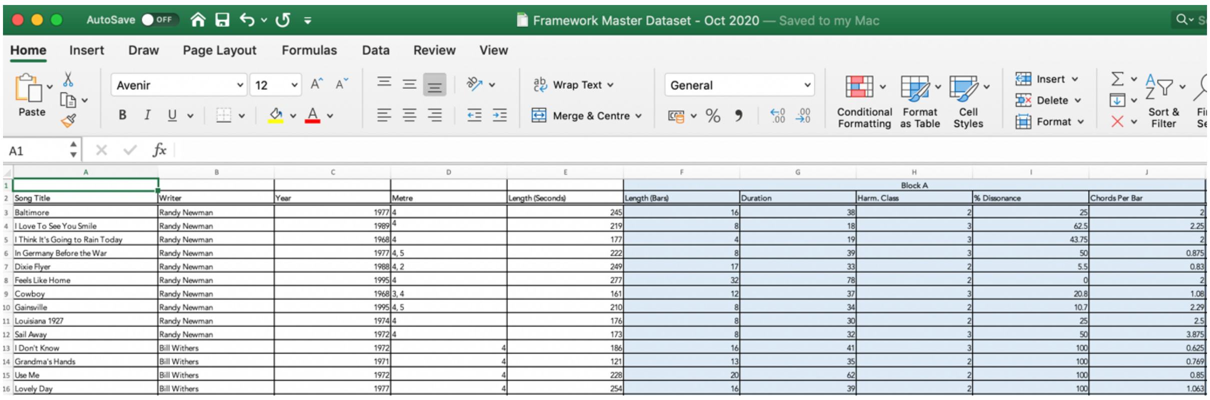
The sets of parameters that comprise the framework might be described as coding schemes in the context of content analysis. Hsieh and Shannon (2005) discuss three types of content analysis:

> In conventional content analysis, coding categories are derived directly from the text data. With a directed approach, analysis starts with a theory or relevant research findings as guidance for initial codes. A summative content analysis involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context. (p. 1277)

Case studies included in later chapters of this thesis could be said to be examples of summative content analysis, where the context of the analysis is provided by the definition of the subset (songs by the same artist for instance). The directed approach is certainly not used. This is consistent with objectivity being mentioned in both the research aims and the research questions for this thesis. A theme will emerge in the explanation of the framework that follows of seeking to avoid allowing expectations about certain elements of song content to determine how data is to be expressed or collected. Some of the framework's data features require a level of interpretation to be applied, and as such there could be a question over whether this would be considered quantitative or qualitative content analysis. With echoes of Cook's (1989) assertion about the interpretative nature of analysis, Krippendorf (2004) writes: "Ultimately all reading of texts is qualitative, even when certain characteristics of a text are later converted into numbers" (p. 16). This doesn't necessarily apply to data features that already have numeric metrics such as track length, but some data features require a level of interpretation. Also, certain data features are clearly defined and do not require interpretation, but some of the definitions are native to this framework and arguably this constitutes a historical trace of qualitative judgement.

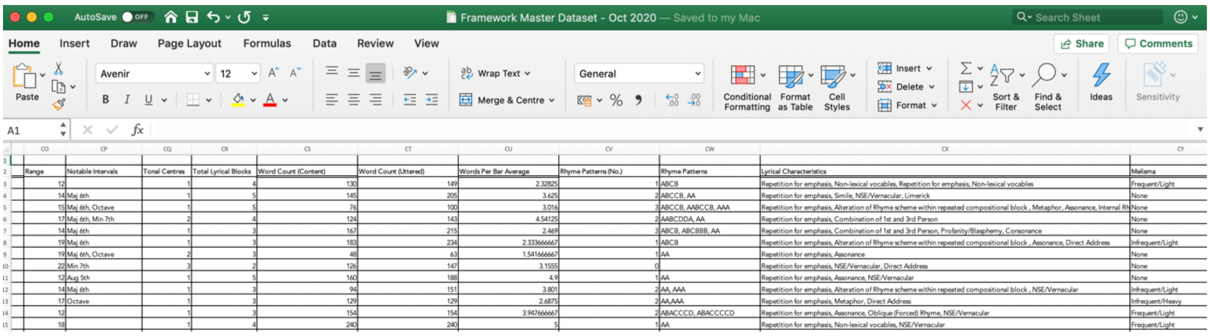
Before discussing the parameters of the framework itself it is also important to note how the extracted data is stored. It is also useful to see a visual representation of the most tangible part of this research: the data. An excel spreadsheet has been designed as a means of organising the data in such a way that it may be easily and flexibly examined once a process of data collection is complete. Below are some examples of how sections of the database appear in Excel[12].

Fig. 3.1. Database Example 1



Song Title	Writer	Year	Metre	Length (Seconds)	Block A: Length (Bars)	Duration	Harm. Class	% Dissonance	Chords Per Bar
Baltimore	Randy Newman	1977	4	245	16	38	2	25	2
I Love To See You Smile	Randy Newman	1989	4	219	8	18	3	62.5	2.25
I Think It's Going to Rain Today	Randy Newman	1968	4	177	4	19	3	43.75	2
In Germany Before the War	Randy Newman	1977	4, 5	222	8	39	3	50	0.875
Dixie Flyer	Randy Newman	1988	4, 2	249	17	33	2	5.5	0.83
Feels Like Home	Randy Newman	1995	4	277	32	78	2	0	2
Cowboy	Randy Newman	1968	3, 4	161	12	37	3	20.8	1.08
Gainsville	Randy Newman	1995	4, 5	210	8	34	2	10.7	2.29
Louisiana 1927	Randy Newman	1974	4	176	8	30	2	25	2.5
Sail Away	Randy Newman	1972	4	173	8	32	3	50	3.875
I Don't Know	Bill Withers	1972	4	186	16	41	3	100	0.625
Grandma's Hands	Bill Withers	1971	4	121	13	35	2	100	0.769
Use Me	Bill Withers	1972	4	228	20	62	2	100	0.85
Lovely Day	Bill Withers	1977	4	254	16	39	2	100	1.063

Fig. 3.2. Database Example 2



Range	Notable Intervals	Tonal Centres	Total Lyrical Blocks	Word Count (Content)	Word Count (Uttered)	Words Per Bar Average	Rhyme Patterns (No.)	Rhyme Patterns	Lyrical Characteristics	Melisma
12		1	4	130	149	2.32825	1	ABCB	Repetition for emphasis, Non-lexical vocables, Repetition for emphasis, Non-lexical vocables	Frequent/Light
14	Maj 6th	1	5	145	205	3.625	2	ABCCB, AA	Repetition for emphasis, Simile, NSE/Vernacular, Limerick	None
15	Maj 6th, Octave	1	5	76	100	3.016	3	ABCCB, AABCCB, AAA	Repetition for emphasis, Alteration of Rhyme scheme within repeated compositional block , Metaphor, Assonance, Internal Rh	None
17	Maj 6th, Min 7th	2	4	124	143	4.54125	2	AABCDDA, AA	Repetition for emphasis, Combination of 1st and 3rd Person	None
14	Maj 6th	1	3	167	215	2.469	3	ABCB, ABCBBB, AA	Repetition for emphasis, Combination of 1st and 3rd Person, Profanity/Blasphemy, Consonance	None
19	Maj 6th	1	3	183	234	2.333666667	1	ABCB	Repetition for emphasis, Alteration of Rhyme scheme within repeated compositional block , Assonance, Direct Address	Infrequent/Light
19	Maj 6th, Octave	2	3	48	63	1.541666667	1	AA	Repetition for emphasis, Assonance	None
22	Min 7th	3	2	126	147	3.1555	0		Repetition for emphasis, NSE/Vernacular, Direct Address	None
12	Aug 5th	1	5	160	188	4.9	1	AA	Repetition for emphasis, Assonance, NSE/Vernacular	None
14	Maj 6th	1	3	94	151	3.801	2	AA, AAA	Repetition for emphasis, Alteration of Rhyme scheme within repeated compositional block , NSE/Vernacular	Infrequent/Light
17	Octave	1	3	129	129	2.6875	2	AA,AAA	Repetition for emphasis, Metaphor, Direct Address	Infrequent/Heavy
12		1	3	154	154	3.947666667	2	ABACCCD, ABACCCCD	Repetition for emphasis, Assonance, Oblique (Forced) Rhyme, NSE/Vernacular	Frequent/Light
18		1	4	240	240	5	1	AA	Repetition for emphasis, Non-lexical vocables, NSE/Vernacular	Frequent/Light

Each column is dedicated to a different type of data extraction. In the following, when reference is made to a *column* it is in this context – referring specifically to the outcomes of one discrete data extraction or data feature.

[12] A copy of the master dataset is included as a digital appendix to this thesis. Readers are encouraged to explore the data to further contextualise the demonstrative case studies offered in chapters four to six.

3.3. The Framework

Below is a full list of the extractions (column headings) employed in this framework:

Temporal and proportional measures:

- Metre
- Duration (Seconds) – block-by-block and total
- Length (Bars) – block-by-block and total
- Total compositional blocks (with lyrics)
- Total compositional blocks (instrumental)
- Total compositional blocks

Data relating to harmony:

- Harmonic classification
- Percentage dissonance – block-by-block and total
- Chords per bar – block-by-block and total
- Total number of chords
- Number of tonal centres

Data relating to melody:

- Melodic characteristics
- Range
- Notable intervals
- Melisma

Data relating to lyrics:

- The compositional block to which a lyric is set
- Number of occurrences of a lyrical block
- Word count – block-by-block and total (content)
- Total uttered word count
- Words per bar – block-by-block and total
- Total lyrical blocks
- Number of rhyme patterns
- Rhyme pattern types
- Lyrical characteristics
- Semantic fields
- Key words

In order to try to achieve research techniques which result in findings that are replicable, there are sets of rules for each of these extractions that govern how the data is obtained and presented. A number of the extractions are made on a *block-by-block* basis. It makes sense that a description of the data extraction framework should begin with an explanation of how compositional blocks are defined.

3.4. Compositional Blocks

In the broader context of musical form, one of the defining features of popular song is its strophic nature – the use of repeated sections where the same melody is used with different or repeated lyrics. Given that the notion of structure was to be so important to the makeup of the framework, it was vital to establish a clear set of rules for defining how a song was to be broken up into sections. The consideration of repetition is at the core of this definition.[13]

Ascribing structural terms to parts of a song is a common practice for musicians and non-musicians alike, most people are comfortable with terms such as verse and chorus, and what is meant by these two terms is fairly clear. However, there is more confusion when discussing the 'middle eight' of a song, or a 'bridge' or 'pre-chorus'. These terms are not only unclear in terms of their specific use, but there is also an issue of implied hierarchy (one might argue that it is commonly held that the chorus is the most important part of a song for instance) that wouldn't serve the objective nature of the framework. In order to avoid this, the term 'compositional block' has been employed. A compositional block is defined primarily by the melody and accompanying harmony of a section that is repeated or otherwise. There is a small level of tolerance for discrepancies between repeated versions of blocks, this allows for slight phrasing changes between different verses or different interpretations of the same chorus. A typical song might consist of the following structure:

Fig. 3.3.

Example 1

Verse 1

Chorus

Verse 2

Chorus

Middle Section

[13] The framework was devised primarily for interrogating pop songs, and as strophic form is the dominant structure in popular song this seemed appropriate. This does not mean that the framework cannot be used for through-composed songs for instance, but rather that data features collected for these songs that have a structural element may present as outliers. Incidentally, the dataset discussed in this thesis (collected from a sample field of pop and rock songs) confirms that strophic form is the pre-dominant structure, with a handful of outliers.

Chorus

Chorus

In this example verses one and two use the same melody and harmony, so would be described by the framework as consisting of the same compositional block. The chorus and middle sections consist of two separate compositional blocks, so this song is made up of three compositional blocks in total. At this stage the order in which the compositional blocks occur or are arranged is unimportant for the purposes of gleaning musical information – the purpose of this is to break the song down to its components and examine them on a block-by-block or overall basis.

Fig. 3.4.

Example 2

Verse 1

Pre-Chorus

Chorus

Verse 2

Pre-Chorus

Chorus

Instrumental Section

Pre-Chorus

Chorus

Chorus

Example 2 shows an instance where repetition or otherwise is crucial in defining the size of a compositonal block. Take the relationship between what is called the Pre-Chrorus and the Chorus in this example. If it were not for the separate chorus at the very end of the song, the Pre-Chorus and Chorus would be defined as one single compositional block since up to that point they always occur together. However, the independent repetition of the Chorus at the end marks it as a seprate compositional block. Similarly, the Pre-Chorus is defined as separate from the verse because it occurs independently after the instrumental section.

Whether or not the instrumental section is defined as a separate block depends on whether its harmony comes from one of the other compositional blocks in the song. Commonly such sections feature a solo or instrumental arrangement that uses compositional material (the harmony and often parts of the melody) from a compositional block that previously had lyrics attached to it. When this is the case this section is not defined as separate since the section does not provide new compositonal data – rather it is an arrangement device. However, if the section contains a new harmony, then it would be defined as an Instrumental Compositional Block. If this were the case in Example 2 then that particular song would be described as containing three Compositional Blocks and one Instrumental Compositional Block.

There are occasions when the lyrics must be considered in defining the size of a compositional block. If a song's structure is perceived:

Fig. 3.5.

Example 3

Verse 1 - 8 bars – with singularly occurring lyric

Chorus – 8 bars – with lyric that occurs again later

Verse 2 - 8 bars – with singularly occurring lyric

Chorus – 8 bars – with the same lyric from the previous chorus

There is an argument that musically this could be described as one repeated 16 bar block that comprises of the 'verse' and the 'chorus' together. However, this study is underpinned by the notion of inter-connectivity of lyric and music. Therefore, it is appropriate to allow the lyrical discrepancy to be considered, so that this song would be described as having two compositional blocks of 8 bars length. In 'Form in Rock Music: A Primer', John Covach discusses how the repetition or otherwise of lyrics in the context of their musical setting "can be useful in making important formal distinctions" (p. 66). In the same way that a lyrical consideration is being used to define compositional blocks, compositional blocks are also vital to the definition of lyrical blocks, which will be explained shortly.

In scenarios where a very small amount of lyrical material is repeated within what would otherwise constitute a larger block (e.g. a single word used in the same place in the melody in two iterations of the same block but with otherwise separate lyrics) this will not constitute a separate block. This caveat is in place to avoid the data presenting false outliers. The repeated lyrical material must constitute more than one bar of the larger potential block in order for it to require consideration as two separate blocks.[14]

The number of blocks with lyrics attached, the number of instrumental blocks and the number of blocks in total is recorded for each song. This is straightforward data to record, but one that gives an idea of the amount of compositional content used in a song.

When two sections of a song are deemed to be the same compositional block, this does not require them to be completely identical on the source recording. There was need for a level of tolerance for rhythmic discrepancies in the melody, or slight

[14] During the data extraction process a similar working rule was in place, but rather than one bar, up to one line of the lyric was tolerated in some examples. After reflecting on some individual cases, this more closely defined rule was decided upon.

melodic shape discrepancies, providing the vast majority of the melodic and harmonic information is the same. This is not a matter of allowing inaccuracy into the function of the framework, rather it is an application of pragmatism that is in line with the experiential element of listening to a song. A general audience will recognise the fundamental sense of repetition that relates verse one to verse two even if there are discrepancies between the melodies and the number of syllables in parts of the lyric. The design of the framework needs tolerances in order that the meaningfulness of its structural definitions are not compromised.

3.5. Temporal and Proportional Measures

As mentioned above, a recording of the song is used as the source text for extracting data, as well as a transcription of song content taken from this recording, allowing certain data features to be collected that relate directly to the recording and some that are informed more by the transcription. This combination of approaches is at play when considering some of the temporal elements of a song. The duration of the source recording (in seconds) is taken down. Then the duration of each compositional block is recorded. These two similar but separate measures are a good example of the logic of the framework, and an early insight into its intended use. The length of a track is a relatively unremarkable piece of information, but when this information is held alongside the lengths of different sections (compositional blocks) there is an opprotuinty to investigate proportion. On a micro-level one might look at the proportional relationship between one block and the whole track, but across a large dataset one might wish to examine the average proportional relationship between individual blocks and whole tracks, and then which songs feature blocks that deviate most from this average. The logic is that the most illuminating findings will come from examining the relationships between the streams of data that this framework produces.

As well as recording the duration of each block, the length of the block is also recorded in bars. What consitutes a bar will be different for each song, since this is governed proportionally by metre and temporally by tempo. As such it does not necessarily follow that the longest block in a dataset (when measured in seconds) will feature the highest number of bars. This means that the information in these columns (plural since the database is split into blocks in order to capture this data) is directly comparable, but this information is vital in informing other measures within the block that have proportional elements that are more easily and accurately expressed by considering bars of music than simply the amount of time elapsed.

Metre is recorded on a whole-song basis, in the most basic terms (e.g. 2, 3, 4 etc.) with compound time signatures expressed simply in terms of strong pulses (6/8 expressed as 2, 9/8 expressed as 3 etc.). When songs feature changes in metre, this is also recorded in the same column, with the most-used metre recorded first, therefore a song that is in 4/4, with the occasional bar of 3/4 is recorded thus: 4,3. A song that is in 3/4 that has a short section in 4/4 is recorded 3,4. This distinction is important because it allows for a higher number of statistical sub-sets when considering this particular data feature. Across a dataset one might wish to examine what proportion of songs make use of a change in metre, but one might wish to go further still and ask what proportion of songs are predominantly in 4, but feature other metres. This is where the order that the metres are recorded becomes important. This is an example of how carefully considering how data is expressed can open avenues for musically meaningful statistical analysis.

3.6. Data Relating to Harmony

On a block-by-block basis, three elements of a song's harmony are examined in applying the framework. One relates to the function of the harmony used in a section, and the relationship between the chords used in that section to one another and to the tonic of that section. The second relates to the type of harmony used in the section in a vertical sense, but also relating to temporal proportion. The third is concerned with the rate of harmonic change within a section. For each of these measures a method has been devised specifically for use in this framework with direct comparability in mind.

A very conscious attempt has been made to avoid this appearing to be a method of measuring levels of harmonic complexity. In the first instance, the notion of something being more or less complex can bring with it the issue of hierarchy and implied judgements about quality. This study seeks to avoid such judgements and focus solely on the content of a song's composition. Secondly, more pragmatically, the complexity or – to use a term more appropriate to this study – the character of the harmony of a piece of music is not defined by one facet of the harmony alone, hence three separate methods of defining harmonic content being employed by the framework.

The first of these three metrics is a harmonic classification. This is a three-tier system devised to give a sense of how the chords used in a given section relate to one another in the context of a perceived tonic as discussed by Schacter (1987)[15]. The three classifications are simply numbered.

1. The chords belong to only one of the following: the major scale, the harmonic minor scale or the melodic minor scale[16].

Examples

- C – Am – F – G

[15] Mentioned in the previous chapter.
[16] In this case, the ascending melodic minor scale only.

- Cmaj7 – Am7 – Fmaj7 – G13 - *all of these extensions come from the same key (C major) therefore this sequence is still in classification 1.*
- Bm – D – F♯m – E – *all chords come from A major, the presence of the tonic chord is not required.*
- Am – Fmaj7 – Bm7♭5 – E7♭9 – *again, even though some upper extensions are used, all of these come from A harmonic minor.*
- *Should a compositional block have modal characteristics (e.g. a drone accompaniment with melodic material implying a certain mode) this block would be defined as classification 1 providing only one mode is used. Similarly, songs like 'Sweet Home Alabama' (1974) by Lynyrd Skynryd, that have a mixolydian quality would be defined as belonging to classification 1. The chord sequence:* D – C – G *is used throughout, these three chords belong to the key of G major, but the perceived tonic is D, hence D mixolydian. For the purposes of the harmonic classification it is not necessary to label the chord sequences used in this way.*

2. The harmony also features chords with a secondary dominant function or from the sub-dominant or dominant key. In this instance what is meant by 'secondary dominant' is any chord that has a dominant-tonic relationship with a chord from the home key, other than the dominant itself. Compositional blocks in minor keys that feature characteristics from more than one minor mode (with the same tonic) also fall into this classification.

Examples

- G – B7 – C – A – *as in 'Sitting On The Dock Of the Bay' (1968) by Otis Redding. The B7 is the secondary dominant of Em and the A is the secondary dominant of D, both Em and D belong to the home key of G major.*
- C7 – F7 – G7 – *typically blues-derived songs might feature dominant chords that imply three separate modes. In this instance, C would be perceived as the*

tonic. Defining the home key has a modal element in this case as a result, since C7 comes from F major, generally blues-derived songs make use of mixolydian mode in this way. Regardless, the relationship between the chords used places this sequence in classification 2, because the relationship between C7 and F7 is a sub-dominant one and G7 has a dominant-tonic relationship with C, the perceived tonic.

- Am – F – E7 – Dm7 – Cmaj7 – Bm7♭5 – E7 – *as in 'Smooth' (1999) by Santana. This chord sequence features chords from A harmonic minor (Bm7♭5, E7) and A natural minor (Cmaj7).*

3. The harmony used in a compositional block can not be classified as either purely diatonic (as in classification 1), or closely-related (as in classification 2).

Examples

- D – A – E – D – E – A – C♯ - B – *as in 'Rikki Don't Lose That Number' (1974) by Steely Dan. A diatonic chord sequence is disturbed by an unexpected parallel chromatic chord movement that uses major triads from unrelated keys.*
- Cmaj7 – Dm7 – G7 – Cmaj7 – Dm7 – G7 – Cmaj7 – Bmin7 – E7 – Amaj7 – *from the B section of 'You Are The Sunshine of My Life' (1972) by Stevie Wonder. The chords Bmin7 and E7 could be described as coming from the dominant key and as being a secondary dominant respectively and would satisfy the requirements for classification 2, however it is the resolution of E7 to Amaj7 that categorises this block as belonging to the third classification.*
- F – B♭ – A♭ – D♭ – *as in 'Smells Like Teen Spirit' (1991) by Nirvana. This chord sequence is characterised by two pairs of chords. Bb is the sub-dominant of F, and the same relationship then undergoes a parallel shift up a minor third. Bold parallel shifts to relatively unrelated key areas are a defining harmonic*

> *feature of the music of early nineties grunge bands such as Nirvana and Pearl Jam.*

As previously discussed, Allan Moore (1992/1995) and Gary Burns (1989) have published work using similarly methodical approaches and have developed typologies and frameworks for classifying chord sequences and harmonic hooks respectively. However, these pre-existing methodologies were so all-encompassing in the context of harmony specifically as to be unwieldy in the context of this framework, which considers many other elements of the music and lyrics of a song. As mentioned in the previous chapter, Moore's 'Patterns of Harmony' organises different types of chord progressions into categories, and groups these categories into "classes" (1992, p. 73) based on the nature of the chords' relationships to one another. This concept of classification was instrumental in designing this data feature, although the types of relationship that determine classification here are different and there are significantly fewer different classifications. It must also be borne in mind that the framework makes use of other methods for defining harmonic characteristics and one's understanding of a song's harmony (in the context of this methodology) should be informed by the relationship between the outcomes of these combined methods.

The second method for defining harmonic characteristics is concerned with the richness or 'colour' of the harmony used in a given compositional block. The method is a measure of the proportion of chords in a compositional block that consist of more than a basic triad (that use upper extensions). The harmonic classification makes no distinction between the chords Am and Am7 (where Am is chord ii, iii or vi of a major key for instance, and where the upper extensions do not change the modal implications of the chord), but this measure does. There is also a temporal element to this measure. The name given to this measure is Percentage Dissonance.

In fig. 3.6. below ("Roberta" (1974) by Billy Joel) bars 1 to 16 are a single compositional block. With these first sixteen bars there are seven instances of chords that consist of more than a basic triad. The chord B♭/C (which could also be described as C9sus4) occurs four times, followed by single occurrences of the chords Gm11, G7 and C7. The sixteen bars in question last for four beats each, so 64 beats in total. The total number of beats where the chord uses upper extensions in this compositional block is 18. 18 divided by 64 gives 0.28125, a percentage dissonance of 28.125%.

The final six bars in fig. 3.6. are another separate compositional block. In this block the chords B♭maj7, B♭6 and B♭/C use upper extensions (are considered dissonant by this classification). Of the 24 total beats in this block, a 'dissonant' chord occurs on 12, therefore the percentage dissonance for this block is 50%. Since this is a proportional measure it is possible to say that this block features a greater proportion of chords with upper extensions than the previous block measured, even though chords with upper extensions occurred for a longer period of time in the previous block.

Fig. 3.6.

Roberta

Billy Joel

Percentage dissonance is measured on a block-by-block basis, and a mean percentage dissonance is also recorded for the whole song. This mean is calculated by totaling the figures for each compositional block and then divided by the number of blocks that make up the song. In this respect it is an average of the raw compositional data, not taking into account how many times a block is repeated throughout the recording of the song that is used as the source text.

Certain terms carry meanings in the context of this framework that may be more specific or prescriptive than in general use. This is certainly the case with the use of the term *dissonance* when referring to 'percentage dissonance'. As explored in the literature review, an exact musical definition of the term *dissonance* is somewhat elusive, and seemingly subject to debate depending on era and genre[17]. For the purposes of the framework, what is deemed dissonant by this particular measure is tightly defined, and the word itself was chosen as it was the best available term for referring to the phenomena being examined (as a harmonic facet separate to the others measured by using the framework).

The third harmonic factor that the framework employs is 'Chords Per Bar', and requires little explanation. Using fig. 3.6. once more, the first 16 bars make up a compositional block, and feature 21 chords. Therefore the number of chords per bar for this compositional block is 21/16, or 1.3125. When a compositional block's harmony consists of a one chord vamp the number of chords per bar is 1 divided by the number of bars. This is an important point to note, since it allows distinctions to be made between sections of music that feature static harmony based on their length (in terms of bars). There is a potential question over the logic of referring to the number of chords, when arguably it is the number (and rate) of transitions that is examined by this method. One could achieve a similar result by referring to the number of *changes,* but in this case all sections with static harmony would be

[17] This is discussed in section 2.5.

recorded as 0, regardless of whether they featured static harmony for 8 bars or 32 bars for instance. Employing the method outlined allows the same comparisons to be expressed between sections that feature one or more chord changes at the same time as allowing for comparisons between static harmony sections also.

Similar to percentage dissonance, data for chords per bar are recorded on a block-by-block basis and then a mean calculation is made for the song. The fact that for the mean figure the calculation for a 4 bar block would carry the same significance as a 50 bar block could be questioned. However, the blocks are defined as distinct, non-hierarchical entities, and this is a calculation that is concerned with proportion and rate rather than relative size, therefore the method for calculating the mean is appropriate.

The use of bars as the temporal marker rather than using time in seconds requires discussion. It could be argued that using time would produce an objective, content-based result, but this wouldn't consider tempo. Using the number of bars (as determined by the transcription of the source recording) allows one to record a data feature that is more meaningful in terms of recording content about the song rather than the individual performance.

The total number of chords used is the final harmony-related data feature employed by the framework. If 'harmonic classification' is concerned with harmonic function, 'chords per bar' with density and 'percentage dissonance' with the colour or richness of harmony, this data feature, though statistically basic, complements all three in the way that it gives a sense of harmonic variety in a song as a whole. Regardless of how many times a particular chord is used, it is only recorded once – so this is not a measure of how many chord changes occur, but how many different chords are used in a song. Different voicings of chords that have the same function (Am/Am7/Am9) are recorded separately for the purposes of this feature. If a key change occurs resulting in the same compositional block being reiterated in a different key, all the new chords are recorded by this feature. This is one way of this musical phenomenon being expressed by the framework, since it would not be expressed by some of the features that are concerned with structure (i.e. a wholesale key change on a final chorus does not result in any new compositional data being recorded from the perspective of compositional or lyrical blocks and by extension by any of those data features that are defined by block). The other data feature that allows the framework to recognise a wholesale change of key is 'Tonal Centres'.

3.7. Tonal Centres

The number of tonal centres featured is also recorded for each song. A change of tonal centre is deemed to have occurred when a modulation has taken place. This is a separate occurrence to the use of a chord that is foreign to the key for effect, but rather when a cadence resolving to the tonic of a new key occurs, (provided that the resolving chord does not belong to the home key) or a transition becomes apparent by the concurrent use of three or more chords from a key other than that in which the block is deemed to have started. Some songs feature blocks that are simply in different keys as an arrangement device. Where parallel modulations occur and the relationship between the harmonic and melodic material stays the same (for instance Barry Manilow et al.) this is considered an arrangement device and is not recorded. Should a key change occur via another section however (say in a middle eight that transitions to a new key, with the following chorus repeated in the new key), this is recorded as the transition to a new tonal centre has been achieved via the compositional material.

Examples:

- **Emaj7 – Bm7 – E9 – Amaj7 – G♯m7 – F♯m7 – A/B – Emaj7** – *The home key is E major, and although a ii-V-I into A major occurs, since A major 7 is the sub-*

dominant of the home key this would not be described as a change of tonal centre for the purposes of this framework.

- Dmaj7 – Gm7 – C9 – Dmaj7 – *In the context of D major in this example, iv-bVII is often referred to as a 'back-door ii-V'. Although the two chords Gm7 and C9 come from F major, the fact that C9 resolves upwards in a parallel fashion to D (the expected F tonic of F major replaced by the F# major third of D major, giving a sense of 'lift') means that the illusion of F major was a brief sojourn serving the purpose of a home key resolution rather than a change of tonal centre.*
- Cmaj7 – Dm7 – G7 – Cmaj7 – Dm7 – G7 – Cmaj7 – Bmin7 – E7 – Amaj7 – *again from the B section of 'You Are The Sunshine of My Life' (1972) by Stevie Wonder. In this example a ii-V progression that, on its own, would not constitute a change of tonal centre is resolved to the tonic of the new key (A major in this case). Therefore this would be recorded as having two tonal centres.*
- F – B♭maj7 – F – B♭maj7 – F – B♭maj7 – Am7 – C/D – G – D – C – G – D –C – *from 'Captain Jack' (1973) by Billy Joel. The verse is unambiguously in F major, and the chorus (that follows the transition through Am7 and C/D at the end of the verse) is in G major. Incidentally, the chord changes written above come from two separate compositional blocks in the context of the framework. The first G major chord is the start of the second block. Because of the voicings used at the end of the verse, both compositional blocks would be considered in classification 1 (diatonic). Even though the Am7 and C/D function as a ii-V into G major, the harmonic material still all comes from F major at this point. This is an example of the multiple measures of harmonic interest working together, and underlines the usefulness of the tonal centres column in the database. To see that the two compositional blocks use diatonic material*

would only tell part of the story, therefore it is important that the use of two tonal centres is recorded.

Given the range of harmonic data features described above, it should be clear how some of the chroma extraction programmes mentioned in the literature review would not be ideal at this stage – although that is not to say that parts of the data extraction process for harmonic data features might not be automated in future in order to speed up this process.

3.8. Data Relating to Melody

Although the melody is perhaps the most significant musical element of a song, devising methods to quantitatively record information about melody is challenging. A method that has been used more than once in this framework is to make use of a finite typology of characteristics (in this case melodic characteristics). During the process of extracting data from a recording and transcription, one may select none, one or many of the characteristics from the typology. This flexibility frees one up from having to classify the melody of a song using a single classification. Melodies develop and change and as such it is appropriate to expect that multiple types of melody may be used in one song, in fact it is often the juxtaposition of different types of melody that gives a song its character and makes it successful as a composition. Designing this part of the framework to give the ability to select multiple options avoids the risk of defining a song's melody as much by what it is not than what it is, and also avoids having to make difficult decisions about which characteristic is most dominant. An individual applying the framework selects one or more characteristics from the following list:

- Single Note – this would not require a whole song or block to use only one note, rather that a significant part of a block makes use of this feature
- Two Notes
- Frequently Repeated Interval
- Frequently Repeated Phrase
- Arch-Like – this is to be applied in a general sense, more as a line of best fit
- Ascending In Pitch
- Descending In Pitch
- Scalic
- Sequence – this can be applied if the intervallic shape of a phrase is repeated even once more in a different scalic position
- Blues Notes
- Pentatonic Melody
- Embellishment Within Otherwise Repeated Block
- Detached
- Undulating – to be applied loosely to continually rising and falling melodic contour
- Chromatic Melody – could apply to scalic chromatic passages, but also where a phrase moves in sequence chromatically rather than diatonically. Similarly where a single note of a repeated phrase is altered chromatically.

To re-iterate: the purpose of such a typology is to positively record characteristics, rather than be too purist with the application of terms. With the term 'arch-like' for instance, if a phrase features a melody that ascends and then descends across the length of the phrase but for one note that deviates from that arc shape, the argument is that the aesthetic effect of the arch-like melody is broadly understood by the listener, and as such is worth noting.

Some of the options in this typology are good examples of how the use of typologies can be used to complement other measures. Considering 'blues notes' for instance can be useful, since it considers a harmonic element of the melody in a way that the block-by-block harmonic measures does not, thereby enhancing the overall sense of a song's harmonic construction. Similarly, the ability given by this typology to record embellishments within otherwise repeated blocks means that in situations where there are subtle differences between phrasing or even melodic contour in different iterations of what is otherwise understood as the same compositional block, then this extra detail is recognised similarly subtly.

The column for recording melodic characteristics is complemented by two relatively straightforward statistics recorded on a whole-song basis about the melodic content. The first of these is the range of the melody, recorded as a single figure of the number of semitones between the highest and lowest note in the sung melody (rather than the highest and lowest note played on the record).

Any interval greater than a perfect fifth between successive notes in the melody is also recorded in a column called 'notable intervals'. Intervals larger than a fifth bear noting since they are often regarded as moments of drama or interest within a melody. Again, one may input multiple intervals into this column. It is important to note the specific requirement for an interval's inclusion in this column. It is true that an interval smaller than a fifth may be considered *notable* if it is the only interval used in a song, or if it occurs only in certain places to break up a melody that otherwise consists of one repeated note. However, this measure is in place to record those intervals that might be considered noteworthy across a sample field and to produce data that is comparably meaningful. It is inevitable that the framework will overlook some of the idiosyncrasies that mark out songs as interesting, since the aim of the study is to draw conclusions about a corpus.

As is the case with harmony, the framework seeks to build a profile of a song's melody by looking at the answers to discrete questions about different facets of it. The melodic characteristics and notable intervals give an idea of style and melodic shape, whereas the range gives a sense of scale and content.

3.9. Melisma

Melisma is a phenomenon that deals with the synergy between music and lyric in terms of how the proportionate value of a word to a line of poetry may differ to its setting to a musical phrase in terms of duration. It is therefore an interesting element to investigate. A finite typology has been decided upon for describing the nature of the use of melisma in a song that allows for some variation, but that is not so specific as to become confusing. The level of melisma is described as one of the following:

- None
- Infrequent/Light
- Infrequent/Heavy
- Frequent/Light
- Frequent/Heavy

A level of interpretation is relied upon here, but at the very least this measure gives a sense of how often melisma occurs, and how intricate it is when it does. As with the use of non-lexical vocables, the recording of instances of melisma refers to its use as part of the main melody of the song rather than improvisations that may be considered part of the arrangement. This data feature could be seen as complementary to the 'words per bar' feature, as it gives more context to a sense of lyrical rate as opposed to melodic density (i.e. very few words in a phrase would have a low rate of words per bar, but with heavy use of melisma it is possible that there could also be a high rate of melodic density). A method for measuring syllabic rate/density could also produce interesting results, however given the scale of the data extraction as it stands, this is a level of detail too far – although that is not to say that a future study that is concerned more exclusively with lyrical setting, or melody use in songs could not incorporate additional data features (but then – this is true for any element of this framework).

3.10. Lyrical Blocks

Defining compositional blocks is also part of defining lyrical structure. In general, the size of a compositional block defines the size of the corresponding lyrical block. However, as previously outlined, there are scenarios where the repetition or otherwise of a lyrical section is used to define compositional blocks in turn. Once again the use of the term 'block' is used to avoid any confusion and to ensure that the framework is non-hierarchical. It is possible for multiple lyrical blocks to be set to the same compositional block (this scenario occurs most commonly with the verses of songs).

As with compositional blocks, certain data features about lyrical elements are taken by individual lyrical block. In terms of layout, the database names the compositional blocks A, B, C etc. in the order that they first occur in the source text once they have been separated from one another. Instrumental blocks are named IA, IB, IC etc. and lyrical blocks are named 1, 2, 3 etc. similarly, in the order that they first occur.

In most cases the size of a lyrical block is defined by the parameters of the compositional block within which the lyrics occur. Example 3 (fig. 3.5.) above is the exception to this rule whereby the lyrics contribute to determining the size of compositional blocks, and then - with a sense of circularity - the corresponding lyrical blocks.

As previously discussed, the use of the term lyrical block helps to avoid the pitfalls of using terms such as *verse* and *chorus*, however it is by examining synergies between compositional blocks and lyrical blocks that one might recognise characteristics that are 'verse-like' (multiple lyrical blocks set to the same compositional block) or 'chorus-like' (a compositional block that has only one lyrical block attached to it, but occurs multiple times). The framework features a mechanism to readily examine such synergies. For each lyrical block, one notes the corresponding compositional block and the number of occurrences of that lyrical block in the source recording.

In saying that terms such as *verse* and *chorus* are avoided during the data extraction process, it is not for the purpose of seeking to redefine sections of a song. Indeed, this would be a redundant exercise. The common understanding of which part of a song the chorus is (held by musicians and non-musicians alike) is testament to the fact that the phenomenon of chorusness is a vital part of the architecture of song. The use of neutral terminology to define any section of a song is not to contradict or undermine this, rather to frame sections in an objective way in order to examine them free from the presupposition of how a section ought to be constructed or of what it ought to consist.

The total number of lyrical blocks is recorded separately in order that this statistic might be considered alongside whole-song statistics about compositional blocks.

3.11. Word Counts

Led by examining practice in content analysis and corpus analysis in linguistics, the framework makes use of a variety of types of word count to record similar information in such a way as to open a greater number of avenues for comparison.

Each lyrical block has a word count recorded as well as the number of words per bar. Block-by-block word counts allows for a comparison of lyrical content between lyrical blocks set to different compositional blocks as well lyrical blocks that are set to the same compositional block. It is thus possible to establish data about the typical discrepancy between word counts (lyrical content) for verses in a sample field (where verses are defined specifically as multiple lyrical blocks set to the same compositional block) for instance.

The number of words per bar is a statistic that is calculated by dividing the number of words in the lyrical block by the number of bars that constitutes the compositional block that it is attached to. This statistic is an indication of lyrical density in the context of bars of music. The data produced would be different if the calculation was made using duration in seconds rather than musical bars. The decision to use bars as the temporal marker is on the basis that in song (as opposed to verse) the setting of the lyric is relative to the organisation of the music. Even though the actual duration of a single bar has other variables attached (tempo and metre) as with chords per measure, it has been decided that using bars as the temporal measure will yield comparably meaningful data about rate and density rather than content and pace, which can be measured by other statistics in the framework. An average for words per bar for the whole song is also calculated and recorded.

Two separate total word counts are recorded for each song: Word Count (Content) and Word Count (Uttered). Word count (content) is calculated by simply adding together the word counts for each of the lyrical blocks. This is a word count that ignores the repetition of lyrical blocks. It is important to clarify that the repetition referred to here is at a whole block level, rather than avoiding any repetition at all as some content analysis techniques in linguistics do. The point of this measure is to have a record of the total number of words used when the song has been broken down to its basic components, in line with some of the data extraction methods explained above for musical elements.

The content word count is complemented by the word count (uttered), which includes the repetition of lyrical blocks (choruses, repeated verses etc.). This is also a legitimate measure, since it is partly the repetition of lyrics in a chorus that gives the chorus its prominence in the form of a song.

Recording both kinds of total word count is preferable to making a contentious decision about which would be most pertinent or useful. Since the logic governing the design of the framework is to create multiple data streams for comparison it follows that certain data streams would be better compared with one word count than the other. Furthermore, it allows for the discrepancy between the two to be examined across a sample field.

3.12. Rhyme Patterns

Establishing a systematic method for recording the existence and type of rhyme patterns in a lyric is an interesting challenge. As discussed in chapter 2, techniques exist for describing and analysing rhyme in the context of poetry analysis. Rhyme is a structural device that can be related to rhythm and regularity when read aloud or performed, but that also can rely on a spatial visual setting when read on the page. The theory for discussing rhyme patterns in poetry relies on the layout of the verse on the page in order to define the different types of rhyme and the patterns in which they occur. There is a subtle distinction to be made, however, when considering how rhyme works in song. Rather than the rhyme being situated at the end of a *line,* the points in a song where a rhyme occurs tend to be at the end of a *phrase.* Take these lyrics from the first verse of 'Fire' by Bruce Springsteen:

"You say you don't like it,
But girl I know you're a liar,
'Cause when we kiss: fire."

Traditional poetic analysis might say that the rhyme pattern here is ABB, whereas the musical setting of the lyric means that the third line occupies the same number of bars as the first two, and based on the phrasing and the gap of almost two bars between *kiss* and *fire,* it is really an ABAB or ABCB[18] rhyme pattern that might be better expressed:

"You say you don't like it
But girl I know you're a liar
'Cause when we kiss:
fire."

For the purposes of recording the occurrence of rhyme in the framework, the latter method is used, considering the musical setting of the lyric. This is consistent with other methods used elsewhere in the framework where the synergies between music and lyrics are used to define parameters. The subtle discrepancy between the two approaches is one that exemplifies the value of this process. It is a demonstration that the lyrics of a song cannot be treated purely as verse in the traditional literary sense and their interrogation requires a different approach.

Using the musical setting of the lyric helps to avoid ambiguity of interpretation, however, an issue arises when there is potential ambiguity about phrase length. Whereas the end of a line in written poetry is clearly defined by punctuation, the use of musical setting relies more on proportion and in some cases the attribution of a rhyme pattern is open for debate. Take 'Ferguson Road' (1972) by Carole King as an example (lyrics by Jerry Goffin):

> "I'm gonna head on up to the old Ferguson Road
> Stand beneath the trees and see how tall I am

[18] Dependant on whether 'it' and 'kiss' are deemed to rhyme. The approach in this methodology is that types of rhyme other than pure rhyme, such as half-rhyme, assonance, and consonance are considered as rhyming for the purposes of recording rhyme patterns, and are then also noted as part of the lyrical characteristics typology which will be outlined later in this chapter.

Yes, I'm gonna wade in a cold rocky stream
So I will be sure not to give a damn"

As expressed visually here, the rhyme structure is ABCB. One might argue however that in the interest of establishing a completely unambiguous rule of thumb, and considering the earlier assertion about the proportional element of the rhythmic setting of rhyme in song, that the four lines written here could be viewed simply as two phrases instead, with an AA rhyme structure. This would be logical in terms of proportion, and would point towards a rule for attributing rhyme patterns that strives to use the simplest possible description when possible. This was considered in the design of the framework from the point of view of trying to make the application of the framework as tidy and consistent as possible, but it was decided that this risked neglecting the experiential element of listening to the song and the effect that rhyme's place within the phrase structure has to a listener. A level of pragmatism and objectivity is necessary in all areas of data extraction for the framework to work in the way it needs to, but elements should not be broken down to such an extent that they no longer relate to the listener's experience of a given musical or lyrical element.

In the case of the above lyric, one can argue that there is something about the musical setting that gives a certain sense of phrase length. Harmonically there is a sense of non-resolution at the same time as there is a break in the melody at the end of the line: "I'm gonna head on up to the old Ferguson Road", that acts as a kind of musical comma, marking a break in the phrase before the next line:" Stand beneath the trees and see how tall I am."

Defining the rhyme structure for this part of the lyric as AA rather than ABCB would be to ignore a large part of the musical setting of the lyric. There is not a mechanism in the framework that deals explicitly with phrase length. As this point illustrates, it is a multi-faceted issue whose definition relies on an element of interpretation, nevertheless, allowing the consideration of some of the compositional factors that contribute to the sense of phrase-length to influence how rhyme patterns are recorded is positive. There is an experiential difference between a rhyming couplet and an ABCB rhyme, and a more reductive definition would mean that this difference could not be recorded as part of the framework.

Clearly this opens a space for interpretative discrepancies in terms of different individuals applying the framework, however, in the first instance there is a level of control in that it will be the same individual doing the data extraction. The extent to which such potential discrepancies might affect the overall usefulness of the framework's application can be reflected upon once a large sample field has been through the framework. In the spirit of this research, it seems more positive to allow for more variety in the data extraction stage for this lyrical element in the name of recognising the experiential element of listening, rather than less variety in the name of data consistency.

The information about rhyme is recorded for the whole song. There are two columns in the database, one that records how many different rhyme patterns are used within the song as a whole, and one that lists which rhyme patterns are used. The combination of these two measures allows for the prevalence of particular rhyme patterns to be tracked in a sample, as well as being able to identify a sense of structural variety within the lyrics of individual songs that might be comparable with other relatable measures.

Another crucial question when recording rhyme structures is over what constitutes a rhyme. Much of the established terminology for the various types of rhyme from literary analysis is included in the lyrical characteristics section of the framework (see below). In terms of rhyme structure, the approach is liberal. In order for two lines to be described as rhyming, any form of rhyme other than pure rhyme is acceptable, the purpose of the rhyme pattern column is to record the structural element of the rhyme rather than its character. If a rhyme pattern is recorded and no further clarification is made in the lyrical characteristics column (described below) then the assumption is that the rhyme being referred to is pure/true rhyme in equivalent places in respective phrases. Otherwise (in the case of oblique rhyme for instance, or internal rhyme) the rhyme pattern is recorded regardless, since this is a structural issue, and is then further clarified in the lyrical characteristics column.

3.13. Lyrical Characteristics

The concept of using a finite typology with the option of multiple selection in order to record the occurrence of phenomena within a song has been discussed previously. The same method is used for recording lyrical characteristics. This technique is valuable because it allows one to record note-worthy elements of a song's lyric that contribute significantly to its character, but are not such universal elements that they require a separate section of the framework dedicated to them. The typology used has been developed over a series of drafts of the framework. The column dedicated to lyrical characteristics in the database is simply a record of which of the characteristics listed in the typology occur.

- *Repetition for emphasis* – the repetition of a whole line or phrase in such a way that would be unnatural in normal speech. This is a dramatic effect that is particular to verse and song. It could also be attributed to many repetitions of a single word.
- *Alteration of rhyme scheme within repeated compositional block* – in order for two sections of lyric to be regarded as being set to the same compositional block it follows that the harmony and melody of the two are the same, however it is possible that within the equivalent musical structure a different rhyme structure may occur. See these examples from Randy Newman's 'Sail Away' (1971):

"In America you'll get food to eat
Won't have to run through the jungle and scuff up your feet
You'll just sing about Jesus and drink wine all day
It's great to be an American"

"In America every man is free
To take care of his home and his family
You'll be as happy as a monkey in a monkey tree
You're all gonna be an American"

The first lyrical block could be described as having an AABC rhyme pattern and the second block would be described as AAAB. This is an example of different parts of the framework relating directly to one another, since when the lyrical characteristic in question here is recorded it has a link to the number of rhyme patterns recorded also. It is possible, however, for a song to feature this characteristic in spite of only one rhyme scheme being recorded. If lyrical block 1, set to compositional block A features an ABAB rhyme scheme, but lyrical block 2, also set to compositional block A features no rhyme scheme this would constitute an alteration of rhyme scheme within a repeated compositional block, but only the ABAB rhyme scheme would be recorded.

- *Simile*
- *Metaphor*
- *Assonance* – the resemblance of sound between syllables within a line or phrase, arising from the rhyming of two or more vowels, but not consonants.
- *Consonance* – the equivalent phenomenon but arising from the repetition of consonant sounds, not vowels (dead, dud, did).
- *Alliteration*

- *Internal rhyme* – generally rhyming occurs at the end of a line or phrase, however it may also occur in the equivalent place in the middle of phrases. As described earlier in the context of the framework, the musical setting of the lyric determines what constitutes phrase length/shape and therefore what rhymes would be considered to be internal. An internal rhyme would be recorded as a rhyme pattern in the appropriate column of the database, since the distinction between this and a full rhyme can be made by recording this characteristic here.
- *Double/Dactylic Rhyme* – where two syllables rhyme rather than just one (ended/blended).
- *Forced/Oblique Rhyme* – typically a rhyme that is produced by altering the spelling of a word or the normally shape of a phrase, and also for the purposes of this framework the definition extends to the singer altering a vowel sound to force a rhyme in the source text as in Adele's 'A Million Years Ago' (2015):

"I try to think of things to say
Like a joke or memory"

In this example the last syllable of memory is pronounced 'ray' to rhyme with 'say'.

- *Imperfect Rhyme* – e.g. 'love' and 'move'.
- *Non-Lexical Vocables* – vocal content that is part of the compositional material of a song's melody that doesn't use words. Most commonly this occurs when an emotive vowel sound is used for dramatic effect ('oh' for instance). A distinction can be made between the use of non-lexical vocables on a recording and improvisations that may occur in repeated choruses at the end of a song. This characteristic refers specifically to the use of these vocalisations when they are an integral part of the song's melodic composition. Similarly,

the use of sung vowel sounds as part of a backing vocal texture would not require inclusion, since this feature refers to the foreground information.

- *Profanity/Blasphemy* – the first instance in this typology of a phenomenon that refers more to meaning than structure. The use of profane terms is done for dramatic effect and may relate to the semantic element of the lyric.
- *NSE/Vernacular* – The definition of Non-Standard English may be applied liberally to include slang terms and regional idioms as well as terminology and phrase structure or contractions that derive from regional variations of English. The term NSE/Vernacular was chosen because it does not require one to point towards the origin of the usage which could be contentious, but simply to record it. To define a language usage as non-standard is relatively factual, but to attempt to categorically state the origins of the non-standard usage may be to deviate too far from the remit of the framework into the realms of conjecture.
- *Borrowed Words* – In its current form, the framework is only designed to deal with songs in English, although it is entirely possible that a multi-lingual application could be developed. However, songs that are pre-dominantly in English may feature individual words that are 'borrowed' from other languages either in isolated instances used for effect.
- *Combination of first and third person* – using a combination of both can have a specific narrative effect.
- *Direct Address* – part of a song, or all of it is addressed either directly to the listener. It might also be perceived that the lyric's narrative is addressed to a third party by the singer and the listener is privy to the exchange.

3.14. Semantic Fields

One of the limitations of this framework is that it does not deal with lyrical meaning in an extensive way. The purpose of using the framework is to extract data that can be readily compared, which is somewhat at odds philosophically with the process of deriving meaning, which requires one to perform very specific, song-by-song analysis. However, it is possible to record something about the content of the lyrics that at least alludes to the topics and themes that are included in the lyrics.

No attempt is made to classify a *type* of song, or to define it as having one prevalent theme, rather, consistent with the approach in other parts of the framework, a multiple-input typology is used to record something about the thematic content of the lyrics. Referring to semantics is appropriate because it may well be that words are used from a particular semantic grouping because that is ostensibly what the song is about, however, songs from another semantic grouping may be used in an analogous way. The application of this typology makes no distinction and just refers to the content of the lyrics.

This part of the framework is the only one where a typology has been directly imported from elsewhere. A semantic classification developed by Carl Darling Buck (1949) for the study of etymology in early Indo-European languages has provided a useful framework for classifying the semantic content of lyrics in songs. Buck identified 22 semantic classifications, providing a typology that is large enough to produce some varied and meaningful data, but finite. This is an example of one of the framework's questions that relies more heavily on the interpretation of the individual researcher, but whose answer is made directly comparable by the use of the typology.

The semantic classifications are:

1. Physical World
2. Mankind
3. Animals

4. Body Parts
5. Food & Drink
6. Clothing & Adornment
7. Dwellings & Furniture
8. Agriculture & Vegetation
9. Physical Acts & Materials
10. Motion & Transportation
11. Possession & Trade
12. Spatial Relations
13. Quantity & Number
14. Time
15. Sense Perception
16. Emotion
17. Mind & Thought
18. Language & Music
19. Social Relations
20. Warfare & Hunting
21. Law & Judgement
22. Religion & Beliefs

A more detailed glossary is also available on the Texas Liberal Arts website under the Indo-European Lexicon section (2019) with examples of how specific words or sub-themes belong to the various classifications.

3.15. Key Words

The word counts described above are aided by the use of software available from wordcounter.net. This software also enables the automated recording of key words within a lyric in terms of density, set at different levels of word density as a percentage. For the framework, key words that have a higher percentage than 5% are used. This is a typical measure from content analysis in linguistics, but is allied to other parts of the framework that deal with measures of frequency or density.

3.16. The Process of Data Extraction and The Sample Field

The description of the framework above has grouped data extraction methods together based on the musical and lyrical phenomena they deal with, but in a sense it would also be valuable to group methods together based on the type of question that is being asked and the type of data that is being produced. It stands to reason that extraction methods that are to do with scale and size go together, for instance Song Duration and Word Count (Uttered) are directly comparable. Words Per Bar and Chords Per Bar are similarly synergistic since they deal with proportion and rate.

It is during the phase following the application of the framework and the extraction of compositional data that these synergies and comparisons can start to be explored. The aim of the framework is to provide multiple streams of data whose many permutations can be explored in a manner that is much less prescriptive than the design and application of the framework itself.

By this stage it should be apparent that there could be numerous potential applications of the framework, where it could be used to produce data that could support or refute an argument or as one of a series of investigative tools about a specific body of work. The purpose of this research, however, is to demonstrate the framework's application in order to give a sense of how it might potentially be used. To also use the framework to attempt to address another research question (for instance comparing top ten hits from different decades or comparing artists' first and last albums) would be to draw focus away from the focus of the thesis.

During the process of drafting the framework, certain albums and particular artists were used. There were pragmatic reasons for choosing these (primarily the availability of good transcriptions that helped streamline the process), and in any case the purpose of that early stage was to test the parameters of the framework, rather than to produce data for analysis. In his essay on "Patterns of Harmony", Allan Moore describes choosing a sample field: "The music used here has been almost randomly chosen, but with a primary concern to evade the implicit construction of a central canon" (1992, p. 72). A similar philosophy applies here, but with some pragmatic considerations, a certain era spread and consideration of how sub-sets of the sample might be established. Nevertheless it is important to re-iterate that the sample selection is essentially arbitrary.

The songs used in the sample that is analysed in this research come from a cache of transcriptions made up of my personal collection combined with what was available to me in various university and college libraries. Inevitably, a level of unconscious personal and situational bias will have influenced these selections, although efforts were made to avoid this undermining the outcomes of the analysis. There is no way that a sample of 300 songs that has been selected to include some albums and sets of songs by the same artist can be fully representative of all of pop music. During the process of data extraction and analysis some genre and era exclusions became apparent that are reflected upon in chapter 7.

The size of sample fields used in draft runs of the framework (e.g. 10 songs in the Randy Newman dataset) might be sufficient for addressing a very specific research question using the comparative qualities and tight definitions of the framework, but in order to generally demonstrate its *potential* usefulness a larger sample field must be used. It has been decided that the choice of material for this sample field can be relatively arbitrary. This is informed by prior scholarly practice in M.I.R. where large datasets are being examined (Harte 2010 for instance), but the sample field itself is not the focus of the work, rather it is being used as a means of demonstrating a particular computational extraction method. Mullensiefen, Wiggins and Lewis (2008) conducted work on over 14,000 songs as part of work for the M4S project. This involved applying automated processes to a library of MIDI transcriptions that had already been made available as part of another project. Clearly the non-automated nature of the framework described above would prohibit such a large sample field being selected at this stage, but it is useful to note that in this case (as with Harte who used data from the pre-existing Beatles dataset) the sample field was selected based on a pragmatic consideration. In the case of this research, a number of published transcriptions were available for use in this project, and it is logical to use these to help streamline the process of data extraction. The process of applying the framework makes use of elements of transcription and also direct use of the source recording (this will be fully outlined in the framework application case studies) and in the interest of standardisation, any previously published transcriptions used in the data extraction process can be used primarily as a guide, but nevertheless, having access to a significant number of lead sheet type transcriptions increased the number of songs it was possible to examine in a certain time frame.

The sample field features numerous songs by different artists, and in some cases this includes whole albums. The benefit of this is that artist-specific or album-specific subsets can be examined against the wider context of the whole sample field. Songs from different eras are examined, and similarly this means it is possible to examine era or decade-specific trends, or at least give a sense of the framework's potential to contribute to this.

3.17. Analysis of the Data

A fully populated dataset with information about 300 songs provides a plethora of opportunities for analysis. As Cook writes: "Although analysis allows you to get directly to grips with pieces of music, they won't unfold their secrets unless you know what questions to ask them" (1987, p. 2). Having used the framework described in this chapter to extract data from a corpus of songs to produce a sample dataset, the following chapters constitute an exploration of the types of question that might be asked of and about the data. The analysis and discussion that makes up the following chapters is intended to be demonstrative of how data might be used to address the main research questions of this thesis. This will take the form of multiple analysis case studies within three groups:

- Wholesale analysis of the sample dataset with a particular emphasis on the relationship between lyrics and music.
- Data analysis with a focus on how 'style' might be examined.
- Examples of future applications of the framework.

Wholesale analysis of the sample dataset that focuses on the relationship between lyrics and music is necessary most obviously to address the first part of research question two: 'What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs?', but it is also important in answering research question one: 'Is it possible to develop a tightly-defined methodology that can examine songs holistically (considering music and lyrics together rather than separately)?'. It should be clear now that the framework element of the methodology is tightly-defined, and holistic in the sense that many data features are inherently defined by the music-lyric relationship (such as any information pertaining to structure, as compositional blocks are defined by the repetition or otherwise of both musical and lyrical phenomena). However, it is the data analysis phase of the research that provides a full sense of considering music and lyrics together - looking at synergies and patterns between multiple data features, that might individually pertain only to music or lyrics.

A key advantage of analysing streams of data for the whole dataset is that it starts to give ideas for the average outcomes for data features and conversely it can start to give a sense of what constitutes an outlier. It can also give information about which individual data features have a wide variety of outcomes compared to those with high levels of conformity to a norm – or in songwriting terms, what musical and lyrical practices do the majority have in common, and which are those where there is a higher level of difference of approach?

Because the sample dataset is comprised of so many data features, and by extension a very large number of permutations of these data features in terms of comparative analysis, a selection of case studies have been chosen that demonstrate different analysis approaches. Chapter four does not cover every possible relationship that could be explored, rather some examples are presented. For instance, analysis of data for the 'words per bar' data feature is compared with that of the 'chords per bar' data feature, to give a sense of how related data features might be compared (these two are related in that they give a sense of density for both musical and lyrical phenomena using the same structural metric).

Chapter four also features case studies where metrics have been used to combine data for different data streams, requiring the coinage of terminology specific to this methodology such as 'musical data proportion' and 'lyrical data proportion' which give a sense of levels of repetition in songs. These two new data features are then compared.

A case study in which levels of harmonic variety (as determined by data outcomes for percentage dissonance) are compared with the presence of certain lyrical characteristics is an example of combining numerically expressed data features with multiple-input typologies. This sort of analysis requires some musicological insight because the combination of different sorts of data does not yield mathematical relationships automatically, but nevertheless reveals something about the relationship between musical and lyrical elements of songwriting that have not been expressed in such a way previously.

Generally, basic data analysis techniques are used. Frequency distributions are used for individual data streams where the data feature is expressed numerically. Where the data tends towards a normal distribution this gives an indication that the mean statistic for the sample is likely to be a reliable mean for a larger dataset. Calculating the standard deviation for data features has been used as a strategy to determine outliers for individual data features. A developing sense of what can be considered usual or unusual for certain data features and then for relationships between them can be used to address the first part of research question three: 'How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics?'. Averages generated by the sample dataset provide the objective starting point for confirming or refuting such expectations.

The second part of research question two: 'can this approach be used to explore characteristics of styles or genres through sample field choices?' is addressed in chapters five and six by data analysis with a focus on how 'style' might be examined. On the subject of style, Moore writes:

> For many cultural theorists and theorists of other media, categories of genre seem to have priority over those of style. Style for these writers is more generally associated with ways of playing, singing, writing, etc, i.e. the specific techniques employed by an individual or established group (what I have come to term 'idiolect') and through which their work can be recognized. (2001, p. 2)

In chapter five, the demonstration of how the question of style can be approached involves case studies of subsets of songs from the sample dataset, where membership is defined by conforming to certain characteristics – the employment of specific writing techniques. In terms of the chronology of the research, wholesale analysis of the entire sample described in chapter four was conducted first. During this process of exploring the dataset in a largely exploratory fashion, certain smaller groups started to suggest themselves based on data outcomes. Chapter five features a case study on a group of songs, for instance that feature the highest levels of structural variety (they are recorded as having the most compositional blocks). There is also a group of songs with no lyrical repetition on a structural level (there are no repeated lyrical blocks) and the songs and artists/songwriters that fall into this category then suggests a link between this data feature and a genre of music (folk). Incidentally, genre is discussed secondarily in the context of other sub-groups but is not used as the defining feature of any subset analyses. The main reason for this is that genre definitions either lead to subsets that were too large ('rock' for instance) or too subjective. Also, various sources for genre categorisation demonstrated high levels of discrepancy for the same songs.

Chapter six contains case studies of subsets of songs by individual songwriters or artists where the emphases of the data analyses vary to demonstrate the different ways the data extracted by the framework might be used. There are case studies on songs by Chuck Berry and Red Hot Chili Peppers for instance where the data is analysed with a view to getting a sense of how features of these songwriters' style, idiolect or identity are revealed by this approach. In these cases the data outcomes could be considered in the context of other research or criticism of these artists.

There is a case study of songs by Randy Newman that deliberately considers how the data outcomes compare with Peter Winkler's 1988 essay "Randy Newman's Americana". This and a case study on songs in the sample set by Radiohead are framed in such a way as to address the second part of research question three: 'How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics? How do these patterns relate to expectations about style and genre?'.

Chapter seven features examples of future applications of the framework. These include suggestions of how certain genres that do not appear in the initial sample compare with data averages for the sample dataset. This stimulates discussion of how the dataset might be grown to make the general averages more representative, as well as reflections on how contemporary music production is having an impact on the compositional element of songwriting as well as simply the sounds of records. This chapter may read as an add-on from a methodological perspective, and for good reason. The case studies on hip-hop and structural elements of twenty-first-century pop are included to point towards stylistic omissions in the initial sample that became apparent during the process of data analysis and reflection discussed in chapters four to six. Chapter seven discusses how the data in a larger sample might be affected by the inclusion of songs from these genres.

It bears re-iterating that at all times, the central crux of this approach is to demonstrate the framework's usefulness as a research tool. The variety of case studies is hopefully an engaging and varied combination, and the data analysis that follows does produce some interesting findings in the context of this method, but the findings themselves are not the principal point of the work so much as what they indicate about how this framework can be used. The chapters that follow also seek to periodically place the data in the context of the songs from which it has been extracted to give a sense of how the data and analysis of it might relate to the experience of listening to the songs in question.

3a. Framework Application Case Study – 'Seven Years'

What follows is a step-by-step illustration of the framework's application in practice. For this case study, the song 'Seven Years' by Norah Jones has been chosen. The choice of song in this case is arbitrary. The song was written by Lee Alexander and the recording used as the source text is the earliest recording of the song from the album *Come Away With Me* (2002, Blue Note Records).

The first two metrics are the metre/s employed by the song, and the duration of the recording. The song is entirely in 4, and lasts 145 seconds.

The next step in the data extraction process is to define the compositional blocks that make up the song. See the score below for a condensed visualisation of the song's compositional information which will be used to contextualise the decisions made regarding the definition of blocks.

Fig. 3a.1.

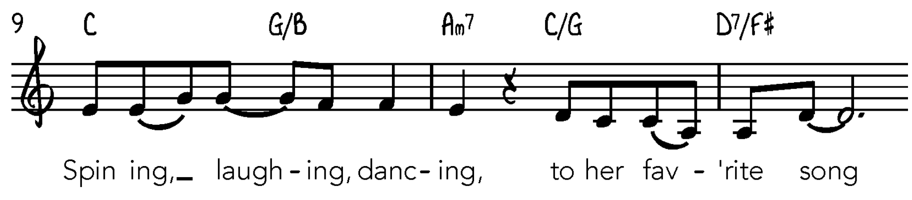
Seven Years

Lee Alexander

This score shows only the first 31 bars of the song, however there is no new (musical) compositional data used after this point. The first 8 bars constitute the song's introduction. Often introduction sections use harmonic material from the song's verse or chorus in an expositional fashion, however this is not the case here, as this is the only time this musical section features, and the accompanying chord sequence is not used in a subsequent section. Therefore these 8 bars constitute an Instrumental Compositional Block, now referred to as Block IA.

Bars 9 to 24 feature the same 8 bar harmonic sequence repeated, followed by a 7 bar harmonic sequence in bars 25-31 that is entirely separate. The definition of compositional blocks is rooted in the concept of repetition, therefore if the two identical 8 bar sections in bars 9-24 feature sufficiently similar harmony then they would be defined as two instances of the same compositional block. The working rule during earlier drafts of the framework was to allow for discrepancies of up to 20% of the respective instances, and this has proven thus far to be useful in allowing for the common sense of repetition of sections we experience as listeners to not be undermined by fine detail technicalities of the framework. There are some melodic discrepancies between these two instances of the melody, therefore it is necessary to investigate the extent of these. Should the compositional block be 8 bars rather than 16, then bar 9 would correspond with bar 17:

Fig. 3a.2.



There is a level of discrepancy here, but this is mostly in terms of phrasing, and in the case of the second example this discrepancy is forced by phrase-shape discrepancies in the lyric. The combination of the overall similarity of the melodic shape, the actual notes in the melody and the identical harmony are sufficient to define the two 8 bar sections as being the same compositional block.

Having established this it is possible to describe the song as having three compositional blocks, of which one is instrumental:

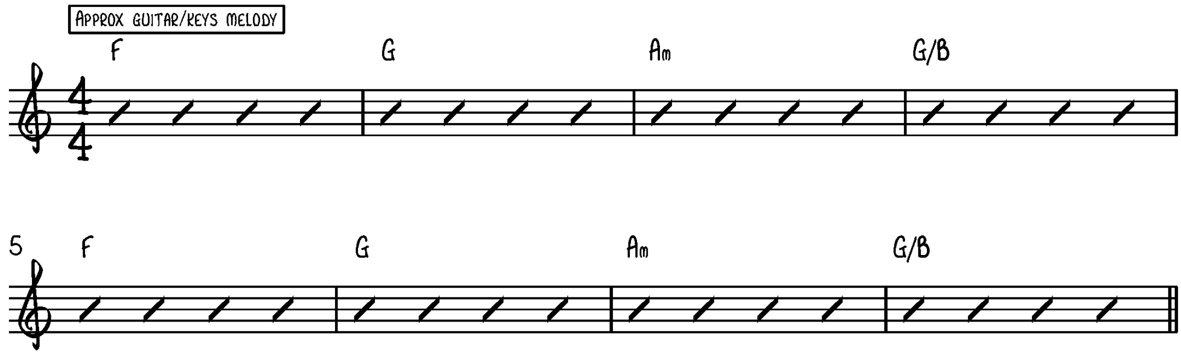
- Bars 1-8 – now referred to as Block IA
- Bars 9-16 – now referred to as Block A
- Bars 25-31 – now referred to as Block B

On the record, after bar 31 of the sketch score, block A occurs three times, once with another set of lyrics, and then twice as the harmonic accompaniment to the solo. This does not constitute a separate instrumental block because the harmony used is identical to that of Block A. Even though the blocks are initially defined by both harmony and melody, it is sung melody with lyrical content that is crucial in defining the block, the use of the same harmony for a solo or instrumental section is an arrangement device and is distinct from the introduction which has different compositional material.

After the solo block B is repeated with the same lyrics as before, followed by block A. The final four bars of block A are repeated for emphasis the final time. This re-use of material from a compositional block that is clearly defined elsewhere does not constitute a separate compositional block.

Block-By-Block Metrics

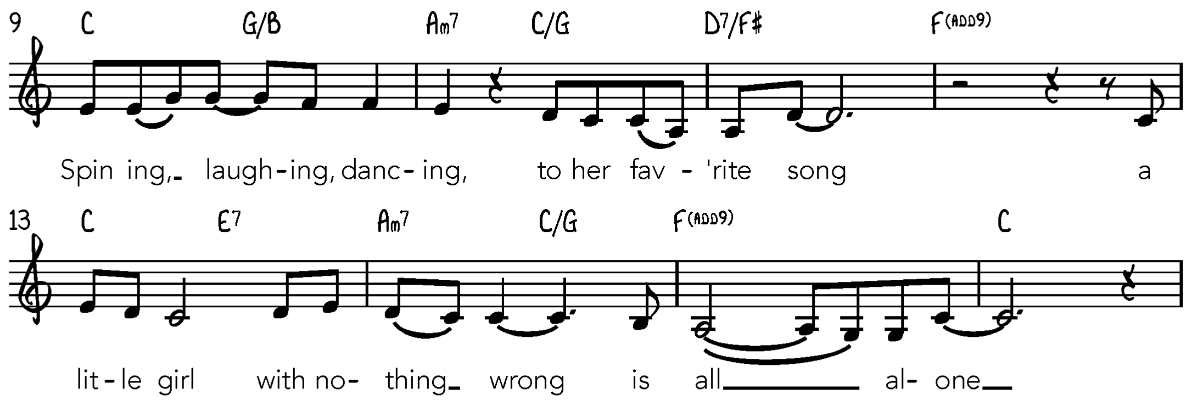
Fig. 3a.3. Block IA



The block's length in bars is recorded (8 bars) as well as its duration in seconds as it first occurs on the source recording (15 seconds).

This is followed by noting which of the three harmonic classifications it falls under. In this case all of the chords in the block belong to C major, therefore this block falls into the first classification. Since all of the chords above consist of triads without upper extensions then the percentage dissonance is recorded as 0%. There are 8 chords in the space of 8 bars, therefore the number of chords per bar is 1.

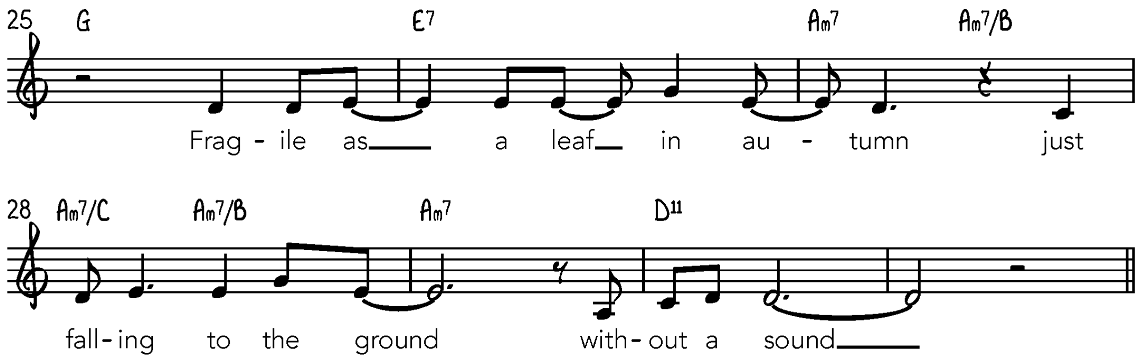
Fig. 3a.4. Block A



- Length (Bars) – 8 bars
- Duration (Seconds) – 15 seconds (0.15-0.30 on the track).

- Harmonic Classification – 2 – This section features two chords that do not belong to the home key of C major. The first of these, D7/F# comes from the dominant key or can be considered a secondary dominant. Similarly the E7 in bar 13 can be viewed as a secondary dominant in that it resolves to a chord in the home key. In this case the resolution occurs (E7 – Am7) but the resolution is not necessary for the definition. Since the non-diatonic chords used are secondary dominants, this block is in the second tier of the classification.
- Percentage Dissonance – 56.25% - The shortest chord duration in this block is a minim, and there are 16 minims in the 8 bars that constitute the block. Chords with upper extensions (Am7, D7/F#, Fadd9, E7) occur for nine minims-worth of the time that the block lasts for. Therefore the figure for percentage dissonance is 9/16 – 56.25%.
- Chords Per Bar – 1.5 – 12 chords are used over the space of 8 bars, 12/8 = 1.5

Fig. 3a.5. Block B



- Length – 7 bars
- Duration (Seconds) – 13 seconds (first instance 0.45-0.58)
- Harmonic Classification – 2 - Although there is arguably a shift to A minor occurring bars 26-27, and bars 29-31 are a ii-V progression in G major, because of the close relationship between G major and the home key of the other sections of the song of C major, this still would fall under the second

classification. The E7 chord is operating in its capacity as a secondary dominant related to the home key. In terms of a shift in tonal centre, although the ii-V in bars 29-31 implies G major, it does not resolve to G, so this is not sufficient to describe a change of tonal centre in the context of the framework.

- Percentage Dissonance – 85.714% – There is only 1 bar out of the 7 in the block that features a chord without upper extensions, therefore the figure for percentage dissonance is 6/7, or 85.71%.
- Chords Per Bar – 1.14 – 8 chords are used in the space of 7 bars. 8/7 = 1.14.

Whole Song Musical Data

- Mean Percentage Dissonance – 47.32 (The sum of the percentage dissonance figures for each block divided by the number of blocks)
- Mean Chords Per Bar – 1.21
- Range – 12 – The lowest note in the sung melody is G3 (the G below middle C) and the highest note in the sung melody is G4. The range is recorded in terms of semitones, therefore the octave that comprises the range of this melody is recorded as 12.
- Notable Intervals – The framework defines a *notable* interval as one that is greater than a perfect 5th. There are no consecutive notes in the melody of this song that are more than a fifth apart in pitch, so no interval is recorded for this song.
- Tonal Centres – 1 – As previously discussed, this song features the use of some harmony that implies keys closely related to the home key of C major, but a wholesale change of tonal centre does not occur.

Melodic Characteristics

Lyrical Blocks

See below for the full lyric annotated with how lyrical blocks have been defined.

Block 1: *Spinning, laughing, dancing, to her favourite song*
A little girl with nothing wrong
Is all alone

Block 2: *Eyes wide open*
Always hoping for the sun
And she'll sing her song to anyone
that comes along

Block 3: *Fragile as a leaf in autumn*
Just fallin' to the ground
Without a sound

Block 3: *Fragile as a leaf in autumn*
Just fallin' to the ground
Without a sound

Block 4: *Crooked little smile on her face*
Tells a tale of grace
That's all her own

Block 1: *Spinning, laughing, dancing, to her favourite song*
A little girl with nothing wrong
Is all alone

A little girl with nothing wrong

Is all alone

The blocks are numbered as they appear in the recording and a set of data about the lyrics within those blocks is extracted at a block level:

Block 1: *Spinning, laughing, dancing, to her favourite song*

A little girl with nothing wrong

Is all alone

- Set to Compositional Block – A – this is vital information in terms of establishing synergies between lyrical and musical elements.
- Occurrences – 2 – There are two full occurrences of the block as well as the repetition of half of the block at the end of the song. Although this repetition is not recognised by this measure – which deals with full occurrences of the block only – there is an option in the lyrical characteristics typology where this element of the song can be recorded.
- Word Count – 16
- Words Per Bar – 2 (The word count – 16 – divided by the number of bars in the compositional block the lyrical block is set to – 8).

Block 2: *Eyes wide open*

Always hoping for the sun

And she'll sing her song to anyone

that comes along

- Set to Compositional Block – A
- Occurrences – 1

- Word Count – 18 (This is a content discrepancy between lyrical blocks that are set to the same compositional block which could be explored in the data analysis, as a result the same is true of the Words Per Bar data)
- Words Per Bar – 2.25

Block 3: *Fragile as a leaf in autumn*
Just fallin' to the ground
Without a sound

- Set to Compositional Block – B
- Occurrences – 2
- Word Count – 14
- Words Per Bar – 2 (word count of 14 divided by 7 – number of bars in block B)

Block 4: *Crooked little smile on her face*
Tells a tale of grace
That's all her own

- Set to Compositional Block – A
- Occurrences –1
- Word Count – 15
- Words Per Bar – 1.875

Whole Song Lyrical Data

- Word Count (Content) – 63 – This is simply the sum of the word counts for the lyrical blocks, the total compositional content once the blocks have been defined.

- Word Count (Uttered) – 103 – The number of words sung on the source recording, including repetitions of blocks and repetitions for emphasis. The discrepancies between the two word counts in themselves could be illuminating in terms of establishing some patterns in the practice of songwriters. Furthermore, the two similar but distinct measures might be more or less appropriate for considering alongside other data streams for analysis and including both increases the number of analysis options.
- Words Per Bar – 2.031 – Simply the mean figure from the individual lyrical blocks, giving an overall idea of lyric density in the context of the song's prevailing metric scheme.

Rhyme Schemes

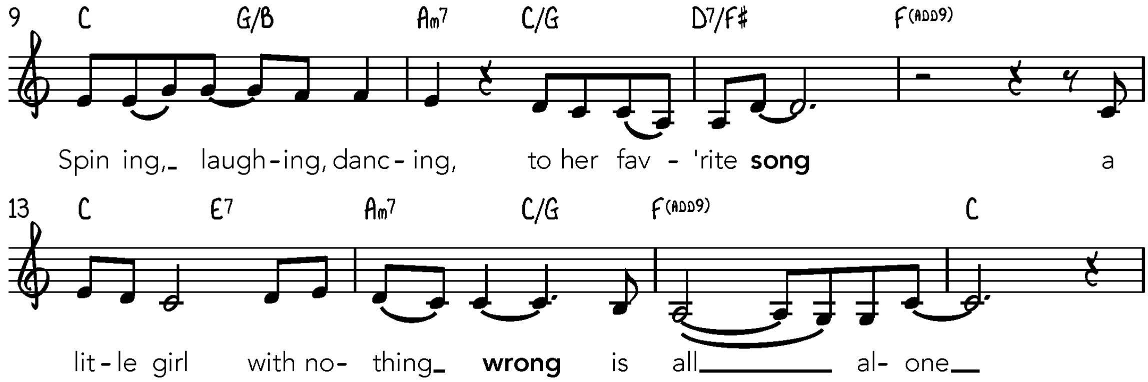
Lyrical block 1 features the same rhyme scheme as lyrical block 4:

Block 1: *Spinning, laughing, dancing, to her favourite song*
A little girl with nothing wrong
Is all alone

Block 4: *Crooked little smile on her face*
Tells a tale of grace
That's all her own

As they appear on the page as poetic stanzas, the rhyme structure of both is best described as AAB, however, the musical setting must be considered. Part of the character of this lyric is that the rhyming syllables appear at different points in their respective musical phrase. The first line (of both blocks) is four bars long and the remaining two are also four bars long. See where the rhyming syllables of *song* and *wrong* are placed relative to one another:

Fig. 3a.6.



Bringing forward the placement of the second part of the couplet gives a sense of movement and pace to the lyric. Whether one were to view this lyric as three lines of differing lengths (AAB) or as two lines where an internal rhyme occurs, the rules of defining rhyme schemes in the context of the framework would still describe this rhyme as AA. The lyrical characteristics column would be used to note that an internal rhyme is being employed. Since it is consistent with the aims of the framework to look to synergies between music and lyrics, and since it is more objective, in this instance the phrase length and therefore the perception of the length of the lyrical lines should be led by the musical phrasing:

Spinning, laughing, dancing to her favourite ***song***
A little girl with nothing ***wrong*** *is all alone*

This will be recorded as an AA rhyme, featuring internal rhyme. The same would also be said for lyrical block 4 which features the same internal rhyme.
Lyrical block 2 provides an interesting alternative rhyme scheme:

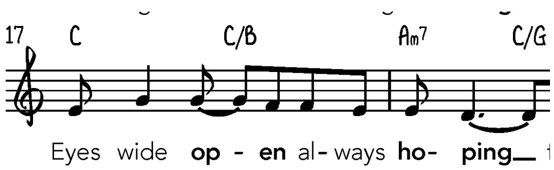
Block 2: *Eyes wide open always hoping* *for the sun*

And she'll sing her song to anyone

that comes along

This block is an example of the importance of comparing the recording with the written lyric. Jones pronounces *hoping* with a soft or silent 'g', and her accent is such that there is little discernible difference between the sound of the syllables *open* and *hopin'*. Due to the relatively even spacing of the rhyming syllables in the musical phrasing:

Fig. 3a.7.



It is possible to define this in isolation as a rhyming couplet and therefore an AA rhyme scheme. The purpose of recording rhyme structures in this part of the framework is to make a note of the types of structure, so even though an AA rhyme structure has now been attributed to two parts of this song's lyric where the rhyming couplets sit quite differently in the musical phrasing, this is not problematic in this instance.

Considering musical phrasing is vital to define the rhyme structure for the second half of lyrical block 2. Via a combination of true rhyme and assonance, ***song***, *any**one*** and *al**ong*** can be said to rhyme. This lyrical phrase can be written thus:

And she'll sing her song

To anyone

That comes

Along

So that each rhyme occupies roughly four beats in the musical phrasing. As such an AABA rhyme structure can be attributed to these lines, although the presence of assonance must be noted in the lyrical characteristics column.

Lyrical block 3 is set to a different compositional block to the other lyrical blocks that have thus far been discussed, the setting of the lyric to the music for this block is such that it is appropriate to consider each line as it is written here:

Block 3: *Fragile as a leaf in autumn*
Just fallin' to the ground
Without a sound

This lyrical block is described as having an ABB rhyme structure. In conclusion, for the whole song it can be said that 3 rhyme schemes are used, AA, AABA and ABB.

Lyrical Characteristics

A number of characteristics present in this lyric have already been identified as part of the analysis of the rhyme structure. For instance, assonance is used in this line in Lyrical Block 3:

*And she'll sing her s**on**g to any**on**e.*

Lyrical blocks 1 and 4 make use of the same rhyme structure, but this differs to the rhyme scheme employed in lyrical block 2. All three of these blocks are set to the same compositional block. This structural discrepancy can be noted by applying the framework.

There is also an example of Oblique (Forced) Rhyme, where in the recording the singer makes *open* rhyme with *hopin'*. Oblique rhyme has a subtly different significance in the context of song rather than written poetry because two texts are used to investigate the lyric: the source recording and the written verse. In examples such as this the aural experience of a true rhyme might be contradicted by the words being written down.

There is a clear use of simile in lyrical block 3:

Fragile as a leaf in Autumn

Finally, the second half of lyrical block one is repeated at the end of the song to give a sense of completion.

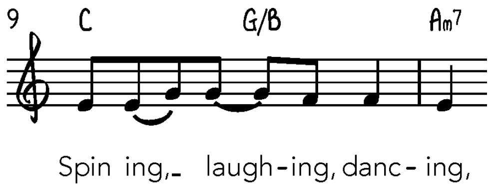
In conclusion the following characteristics would be selected from the typology as being employed by/used in this song:

- Repetition for emphasis
- Alteration of rhyme scheme within repeated compositional block
- Simile
- Assonance
- Internal Rhyme
- Oblique (Forced) Rhyme

Melisma

The use of melisma in this song would be described as *Infrequent/Light* since melisma is employed a handfull of times, and when it is, it is fleeting and often anticipates the note that the next syllable is set to:

Fig. 3a.8.



Semantic Fields

Elements of the lyric come from the following categories:

- Physical World – *Fragile as a leaf in autumn/Waiting for the sun* – imagery from nature is used to describe the nature and actions of a character.
- Motion and Transportation – *Spinning, laughing, dancing/Just fallin' to the ground* – the present participle usage in particular of the verbs to spin and to dance gives a sense of movement.
- Language & Music – *And she'll sing her song* – references to song and dancing are used throughout. The imagery of music, song and dancing is often used to evoke a sense of joy or celebration and in this case the innocence of the abandon of childhood.

4. Exploring Lyrics and Music Data for the Whole Sample Dataset

4.1. Chapter Overview

The framework was used to conduct a process of data extraction using a corpus of 300 songs to populate a sample dataset. This chapter focuses on analysing some of this data in order to address the research aims and questions outlined in the introduction, with a specific emphasis on the relationship between music and lyrics. In doing so the first research question will be addressed in addition to the first part of the second research question:

1. Is it possible to develop a tightly-defined methodology that can examine songs holistically (considering music and lyrics together rather than separately)?
2. What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs? Furthermore, can this approach be used to explore characteristics of styles or genres through sample field choices?

That the framework has been used to generate a significant sample of data via a process of examining songs goes some way to addressing the 'tightly-defined' element of the first research question – but if that data fails to produce anything useful when it is analysed then one could question the point of doing this. It is the process of examining songs 'holistically' that is detailed in this chapter. Furthermore, though the framework is central, it does not constitute the entire methodology. The case studies included in this chapter and those that follow aim to discover what the data reveals about songs, which constitutes the second stage of the methodology. In turn, this will test the framework's usefulness. As for the first part of the second question: this is the central thrust of this chapter.

In order to interrogate what synergies between lyrics and music might be investigated using this framework it is logical to start examining multiple streams of data to look for possible correlations. However, one of the features of the framework is that some of the most statistically basic individual data streams that are generated (e.g. columns in the dataset that feature only one value per cell) are arrived at by a process of data extraction that inherently considers how elements of the music and lyrics relate to one another. As explained previously, the dimensions of a compositional block are informed, in part, by repetition or otherwise of lyrics and likewise, the size of lyrical blocks are informed by this symbiotic structural relationship. For example, in analysing the data for the rate of words per bar (both on a block-by-block basis and as an average for a whole song) only one element of the framework is being considered, but that data is derived from how the lyric is set to the music.

This chapter is comprised of a non-exhaustive set of data analysis case studies which explore different ways the data can be interrogated to examine the relationship between music and lyrics. This was an exploratory process, and this is reflected in the way lines of inquiry initiated by the findings of some of these case studies are followed through into the following section, or have had an influence on some of the content of the following chapters. One approach taken in these case studies is to examine data features for music and lyrics that are directly comparable because of their statistical nature, or the kind of song element they pertain to. The first case study (4.2) compares the data for the 'chords per bar' metric with that for the 'words per bar' metric. Both data features give a sense of density of information and this is the logic behind comparing them. The parameters of the compositional and lyrical blocks that are used to produce this data are linked and themselves informed directly by the music-lyric relationship, meaning layers of this relationship are being explored by comparing the two features. This is followed by a case study (4.3) focusing on how melisma might contextualise a sense of lyrical rate or density, following on from examining the rate of words per bar. This also introduces a feature of this methodology: where different forms of data are compared to attempt to draw a musicological conclusion. Melisma is recorded by employing a classification typology and the various classifications are examined in conjunction with other metrics. Another feature of the dataset is that metrics whose data are expressed in the same way can be used to produce compound data features. This is explored in the next case study (4.4) which introduces the concept of 'musical data proportion' and 'lyrical data proportion', which are again concerned with density. These two data features are expressions of the level of musical and lyrical repetition exhibited by songs that are native to this methodology.

The two case studies that follow this suite of density/proportion-related sections exemplify how single music-orientated data features might be compared with a range of lyrical phenomena (4.5/4.6). Though many permutations of this could have been selected, these sections focus on how the use of multiple metres and the level of harmonic variety respectively compare with lyric-orientated data features.

Sections 4.7, 4.8 and 4.9 feature analysis of data relating to rhyme. Initially this is explored in the context of lyrical and musical structure. The framework defines rhyme patterns based partly on musical setting, so any data features concerning rhyme are inherently defined by an interconnectivity of music and lyrics. Case study 4.8 demonstrates another possible use of the dataset, using statistical outliers for one data feature as a subset. In this case, the highest and lowest numbers of rhyme patterns are compared with other data features. A further line of inquiry is followed in a final rhyme-related case study (4.9) that considers types of rhyme patterns, and explores the relationships between the use of these patterns and other song features.

The next set of case studies (4.10/4.11/4.12) look at the relationship between lyrical characteristics and other data features, beginning by using the 'lyrical characteristics' data feature as an example to discuss the potential uses of multiple input typologies.

This is followed by a more in-depth exploration of the information produced for this data feature and its impact on other data features.

The final analysis section in this chapter (4.13) looks to research question three and addresses expectations about the relationship between music and lyrics.

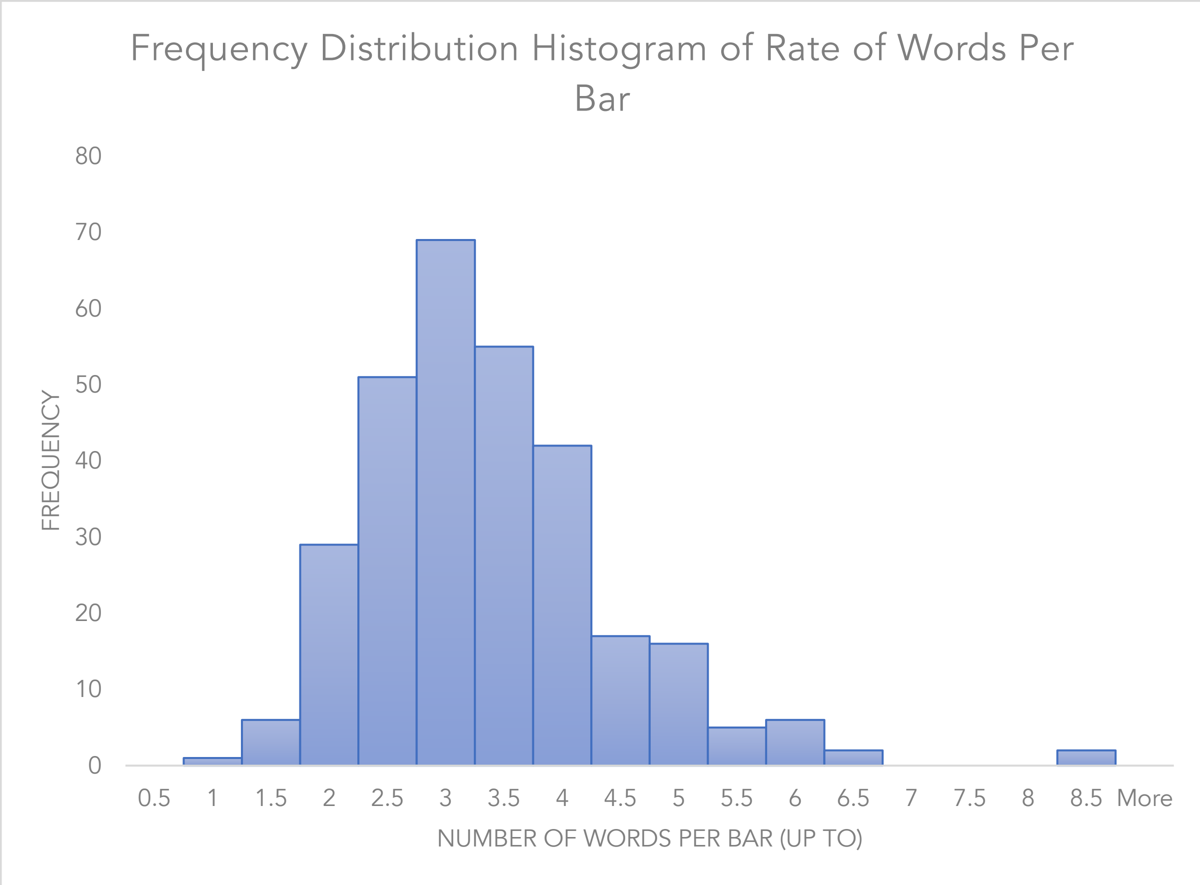
4.2. Chords Per Bar/Words Per Bar – Density Comparison

The vast amount of data extracted by employing the framework allows for more specific questions to be asked of combinations of data streams. A logical relationship to investigate is that between the average chords per bar and the average words per bar. Both metrics give a sense of rate or density and are arrived at in a similar fashion, by taking the average figure from however many blocks (compositional or lyrical) comprise the song. It should be noted that for both measures, the number of times a block is repeated is not considered in this instance.

The average rate of words per bar in the sample is 3.11 with standard deviation 1.02. 230 songs, or 76.67% of the sample have a rate of words per bar that falls within one standard deviation (1SD) of the mean, and 289 songs or 96.33% of the sample fall within 2SD of the mean, indicating that the data for this measure is clustered more closely about the mean than a standard normal distribution[19].

[19] For a normal distribution 68% of values fall within one standard deviation of the mean and 95% of values fall within two standard deviations from the mean.

Fig. 4.1.



The graph above[20] provides a useful visual indication of how the rates of lyrical density are clustered about the mean and mode values, and also clearly indicates the extent to which the extremes of the range are statistical outliers (out of interest the songs in question are 'The Long Day Is Over' (2002) by Norah Jones: 0.69 words per bar and 'Give It Away' (1991) by The Red Hot Chili Peppers with a rate of 8.18 words per bar). These two songs will be discussed in more detail later in terms of the phenomena that account for their unusual rate of words per bar.

[20] Using a frequency distribution histogram rather than a normal distribution line graph shows a sense of how the data is distributed within equally spaced 'bins', giving a sense of how the data is distributed not just in the context of the mean or mode values, but also in the context of the range of values.

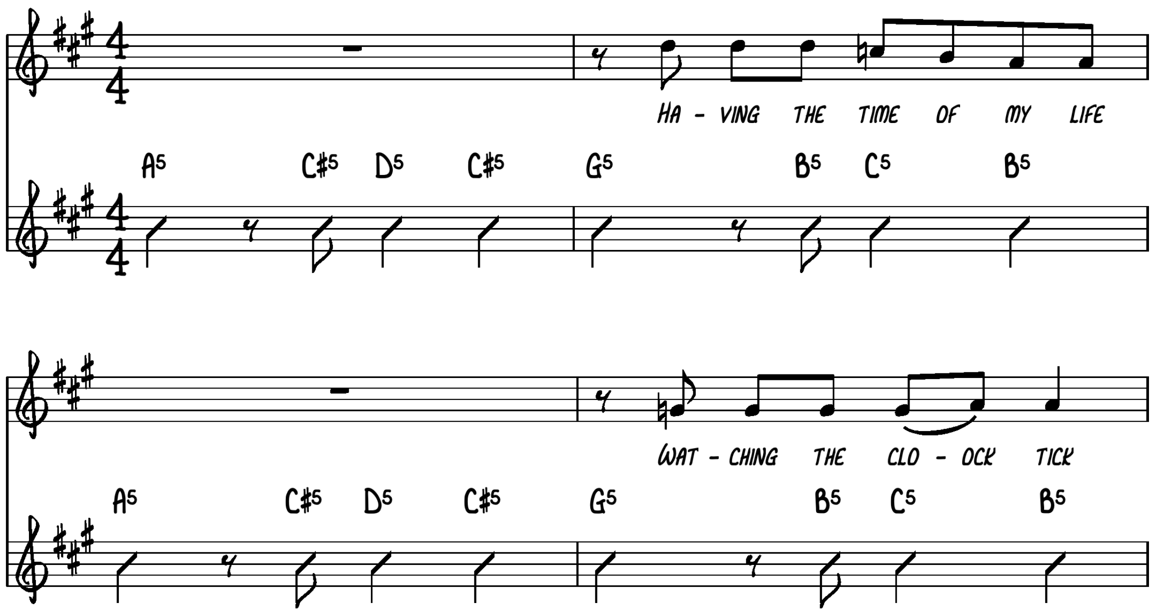
An increased dataset will give a more statistically reliable sense of the average lyrical density in a song, and how individual songs relate to the master dataset. Although, as mentioned above, the data for this metric is gathered slightly more closely about the mean than for a standard normal distribution[21], the data is tending towards a normal distribution which suggests that the mean generated from the initial sample is reliably representative.

The vast amount of data extracted by employing the framework allows for more specific questions to be asked of combinations of data streams. A logical relationship to investigate is that between the average chords per bar and the average words per bar. Both measures give a sense of rate or density and are arrived at in a similar fashion, by taking the average figure from however many blocks (compositional or lyrical) comprise the song. It should be noted that for both measures, the number of times a block is repeated is not considered in this instance.

For context, the lowest rate of chords per bar (holistic average rather than in an individual block) is 0.125, the highest is 2.983, giving a range of 2.858. The average rate of chords per bar is 1.14, with a standard deviation of 0.53. Figure 4.2. below shows a compositional block with a rate of 4 chords per bar, which is the highest figure recorded for a single block in the dataset.

[21] In that more than 68% of observations lie within 1 standard deviation of the mean.

Fig.4.2. 'All The Time' (1997) by Greenday



146 songs (48.67% of the sample) fall within 1SD for both measures and 288 (96% of the sample) fall within 2SD for both measures. This is useful in terms of identifying songs from the sample that can be considered outliers or extreme examples in the context of these two metrics.

Tab. 4.1.

Number of songs	Distribution for 'Chords per Bar'
146 (48.67%)	Within 1 standard deviation of the mean
288 (96%)	Within 2 standard deviations of the mean
12 (4%)	More than 2 standard deviations *above* the mean
0	More than 2 standard deviations *below* the mean

Of the 12 songs which fall outside 2 SD of the mean for chords per bar, none of the songs feature a rate of words per bar that is more than 2SD from the mean. Similarly, there are 11 songs whose rate of words per bar sits outside two standard deviations from the mean, and none of those songs have a rate of chords per bar that is more or less than 2SD from the mean. By this measure (if anything outside 2SD is considered an outlier) no songs in the sample feature *both* an extreme rate of chords per bar and an extreme rate of words per bar.

Of the 11 songs with rates of words per bar that can be considered outliers, only one features a rate that is less than -2SD from the mean (the mean minus two standard deviations). This song, 'The Long Day Is Over' by Norah Jones also features a rate of chords per minute that is less than -1SD from the mean, which makes it the song in the sample that is statistically the sparsest in terms of both harmony and lyrics. This record features a slow tempo, which may partially contribute to this. In this instance the framework enables an analysis of various data streams that can produce statistical representations of something experiential such as a sense of sparsity.

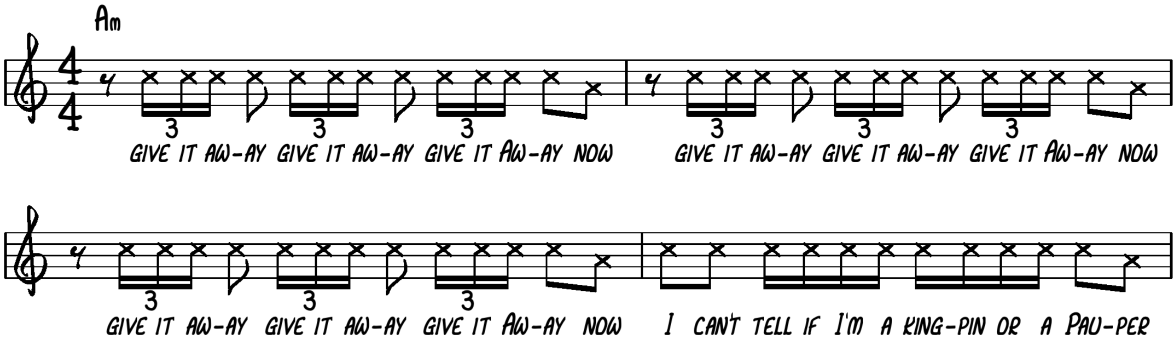
The other ten songs in this sub-set feature a high rate of words per bar. Of these, three have a rate of chords per bar higher than 1SD above the mean, four have a rate of chords per bar that is within 1SD of the mean and three have a rate of chords per bar that is lower than the mean. This does not indicate a strong correlation between a notably high rate of words per bar and any particular rate of chords per bar. However, on an individual basis some interesting qualities become apparent.

Of the ten songs that feature this high rate of words per bar, three are by The Red Hot Chili Peppers. Given that their songs account for 3.333% of the whole dataset, it is significant that they wrote 30% of the songs in this subset. This observation might lead one to interrogate the words per bar averages for all of The Red Hot Chili Peppers songs in the dataset. 90% of their songs featured in the dataset have a rate of words per bar that is higher than the mean for the dataset, 50% of the songs by more than 1SD and 30% of their songs by more than 2SD. This evidence strongly suggests a tendency towards a high level of lyrical density in their songwriting. One might comment that any listener who is familiar with their work, and the influence of rap on Anthony Kiedis' vocal style could say this is fairly obvious. This is positive in terms of the relevance of this methodology, that is to say, strong statistical indicators of compositional phenomena trends being coherent with a listener's experience suggest that the data outcomes have a bearing in reality. The way that the data can be used to explore ideas about style or 'voice' will be explored in more detail in the following chapters.

Another method for exploring lyrical density is to consider the relationship between the total uttered word count and the running time of the track. This gives a sense of lyrical density that is informed less by form and structure. By dividing the total uttered word count by the track length in seconds a figure for 'words per second' is reached. For the whole sample this ranges from 0.2 words per second to 2.45 words per second, with a mean figure of 1.03 words per second. A statistical feature of using this measure to give a sense of lyrical density as opposed to words per bar, is that this measure is unaffected by tempo and metre.

Comparing the two metrics, it is perhaps unsurprising that the same songs are at the very extremes for both measures. In particular, the song with the highest average rate of words per bar by some margin is 'Give It Away' by The Red Hot Chili Peppers (8.18 words per bar average), and this is also the case with its rate of words per second (2.44 words per second). This means not only that there is a high level of lyrical density in the compositional blocks with lyrics, but also that the lyrical density throughout the track is also notably high relative to the rest of the sample field.

Fig. 4.3. 'Give It Away' (1991) by Red Hot Chili Peppers – An Example of a high rate of words per bar



One of the features of the application of the framework is that it can produce results where certain songs present themselves as outliers, or the single most extreme cases for a particular data feature, which might lead one to interrogate them more closely. This is the case here with 'The Long Day Is Over' by Norah Jones. During this initial data extraction period, short repeated lyrical phrases in otherwise unrepeated lyrical blocks were not considered sufficient to determine a separate block. As a result, this particular song was interpreted as featuring only one compositional block, in spite of a single repeated lyrical phrase. This logic is sound in instances where a compositional block is 16 bars in length and one bar of lyrical material is repeated in an otherwise non-repeated block. However, due to the sparseness of this particular song, in hindsight, not recognising this repeated phrase as a separate compositional block could arguably miss some of the structural significance of this particular line. The effect that this decision has on some of the data is made slightly more significant because the decision to interpret this song as having only one compositional block, and not recognising the repetition of some of the material at a structural level means that the song presents as an outlier for certain data features (as mentioned above in terms of the relationship between its words per bar and chords per bar averages, and also in that it presents as one of a group of songs with 100% lyrical data proportion – this will be discussed later). Indeed this is what led to a review of the data for this song in particular. This is not a failing of the framework – rather that closer consideration of an outlier has led to a re-calibration of certain data extraction rules.

For the purposes of this project, this will not be 'corrected', but rather future applications of the framework for data extraction will benefit from this metric being even more tightly defined (as was mentioned in chapter three).

4.3. Considering Melisma

Another data feature that could add context to the idea of the rate or density of lyrics in a given song is the melisma typology. Though measuring the number of words per bar across a large group of songs can start to give a good sense of what is considered within and without an expected range, it does not give a sense of syllabic rate or melodic rate. For this reason, the decision to record five melisma classifications was made[22]. See the table below for a breakdown of how the songs in the sample are distributed for this measure and how it relates to their lyrical density:

Tab. 4.2.

Melisma Classification	Average Rate of Words Per Bar
None	3.58
Infrequent/Light	2.99
Infrequent/Heavy	2.78
Frequent/Light	3.22
Frequent/Heavy	3.05

[22] One should bear in mind the concession made in chapter 3 that this data feature relies heavily on interpretation of the individual doing the data extraction and is one of the more loosely-defined features.

Given that the mean figure for the rate of words per bar for the whole sample is 3.11, it seems that songs that feature no melisma are more likely to have a higher rate of words per bar. There is a level of logic to this relationship. It is interesting however, that the data seems to show that songs that make infrequent use of melisma have a lower rate of words per bar on average than those that make frequent use of it. Clearly there is not a linear relationship between levels of melisma and lyrical density in the sense of a kind of density compensation.

In conclusion – it seems as though there is a relationship between the rate of words per bar and the use of no melisma, but in circumstances where a level of melisma is employed, there does not seem to be a direct relationship. Given the varied styles of song represented by the dataset this arguably suggests that variety of melodic density exists and this is the factor that explains this lack of clear linear relationship.

Comparing use of melisma with melodic characteristics: 83.33% of songs recorded as making no use of melisma are recorded as featuring a frequently repeated phrase or interval. In circumstances where melisma occurs, a melismatic passage could constitute one such repeated phrase or include the repeated interval, so these phenomena are not mutually exclusive. This is just one of many possible correlations that can be foregrounded by the data produced by the framework.

4.4. Musical Data Proportion and Lyrical Data Proportion

Continuing on from exploring an idea of density in terms of harmony and lyrics, comparisons can be made between data derived from individual blocks and data pertaining to a whole song. One might consider this the relative amount of general repetition of compositional data within a recording[23]. In order to do this, it is possible to take the sum of the lengths of each compositional block and instrumental

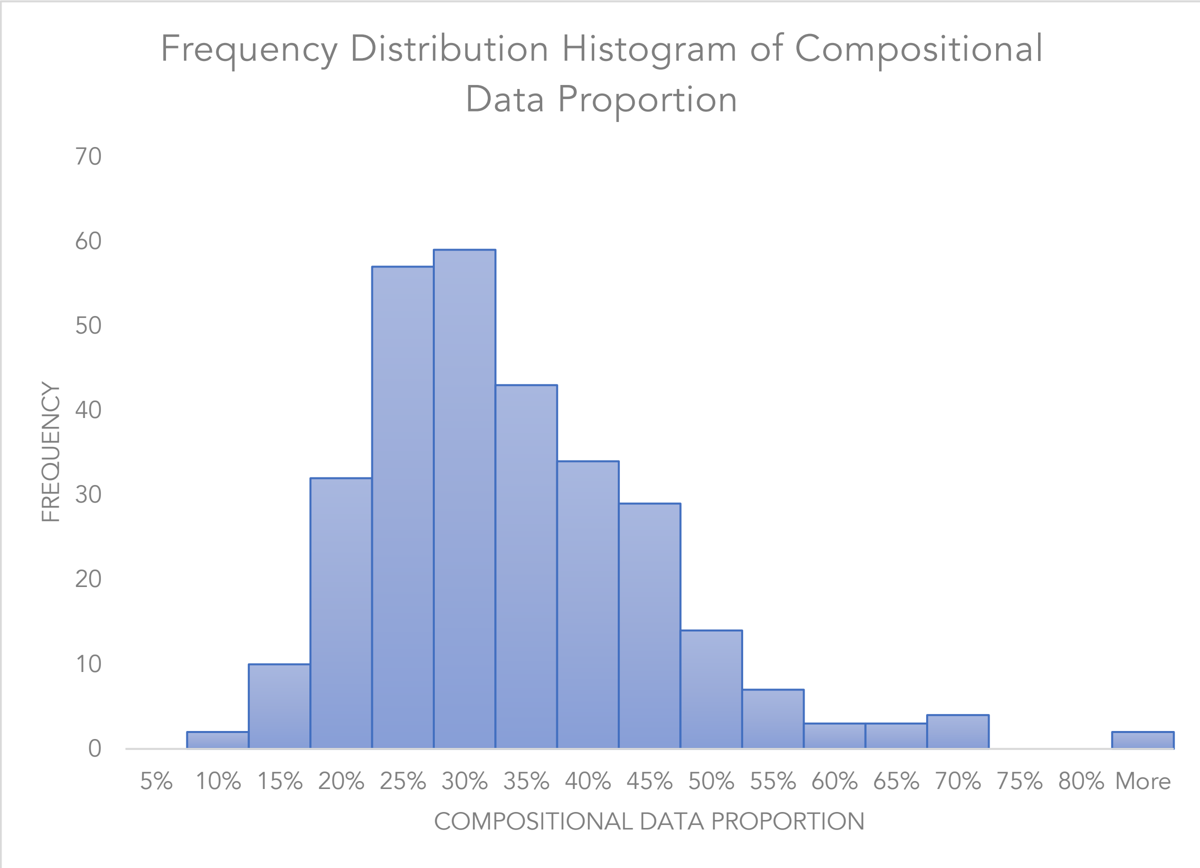
[23] This is similar to what Morris (2017) refers to as 'compression' but taking musical content into account as well as lyrics.

compositional block for each individual song to give a figure in seconds for the amount of unique compositional material, and then take the total running length of the track in seconds to generate a proportion as a percentage. This will be hitherto referred to as the musical data proportion. In musical terms, a song that is completely through-composed with no repeated sections would have a musical data proportion of 100%. In terms of the framework, such a song would be said to consist of only one compositional block and one lyrical block. The greater the amount of sectional repetition, the lower the musical data proportion.

The lowest score for the sample of 300 is 6.99%. The song in question is 'Promised Land' (1964) by Chuck Berry, which features only one compositional block 10 seconds in length that is repeated throughout the track that runs for 145 seconds. The highest score is 83.33%: 'Gainsville' (1995) by Randy Newman. This song features two compositional blocks and the sum of their lengths is 175 seconds compared to a total length of 210 seconds. All of the Chuck Berry songs featured in the dataset have relatively low percentages for this measure, this is informed by the fact that much of his music is based around the 12-bar blues, in the case of 'Promised Land' there is only one 12 bar blues verse that is repeated throughout the song with different lyrics[24]. 'Gainsville' on the other hand comes from Randy Newman's 'Faust' – a concept album based on a stage show. The song serves the purpose of character establishment and has recitative-like qualities which informs its largely through-composed nature. It must be seen as another good indicator of the usefulness of the data derived through the application of the framework that songs that are found to be at the extremes of the range for a particular measure in terms of data, are also remarkable experientially.

[24] The amount of unique musical material is just 12 bars.

Fig.4.4.



The mean percentage for this measurement is 31.25%, and as is visible in the graph above, there is significant clustering about the mean. 73.33% of songs in the sample have a figure that is within 1SD of the mean. This points towards a strong sense of what is considered the norm in terms of the amount of compositional material that makes up songs, and how much of that material is generally repeated.

A similar, and structurally linked metric is the equivalent comparison between the 'uttered' word count and the compositional word count (the sum total of word counts for lyrical blocks, not counting repetitions) – the lyrical data proportion. The average proportion is 71.44%. The fact that this figure is much higher than the similar measurement for musical compositional content is hardly surprising when we consider the largely strophic nature of songs. It stands to reason that there is statistically a higher level of musical repetition than lyrical repetition, indeed this is to be expected due to the way that most songs feature verses whose lyrics change whilst the music stays the same. Nevertheless, it is interesting to be able to compare this relationship in this way, and as with other metrics that are contextualised by the framework's definition of compositional and lyrical blocks, this is an original way of expressing this relationship with figures.

The relationship between the sum of compositional block lengths and total length is more straightforwardly temporal, rather than the uttered/total word count comparison which is related due to the same compositional blocks being at the core of the lyrical block definition, but affected by other factors. It is possible for instance for the percentage (of the proportion of lyrical content to total word count) to be fairly high in spite of many repetitions of a lyrical block with a very low word count compared to other lyrical blocks within the song. This is perhaps why there does not seem to be a direct correlation between the two measures across the dataset, rather there is a lot of variety.

A lower figure for lyrical data proportion can be seen as indicative of higher levels of lyrical repetition within a song in general terms. However, because of the issues outlined above to do with musical setting, and how the definition of the size of a compositional block can dictate the size of a lyrical block this cannot be assumed uniformly (a four bar lyrical/melodic phrase repeated with different harmonic accompaniment would constitute a single lyrical block with a repeated line within it, as opposed to if the repeated line used the same chord sequence as before – in which case it would constitute two iterations of a lyrical block of half the length/size).

The lowest lyrical data proportion in the sample is 22.4% - 'Three Little Birds' (1977) by Bob Marley. This song only has two lyrical blocks; a short chorus that is repeated 9 times and a single verse that is stated twice[25].

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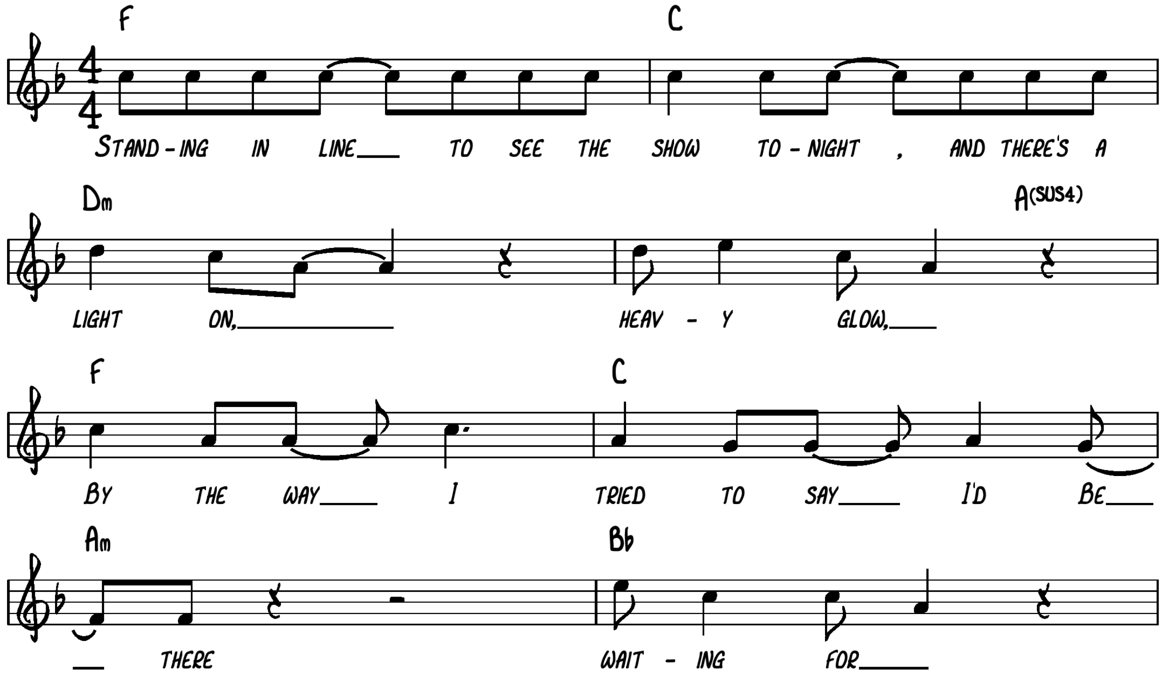
[25] The terms 'chorus' and 'verse' are used here casually to describe how a listener might perceive the song – the framework recognises these sections as compositional blocks A and B.

It is possible for the lyrical data proportion to be less than the musical data proportion if the song features substantial amounts of compositional material without lyrics (lengthy Instrumental Compositional Blocks in terms of the framework) or if there is a repeated lyrical block set to multiple compositional blocks. This is only recorded once in this initial sample of songs in 'By The Way' (2002) by Red Hot Chili Peppers. Lyrical block 1 is set alternately to compositional blocks A and C, however the same is also true of lyrical block 3, which rather evens out the effect of this on the data meaning the musical data proportion is still less than the lyrical data proportion for this song.

Fig. 4.5. 'By The Way' (2002) by Red Hot Chili Peppers: Lyrical Block 1 set to Compositional Block A

Fig. 4.6. 'By The Way' (2002) by Red Hot Chili Peppers: Lyrical Block 1 set to Compositional Block C



There is only one song in the sample whose lyrical data proportion is lesser than the musical data proportion: 'Roll With It' (1995) by Noel Gallagher, which has a lyrical data proportion of 37.74% compared to a musical data proportion of 38.91%. This is due in part to the inclusion of an instrumental section that has no lyric attached to it which increases the musical data proportion. The outro also features multiple repetitions of a short lyrical block (which drives the lyrical data proportion down). It is worth reiterating for clarity that the lower the lyrical or musical data proportion, the greater the amount of repetition of compositional or lyrical blocks.

Though there are no songs in the study that are statistically through-composed (a compositional data proportion of 100%) there are 28 songs that have a lyrical data proportion of 100%. This statistic provides an opportunity to critique an element of the data extraction process. A number of the songs in this group are genuinely through-composed lyrically, such as 'Gypsy' (1982) by Stevie Nicks, 'Souvenir' (1974) by Billy Joel 'Little Wing' (1978) by Jimi Hendrix and 'Up the Junction' (1979) by Glenn Tillbrook and Chris Difford. However there are some songs within this group that have a degree of lyrical repetition that is not recognised by the statistics resulting from a caveat with respect to lyrical proportion in the rules for determining compositional blocks (the repeated lyrical material must last for longer than 1 bar in order to require a split from the larger potential block). One of these songs is 'Mexico' (1975) by James Taylor. This song features what a listener may describe experientially as a chorus due to the way the word 'Mexico' is repeated at the start of the section, and the fact that it is a repeated musical section that follows the verse, and there is a level of structural expectation that such a section is likely to be a chorus. Indeed this song could be a useful case study in what musical phenomena contribute to a sense of chorusness beyond the simplest definition of a repeated lyrical block. However, the repetition of the song title is followed by a different set of lyrics each time. Here are three of the song's lyrical blocks, each set to compositional block 2 (the compositional block in question):

Lyrical Block 2

Oh, Mexico
It sounds so simple I just got to go
The sun's so hot I forgot to go home
Guess I'll have to go now

Lyrical Block 4

Oh, Mexico
It sounds so sweet with the sun sinking low
The moon's so bright like to light up the night
Make everything all right

Lyrical Block 6

Oh, down in Mexico

I never really been so I don't really know

Oh, Mexico

I guess I'll have to go

In this scenario it is clear that a certain sense of 'chorusness' is achieved by the repetition of the word' Mexico' at the same place in lyrical blocks 2 (L.B. 2) and 4 (L.B. 4) but since this lyrical material lasts for only a bar it does not constitute a separate compositional/lyrical block by the data extraction rules. This is reinforced by the fact that the equivalent bar in L.B. 6 is lyrically different (with slight melodic discrepancies within the parameters of the framework). In terms of how the definition of these blocks impacts on how other compositional data is recorded for this song, this decision-making seems appropriate, and this is an unusual case in the sample. However, it is worth noting that there can be some experiential differentiation for songs that have a 100% lyrical data proportion.

A scenario that also falls under this umbrella is the use of a short refrain-like phrase at the end of otherwise different lyrical blocks, as in 'No Particular Place to Go' (1964) by Chuck Berry, where the title is repeated at the end of each lyrical block, but set to a melody that lasts for less than a bar of a 12 bar compositional block. It makes sense that the framework recognises Berry's use of the 12 bar blues sequence, indeed it helps point towards a strong tendency in his compositional practice, however it underlines the point that whilst a lyric that is purely through-composed would always have a lyrical data proportion of 100%, having a lyrical data proportion of 100% does not necessarily guarantee a complete lack of repetition. Indeed, the brevity of the repeated phrase in this case is the reason for it not being structurally recognised by the framework, but is arguably this that makes it significant to the listener.

There is no clear-cut relationship between percentages for lyrical data proportion and compositional data proportion for the whole dataset, and this is also true for the group of songs with a lyrical data proportion of 100%. In fact, both the second highest and the lowest compositional data proportion percentages in the dataset come from this group ('The Promised Land' Chuck Berry – 6.99% and 'Souvenir' Billy Joel – 80.83%.).

A slightly different, but related, area for investigation is to get a sense of the amount of general lyrical content, whether repeated or otherwise, that comprises a song. This is an example of where the data for the 'song' comes from the chosen recording. As discussed, by dividing the uttered word count by the duration of the track in seconds, one can obtain a simple figure that can give a sense of the lyrical density from a more straightforward perspective. Furthermore, it is interesting to consider the relationship between this measure where repetition is not a factor and where the temporal element is a constant, with the words per bar average which is defined by musical structure, and is inconstant in the respect that the temporal element (number of bars) is subject to metre and tempo.

4.5. Relationship Between Use of Multiple Metres and Lyrical Phenomena

Of the 300 song sample, 255 songs are in 4, with this as the only metre employed. With such a dominant figure for this data feature it makes it more likely that interesting correlations or synergies between this feature and others are more likely to be seen in the songs that don't conform to this characteristic.

The next most populated group is songs in 3, which accounts for 11 out the 300. Looking at the songs that make up this group, however, raises questions about the level of interpretation involved in recording the data for this feature. This group includes 'Sweet Baby James' (1970) by James Taylor, 'Not The Girl You Think You Are' (1996) by Neil Finn (Crowded House) and 'Come Away With Me' (2002) by Norah

Jones, that are fairly unambiguously in 3, with pseudo-waltz figures. Albeit at brisker tempi, the same can be said for 'America' by Paul Simon and 'The Times They Are A-Changin' (1963) by Bob Dylan. However, one might argue that '(You Make Me Feel Like) A Natural Woman' (1967) by Carole King features compound time bars of six quavers (instead of two bars of three crotchets) or even bars of 12 quavers (rather than 4 bars of 3 crotchets). Clearly one might organise a notational transcription of these songs with any of these three with the same eventual aural effect, but as for what is the *correct* time signature there is often a grey area (indeed this is often a cause for debate amongst musicians in bands – especially when working without a score).

This is further clouded by considering the three songs recorded as being in 6. 'Syncronicity I' (1983) by Sting can be described relatively non-controversially as being in 6/4. 'Subterranean Homesick Alien' (1997) on the other hand is a classic example of 6/8 used in a pop context, with two strong beats sub-divided into groups of three quavers (with the bass drum on the first quaver and the snare drum on the fourth – giving a sense of a back beat). One might argue however that this could be described as being in 2, since this is the over-riding emphasis of the groove. To confuse matters even further, there are examples within the predominant group of songs recorded as being in 4 such as 'My Book' (1990) by The Beautiful South that have implied triplet quaver figures.

It appears from this analysis, that the absolute validity of the data recorded for this particular feature is possibly undermined by the interpretative nature of many examples. [26] However, one element of this data feature that is not undermined by this is the ability it affords one to look at songs that use multiple metres, since regardless

[26] During the data collection process, when using a published transcription, the decision was made to go with the metre selected by the transcriber, with a view to removing bias from this issue of interpretation. It is possible that the bias was merely outsourced, however.

of the accuracy or consistency of how various metric schema are recorded – the use of more than one is a separate matter.

Tab. 4.3.

Metre	Frequency	Proportion of Sample
3	11	3.67%
4	255	85%
6	3	1%
Multiple	31	10.33%

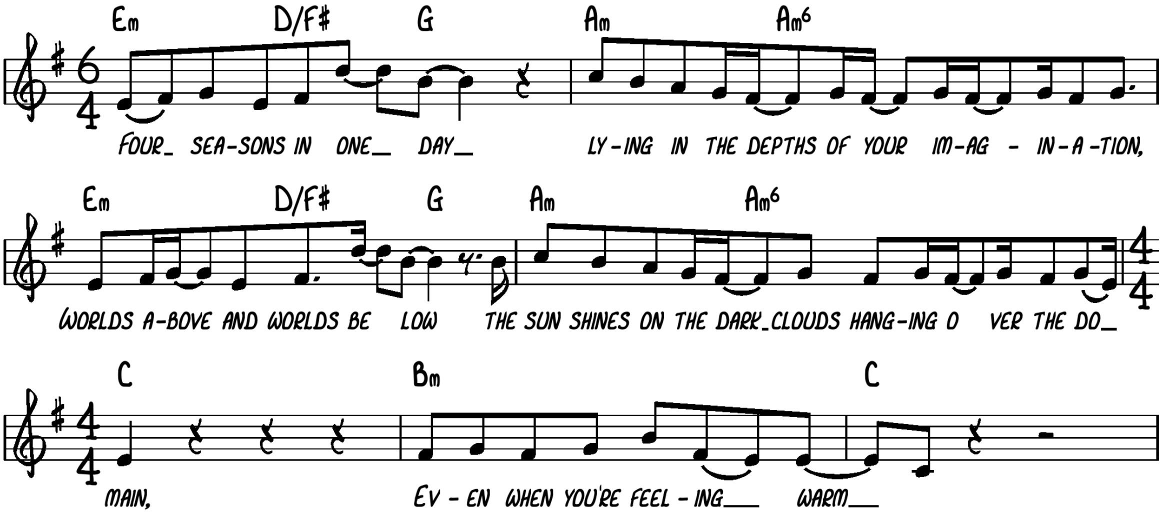
Of the 31 of songs that feature multiple metres, 23 of them are predominantly in 4, also with bars of 2 or 6. Metrically these can be seen as similar since they are different ways of describing an extra two beats in certain parts of the form (whether these are recorded in the form of discrete bars of 2 or 6).

For many of these songs, the appearance of a second time signature occurs in particular moments, for the visceral effect of disturbing the metre for excitement or emphasis. For instance, the sole 3/4 bar in 'Livin' On A Prayer' (1986) by Bon Jovi occurs at the end of a fourth compositional block, immediately before a wholesale key change up a minor third. The effect is that beat one of the first bar of the key change chorus arrives 'early', which emphasises the drama of the moment.

On the other hand, other examples demonstrate a more consistent approach, moving back and forth between time schemes. Take 'All You Need Is Love' (1967) by Lennon and McCartney as an example. The metre changes in the verse add interest and make for interesting phrase shapes, but this feature also contextualises the anthemic chorus in a regular 4 – arguably emphasising the 'chorusness' of this repeated compositional and lyrical block.

There are also examples where the grey area around metre and 'feel' or 'style' that causes a problem for discrete metric classification, is in fact part of the effect of the music. In 'Four Seasons In One Day' (1991) by Neil and Tim Finn (Crowded House), the first compositional block (the verse) is in 6/4, and the second (the chorus) is in 4/4. The drum part on the record is fairly simplistic, and essentially in 2/4 – leaving the phrase length of the melody to give the sense of 6 or 4.

Fig. 4.7. 'Four Seasons In One Day' (1991) by Crowded House

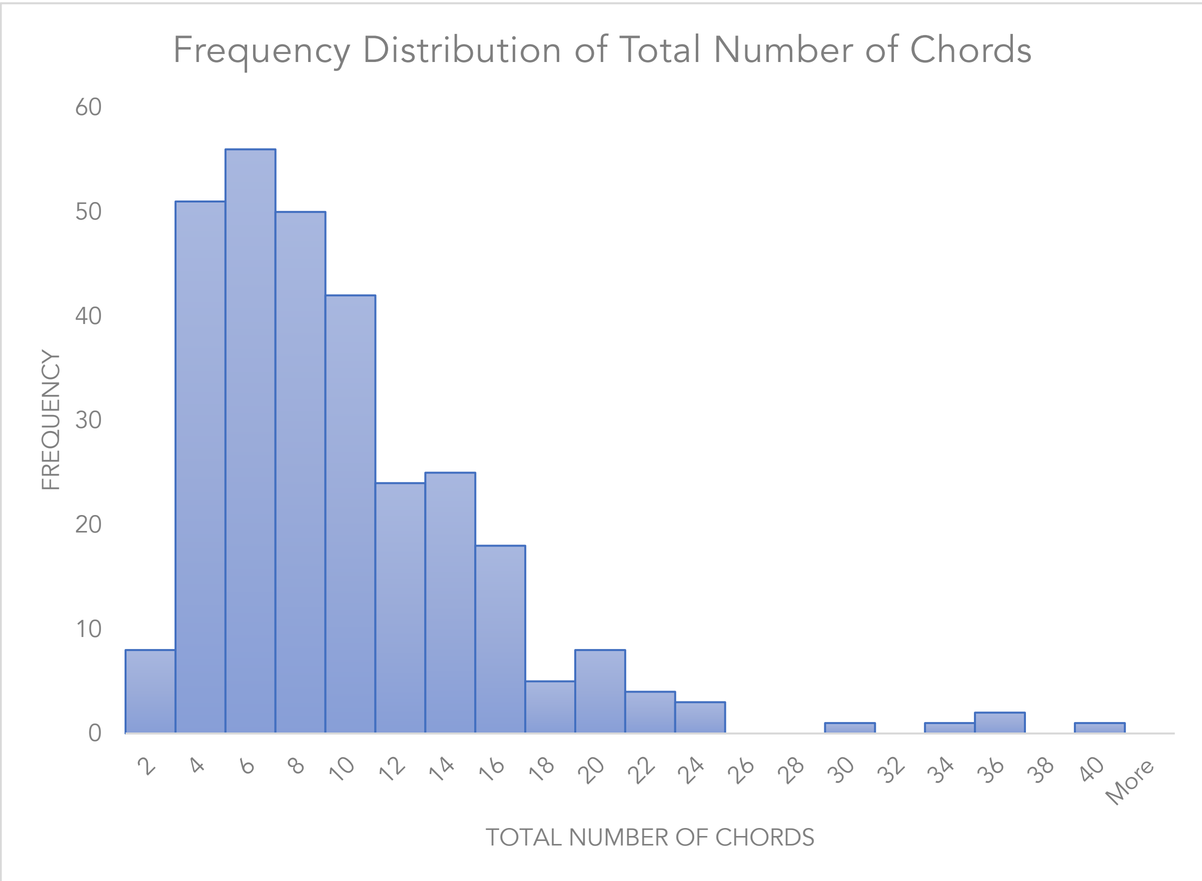


In terms of a potential link between a variety of time signatures and general sectional variety, it appears that there is no relationship. The mean number of compositional blocks with lyrics used in this subset is 2.75, which is slightly lower than the mean for the whole sample, and the mean number of total compositional blocks (including instrumental blocks) is slightly higher than the mean for the sample field at 3.26. Similarly, there appears to be no link between songs featuring in this subset and a sense of increased melodic variety. The mean number of melodic characteristics recorded for this subset is three, the same as the whole sample field and there are no specific emergent characteristics that feature disproportionately in this subset. The mean melodic range of the songs in this subset is slightly higher than the sample average (15.74 compared to 14.78), but not by enough to strongly indicate a relationship between these features.

4.6. Harmonic Variety Compared With Lyrical Variety

The total number of different chords used in a song is recorded in the dataset, giving one sense of harmonic variety. For the purposes of this feature, different extensions of the same chord function are counted as separate chords (Am9, Am7 and Am would be recorded as three separate chords). For the 300 songs in the sample dataset, the average number of chords used in a song is 9.16. The fewest chords used in a song is 2, with one song in the dataset using 40. It is also worth noting that if a key change occurs and a previously recorded compositional block is repeated in the new key, the new chords (i.e. those that haven't already been used in the song) are counted in this feature even though this will not constitute a new compositional block.

Fig. 4.8.



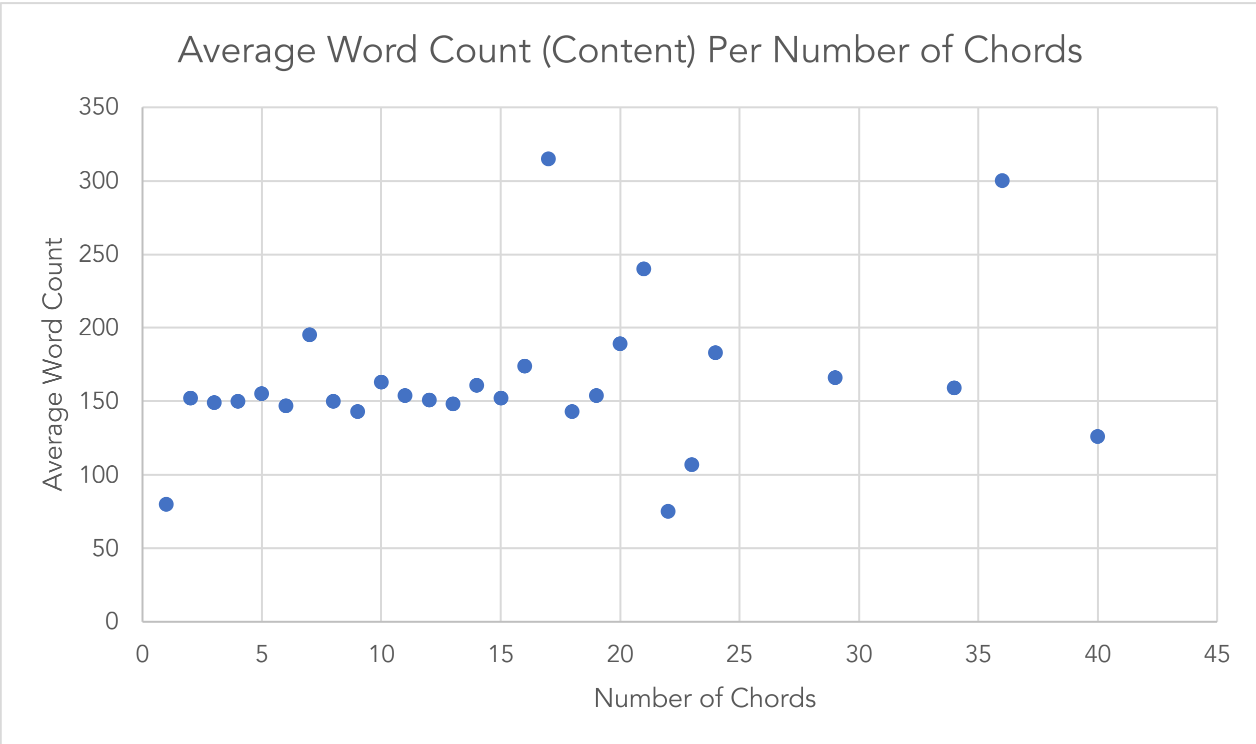
Based on the premise that the number of chords tells us something about the level of harmonic variety used in a song and that the word count (content) tells us something about the amount of lyrical variety, it seems sensible to compare the data for these two features. Below is a table showing the average word count (content) for songs with that number of chords:

Tab. 4.4.

Number of Chords	Average Word Count (Content)
1	80
2	152
3	149
4	150
5	155
6	147
7	195
8	150
9	143
10	163
11	154
12	151
13	148
14	161
15	152
16	174
17	315
18	143
19	154
20	189
21	240
22	75
23	107
24	183
29	166
34	159
36	300
40	126

For songs with 2-15 chords, the averages are the most meaningful since these are the most frequent totals. The same information is perhaps better represented in the form of a scatter diagram.

Fig. 4.9.



It is clear that for songs with 2-16 chords (the most frequent results for these features in the dataset – therefore with the most meaningful mean result for the word count) that the word count averages are densely clustered near the mean for the dataset as a whole (156.86). For songs whose chord total falls outside this group, the average word counts, which in many cases are informed by only one or two inputs, are more varied, but with no discernible positive or negative correlation. One might summarise for the data shown here that those songs whose chord total falls outside 2SD of the mean (for this data this would be those songs with 21 chords or more) there is a higher likelihood that the word count will also be a relative outlier. Nevertheless, there is certainly no sense for this data that a high or low number of chords used within a song has a direct bearing on the amount of lyrical content in terms of words used.

This is not the same as saying there is no relationship in practice, rather that the nature of the relationship is such that one element is not directly connected to the other. This is the sort of finding that can be identified objectively by comparing individual music-related data features with lyric-related features in this way.

4.7. Considering Lyrical and Musical Structure - Rhyme

Rhyme schemes represent a way of structuring or organising lyrics, so it follows that considering the information recorded in the rhyme-related features of the framework alongside some features that deal with musical structure is logical.

The average number of rhyme schemes recorded per song[27] is 2.13, with as many as 6 rhyme patterns recorded in one instance ('Thriller' (1983) by Rod Temperton).

Tab. 4.5.

Number of Rhyme Patterns	Frequency	Proportion of Sample
0	10	3.33%
1	71	23.67%
2	120	40%
3	72	24.33%
4	22	7.33%
5	3	1%
6	1	0.33%

Using the same sort of logic that led to comparing harmonic variety with lyrical variety in the previous section, the number of rhyme patterns can be considered to be comparable with the number of compositional blocks since both data features deal with structure. The table below shows the average number of compositional blocks with lyrics and also the average for the total number of compositional blocks

[27] During data collection a record was made of the rhyme schemes used (e.g. ABAB) and the number of different rhyme schemes employed.

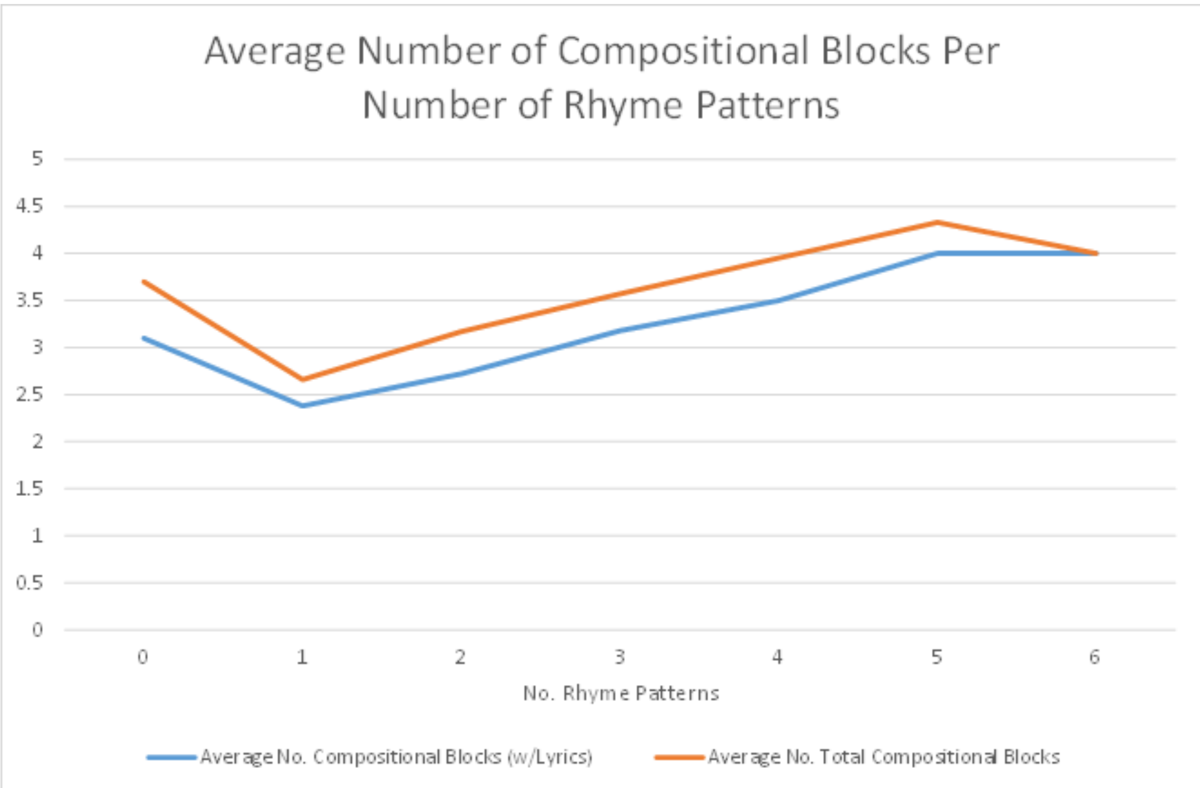
(including instrumental blocks) for songs with the corresponding number of rhyme patterns:

Tab. 4.6.

No. Rhyme Patterns	Average No. Compositional Blocks (w/Lyrics)	Average No. Total Compositional Blocks
0	3.1	3.7
1	2.38	2.66
2	2.72	3.17
3	3.18	3.57
4	3.5	3.95
5	4	4.33
6	4	4

This relationship is perhaps better represented in line graph form:

Fig. 4.10.



Looking specifically at the average number of compositional blocks with lyrics, from 1 rhyme scheme upwards there is clear correlation between the number of blocks and the number of rhyme schemes. This stands to reason, as it follows that a higher amount of compositional material is likely to result in greater variety of any number of song elements.

The average number of compositional blocks used in songs that feature no rhyme scheme is the only result here that contradicts this trend. Perhaps a reason for this is that the absence of rhyme is considered fairly stylised and has an impact because it is rarer than the use of rhyme. In this sense, the writers included in this group may be different to those whose songs are clustered together with 1 or 2 rhyme patterns simply because their preference is for simplicity of rhyme (Chuck Berry is an example of this).

Neil Finn however has songs in the sample that feature 0, 1, 2, 3, 4 and 5 rhyme patterns, as well as eight out of the ten songs of his in the sample that feature an alteration of a rhyme scheme in a repeated block[28]. Half of his songs feature assonance. This indicates that variety of rhyme is part of his practice, and his writing a song with no rhyme patterns is consistent with that apparent pursuit of variety.

Looking at the number of rhyme patterns used in conjunction with compositional block totals gives an opportunity to consider the idea of rhyme being a structural device, but one might also consider rhyme as a stylistic device alongside other features that affect the character of a song. For instance: inquiring as to the relationship between the number of rhyme patterns in use and percentage dissonance. For the purposes of data handling, this will consider the average percentage dissonance for each group, a figure which is an average of an average.

[28] This is one of the options in the 'lyrical characteristics' typology, and is selected when different rhyme patterns are used in two separate lyrical blocks that are set to the same compositional block.

This will fail to recognise some interesting detail that might occur on a block-by-block basis, however in this instance the idea is to see if there is an overall indication of a general relationship.

Tab. 4.7.

Number of Rhyme Patterns	Average Percentage Dissonance
0	21.69
1	32.31
2	32.54
3	25.53
4	26.78
5	40.45
6	85.42*

**only one figure*

This is the sort of analytical question whose results will become more meaningful with a greater size of sample field than currently exists, however in the case of this relationship the current sample size is sufficient to indicate fairly clearly that there is no relationship between the number of rhyme schemes employed and the harmonic colour of a song (percentage dissonance).

The averages for songs that use 4-6 rhyme patterns are somewhat compromised because there are only ten, three and one figures respectively from which to take the average. However for 0-3 rhyme patterns the averages are more meaningful due to there being more figures, and the average percentage dissonance is generally close to the overall average for the dataset (30.38). Within each of these sub-groups there featured a variety of range for percentage dissonance that was also representative of the dataset as a whole. In other words, one feature seems to have no bearing on the other.

Tab. 4.8.

Number of Rhyme Patterns	Average Number of Chords
0	13.8
1	7.17
2	9.74
3	9.44
4	8.5
5	12.67
6	17

The data above indicates that there is no linear relationship between the amount of variety in terms of rhyme and the harmony used. However, it is interesting that the most populated groups (1-4 rhyme patterns) have average chord totals that are close to the average for the whole dataset (9.16) whereas the outliers (0, 5, 6 rhyme patterns) feature more harmonic variety. It could be the case that this is just down to chance and that the relatively small size of the sub-sets make these averages unreliable, however it could also be that (as seemed to be the case with the number of compositional blocks) songs that do not adhere to the norm in terms of rhyme scheme are also more likely to feature greater amounts of variety in other areas.

The next section explores this idea further. Using the premise that songs with 1-4 rhyme patterns form a majority of songs (95.33% of the data-set), a sub-set made up of those songs (the rhyme pattern outliers sub-set) that fall outside of this range is investigated.

4.8. Rhyme Pattern Outliers Compared With Other Features

The 14 songs that make up the rhyme pattern outliers sub-set have an average melodic range of 15.29 compared to an average for the whole data-set of 14.78. It has already been established that the average number of chords used is higher than average for the sample as a whole. The average number of chords used in this sub-set is 13.79 compared to the data-set average of 9.16 (this lies within 1SD which is 5.82 for this metric). The average percentage dissonance for this sub-set is 30.26, which is just under the average for the whole sample: 30.38, but only marginally so. In terms of harmonic function, 7.14% of this subset have a harmonic classification of 1 compared to 30% for the whole dataset. 35.72% of the subset have a harmonic classification of 2 compared to 40.33%, and 57.14% of the songs in the subset have a harmonic classification of 3 compared to 29.67% for the whole sample. The one song with a harmonic classification 1 for this sub-set, 'Sara' by Stevie Nicks, features no rhyme patterns, however 4 of the songs in this dataset with no rhyme patterns also have a harmonic classification of 3.

The average number of melodic characteristics employed is the same as for the whole sample: three, however these songs use, on average, a greater number of 'notable intervals'. The average for the sample of 300 is 0.64, as opposed to the average of 1 in the rhythm pattern outliers subset.

So considering the relative results for melodic range, notable intervals, number of chords, and harmonic classification there is some evidence here to support a hypothesis that songwriters using unusual numbers of rhyme patterns (either high numbers of rhyme patterns, or no rhyme patterns at all) are likely to also make use of greater melodic and harmonic variety as defined by these features.

4.9. Considering The Type of Rhyme Patterns Used

A variation of this interrogation is to look at the nature of the rhyme patterns themselves rather than just the variety of patterns used and enquire as to whether this has any bearing on other features. The most frequently employed rhyme patterns are AA, ABAB, ABCB, AABB, AAAA, AAA, AABC. A subset of 73 songs exists within the sample that makes use of *only* these rhyme patterns.

The average number of compositional blocks with lyrics used in this subset is 2.78, compared to a sample average of 2.84, and the average number of compositional blocks in total for the subset is 3.12 compared to a sample average of 3.24. The average melodic range for the subset is 14.03 compared to a sample average of 14.78, and the average number of notable intervals is 0.63 compared to the sample average of 0.64. The average number of melodic characteristics recorded is exactly 3 – the same as the sample average.

The average number of chords used in this subset is 7.87 compared to the sample average of 9.16 and the average percentage dissonance is 34.29% compared to a sample average of 30.38%.

Based on this analysis one could surmise that, statistically, songs that make use of only the most frequently employed rhyme patterns are also likely to feature fewer than the average number of compositional blocks and fewer chords than the average number. In more basic terms, songwriters that use the most common rhyme patterns are likely to use fewer chords and make use of less sectional variety.

4.10. Lyric Characteristics – Multiple Input Typologies

One of the more malleable methods for recording data features employed by the framework is the use of finite, multiple-input typologies. As discussed in the methodology, the ability to record many characteristics, a single characteristic, or indeed none, is a useful way of recording the presence of interesting phenomena where they appear, but in a way that does not make using the database too unwieldy.

The lyric characteristic column is one such typology. The individual characteristics are listed below, alongside the frequency with which they appear in the sample dataset:

Tab. 4.9.

Lyric Characteristic	Frequency	Proportion of Dataset
Repetition for emphasis	255	85%
Alteration of rhyme scheme in repeated compositional block	149	49.67%
Simile	40	13.33%
Metaphor	220	73.33%
Assonance	133	44.33%
Consonance	18	6%
Alliteration	9	3%
Internal Rhyme	56	18.67%
Double/Dactyllic Rhyme	47	15.67%
Oblique/Forced Rhyme	32	10.67%
Imperfect Rhyme	11	3.67%
Non-Lexical Vocables	94	31.33%
Profanity	10	3.33%
Limerick	4	1.33%
NSE/Vernacular	101	63.67%
Borrowed Words	14	4.67%
Combination of 1st and 3rd Person	18	6%
Direct Address	196	65.33%

A factor of complexity with this data feature is the fact that some of the characteristics recorded here are more closely related than others. Similarly, some of them have an organisational element, where others are more interpretative. Nine of these characteristics for instance are concerned with types of rhyme or rhyme patterns (alteration of rhyme scheme, assonance, consonance, alliteration, internal rhyme, double/dactylic rhyme, oblique/forced rhyme and limerick) and serve a purpose of contextualising other data features to do with the number or type of rhyme patterns, as such their appearance in the dataset is perhaps more comparably significant with those data features than other lyrical characteristics that are recorded in the same column. These rhyme-related characteristics offer a researcher the ability to go to another level of detail when interrogating either the use of rhyme in general, or investigating elements of an individual's lyrical style.

Noting the frequency with which individual characteristics appear is important for context. Alliteration appears only nine times out of 300 songs, which tells us that this is a relatively rare characteristic, which arguably increases the significance of its use.

'Alteration of rhyme scheme in repeated compositional block' occurs in marginally less than one song in every two, which at the most basic level, tells us this is a common characteristic. This is a significant statistic in the context of the framework's application and its ability to express a common phenomenon in an original way. Firstly, the ability to record the occurrence or otherwise of this characteristic is dependent on the definition of compositional blocks and lyrical blocks as coined for the purposes of this framework. Furthermore, as discussed in the methodology, the way in which rhyme patterns are transcribed/assigned for the purposes of the framework takes musical phrasing into consideration, rather than punctuation. Similarly, the rhyme patterns recorded also adhere to the boundaries of lyrical blocks. This differentiates the data about rhyme patterns in this framework from data that might be derived from more traditional poetic analysis. Also, in terms of the research aims of this thesis, consideration of the data relating to rhyme patterns alone is inherently consideration of data relating to synergies between music and lyrics. Beyond that however, the frequency with which this characteristic occurs suggests something fundamental about songwriting. If one accepts the premise that rhyme patterns are lyrical organisational structures, and repeated sections of corresponding melody and harmony are musical organisational structures, it appears that almost 50% of songs are likely to be more rigid in terms of musical structure than they are in terms of lyrical structure – at least in terms of rhyme (based on the number of songs that feature 'alteration of rhyme scheme within a repeated compositional block).

Arguably this is an over-simplified conclusion – because of the setting of words to melody, one might suggest that the syllabic make-up of phrases is more crucial to the notion of lyrical structure from an information density standpoint, but then the frequency with which melisma is recorded within the sample (in 89.33% of the songs in the sample to some degree) calls this in to question.

A number of other more standalone lyrical characteristics are recorded in this data feature. For instance, the use of simile or metaphor gives a sense of a level of figurative language. This might encourage a researcher to look for creative combinations of features (e.g. is there a link between the use or otherwise between figurative language use and harmonic colour?) The usefulness of this feature depends on the context of its discussion – either looking for patterns, reoccurrences within subsets defined by another data feature, or by using one of these individual characteristics as the defining feature of a set.

From a data analysis perspective, the use of finite typologies to record the use of compositional characteristics presents an opportunity to interrogate the frequency with which a particular characteristic is used, but also the number of characteristics recorded per song in order to give a sense of variety. Two measures that could be considered together are melodic characteristics and lyric characteristics. The individual characteristics that make up these typologies are detailed in the methodology. For the purpose of this discussion it is merely the number of characteristics recorded that is relevant.

Before considering correlations between individual characteristics from the two lists, one can examine the apparent degree of variety or content implied by the number of characteristics selected for each song.

Tab.4.10.

Number of Lyric Characteristics	Frequency
2	7
3	41
4	70
5	76
6	63
7	23
8	19
9	1

The mean number of lyrical characteristics recorded in the data sample is 5, which is also marginally the most frequent number of characteristics recorded.

Tab. 4.11.

Number of Melodic Characteristics	Frequency
1	4
2	72
3	126
4	80
5	16
6	2

For this measure the mean (3) is also the mode.

Of the 126 songs in the sample that feature the average number of melodic characteristics, less than a quarter of these (30) also feature the average number of lyrical characteristics. If the two metrics being compared can be said to give an idea of an average amount of variety in terms of melodic and lyrical characteristics, this tells us that the number of examples where the same song has the average number of characteristics for both is relatively few – given that the mean is also the mode for both data features. This finding might, for instance, argue against the notion of an 'average song'. This is an example of how the data collected (even for more interpretative data features) can be used to inform questions about songs and songwriting.

4.11. Further Discussion of Lyric Characteristics

This section goes into further detail about the observations made in the lyric characteristics typology in the sample data-set (see the table above in section 4.10 for reference).

The three most common lyrical characteristics are repetition for emphasis, metaphor and direct address. 126 songs from the sample (42%) feature all three of these characteristics. The frequency with which these three characteristics occur highlights some interesting tendencies of song lyrics in terms of language use. The frequency with which repetition for emphasis occurs is notable, since this does not refer to the repetition that may occur through the wholesale repetition of a lyrical block (as may occur with multiple iterations of a chorus) – rather it refers to repetition of words or phrases within a block in such a way that does not occur in typical prose or standard speech. Even in poetry the repetition of words or phrases for emphatic effect might be considered fairly stylised, whereas it appears that in song this practice is the norm.

The high proportion of songs that feature metaphor suggests that figurative or poetic language is also normal or expected in song. This is something that one might casually expect, so, arguably, the fact the data strongly supports this helps to substantiate other data outcomes of this feature of the data-set.

It is notable that the use of metaphor is recorded significantly more than simile, given the inter-connected nature of the two devices. Although metaphor use is recorded 220 times in the sample and simile is recorded 40 times, a use of 'figurative language' (either or both metaphor or simile) occurs in 235 songs (78.33%). Given that this is such a large proportion of the overall sample it follows that looking at the subset formed of songs where neither characteristic is recorded might yield some notable findings. For the 65 songs in this subset, the average number of rhyme patterns used is 1.83 compared to a sample average of 2.13. Given that rhyme has an organisational function with respect to the sound of words, it is not necessarily related to figurative language use, so it is interesting that there seems to be a link between those songs that do *not* use simile or metaphor and a lower than average amount of rhyme variety. The average word count for this subset is slightly lower than the overall average: 148.12 compared to 156.86, but given the very large range for this data feature, this is not enough of a difference to suggest that the absence of lyrical characteristics can be explained away by lower word counts and therefore less chance of them occurring. In terms of how the lyrics are organised, the findings are similar – the average number of lyrical blocks is very close to the sample average (although slightly lower) – reinforcing the assertion that the use or otherwise of figurative language has no relation to the amount of lyrical content in a song.

There appears to be a trend with some of the main musical data averages for this subset: many of them are lower than the sample average. In a lot of cases, only by a small margin – to the extent that on a feature-by-feature basis the discrepancy would not be worth remarking on, but the fact that this is the case for numerous features is worth drawing attention to:

Tab. 4.12.

Data Feature	Whole Sample Average	'No Figurative Language' Subset
No. Compositional Blocks (W/Lyrics)	2.84	2.77
No. Compositional Blocks (Total)	3.26	3.18
Melodic Range	14.78	14.37
No. Chords Used	9.16	9.03
Tonal Centres	1.23	1.18

Given that the data features above are statistically exclusive from the lyrical characteristic typology, this can be viewed as a link between a certain type of lyric writing and the musical element of those songs, albeit suggested only subtly at this stage. The data above could support an assertion that songwriters who do not use metaphor or simile in their lyrics are less likely to use larger than average numbers of chords, employ greater than average melodic range, or use a larger than average number of sections in their songs.

Almost a third of the 300 songs feature the use of non-lexical vocables, highlighting this as a common song feature. As with the use of repetition for emphasis this is a linguistic device that features in poetry, mainly in the form of exhortations (e.g. Oh!) and its use is generally considered stylised or archaic. The data suggests that its use in song is commonplace – again this seems like common sense. The use of non-lexical vocables is a linguistic device that lends itself to aural rather than written form of language so it stands to reason that it would feature more heavily in song. Still, in the context of confirming the usefulness of the framework as an analysis tool, clear, positive relationships between common sense observations and the actual data outcomes are important.

Another example of this is the frequency with which Non-Standard or Vernacular language use occurs (irregular syntax, use of terms such as 'gonna' or 'wanna', slang, dialectal terminology etc.) – just under two thirds of the songs in the data set. This chimes with expectations about the informal nature of some songwriting styles, as well as the idea of cultural or geographical identity being expressed through lyrics. This also supports the idea that popular song is a vernacular form.

A number of the characteristics in this typology are rhyme features, with the most used by far being assonance. One might argue that this points towards the placement and sonic quality of vowel sounds in particular being the most important facet of rhyme in song.

18.67% of the songs in the sample feature internal rhyme, this feature adds context to the number of rhyme patterns, as this is recorded when rhyming vowel sounds happen within an overarching rhyme pattern. Applying this combination of features can help to give a sense of the character of individual songs and writers, however in this case it also indicates something about when internal rhyme tends to be applied.

Tab. 4.13.

No. of rhyme patterns	No. of songs featuring 'Internal Rhyme'	Proportion of songs in the sample with that no. of rhyme patterns that feature 'Internal Rhyme'
1	7	9.86%
2	22	18.18%
3	18	25%
4	6	30%
5	2	66.67%
6	1	100%

As the table above shows, though songs with a rhyme pattern total of 3 and above are less numerous in the sample, the likelihood that these songs will also feature internal rhyme increases with the number of rhyme patterns.

One might investigate 'double/dactylic rhyme in the same way:

Tab. 4.14.

No. of rhyme patterns	No. of songs featuring 'Double/Dactylic Rhyme'	Proportion of songs in the sample with that no. of rhyme patterns that feature
1	5	7.04%
2	19	15.7%
3	18	25%
4	4	18.18%
5	1	33.33%

Though not quite as strongly as for internal rhyme, there is a similar indication that songs with a greater number of rhyme schemes are more likely to feature double/dactylic rhyme. In the sense that both of these rhyme features are concerned with the structural or organisation of rhyme (as rhyme patterns clearly are), one might hypothesise that, based on the data in the sample, where rhyme is concerned, variety begets variety rather than there being some sort of compensatory balance.

4.12. Impact of Individual Lyric Characteristics on Other Data Features

The amount of information recorded per song as a result of applying the framework is such that there are many permutations of data features that can be examined concurrently, but when specifically looking for synergies between lyrics and music data, one method of filtering the information is to create subsets based on the presence of particular lyric characteristics and investigate whether there are any patterns that emerge for music features within these subsets, or whether the average figures for these subsets diverge from the overall sample in any way.

One of the more commonly used lyric characteristics is 'NSE/Vernacular' (Non-Standard English). For instance in the chorus of 'No Woman No Cry' (1974):

Here little darlin', don't shed no tears,
No woman, no cry

The example of Non-Standard English usage here is the phrase 'don't shed *no* tears' rather than the grammatically standard 'don't shed *any* tears'. There are 191 songs in the sample that have a recorded usage of NSE/Vernacular. For this subset the mean figures for the number of chords used, the level of percentage dissonance and the number of compositional blocks used are all slightly lower than the sample average.

Tab. 4.15.

	NSE/Vernacular Subset Average	Sample Average
No. Chords Used	8.44	9.16
Percentage Dissonance	29.65	30.28%
Total Comp. Blocks	3.19	3.26

One reading of these statistics is that there is the suggestion of a link between the use of non-standard English in lyrics, and the use of less harmonic variety and less sectional variety. However, given that NSE/Vernacular is recorded as being used in 191 out of 300 songs in the sample, perhaps it is more accurate to say that those songs that do *not* feature NSE are likely to feature higher levels of harmonic variety and sectional variety. The figures above show lower figures than the sample average for the chosen data features, but only by small margins. Therefore, the reverse subset must have average figures that are not only higher than those for the sample, but by a greater margin.

As mentioned previously, there are 56 recorded examples of 'Internal Rhyme' being used as a lyrical device in the sample. One of the first observations about this particular subset is that a number of writers have more than one song in the subset, or in other cases multiple songs by the same band or artist occur even if by different artists: there are three songs by The Eagles in this subset.[29] Red Hot Chili Peppers, Eagles, Billy Joel, Carole King, The Beatles, Oasis, Norah Jones and Sheryl Crow all have three or more songs in this subset, suggesting that for some writers or artists, the use of internal rhyme is a strong part of their lyrical styles. Carole King and Noel Gallagher make particular use of this characteristic, with four and five songs respectively in this subset. Also, six out of the ten Norah Jones songs included in the overall sample make use of internal rhyme, although they are written by a

[29] The songs in question were written by Bernie Leadon/Don Henley, Don Henley/Glenn Frey and Don Henley/Glenn Frey/Joe Walsh respectively.

combination of writers (Norah Jones, Jesse Harris and Lee Alexander). Nevertheless, the characteristic could be said to be part of the style of her songs as an artist rather than writer.

The average number of rhyme schemes used in the subset of songs that use internal rhyme is 2.59 compared to a sample average of 2.13, which indicates that the use of internal rhyme is often associated with greater levels of variety in terms of rhyme. This is especially pertinent given that internal rhyme, as recognised by the framework, occurs when an additional internal rhyme is present within another recognisable rhyme structure – so this characteristic does not contribute necessarily to the figures for the number of different rhyme schemes used.

Beyond the figures for the number of different rhyme schemes used, there is further evidence to suggest that the use of internal rhyme is connected with a general sense of variety of rhyme when the use of other lyrical characteristics is considered. 49 of the 56 songs in this subset make use of at least one other rhyme-related lyrical characteristic, and of these 28 make use of two or more others. This would seem to indicate that where there is a use of internal rhyme, it is likely to be as a result of the creative use of rhyme in general being a stylistic tendency or priority for those songwriters. The other rhyme-related characteristics include 'alteration of rhyme scheme in repeated compositional block', which, like internal rhyme, has a lyrically structural element – in that recognising internal rhyme is to do with considering *where* in the phrase rhyming phonemes are placed. However, some of the other characteristics that are often seen alongside internal rhyme include 'assonance', 'consonance' and 'oblique/forced rhyme' – and these are concerned with the sound of the rhyme or the relationship between sounds that are deemed to be part of a rhyme structure, rather than the structure of the rhyme itself.

Looking to other data features, and at potential patterns within the subset formed by songs that feature internal rhyme, one might ask what musical features might have similarities? One of the melodic characteristics recorded as part of that finite typology is 'embellishment within otherwise repeated block'. The purpose of this particular characteristic is to recognise where a small part of the melody might be altered, but not a significant enough amount of the block for this to constitute a separate block being recorded. This might be to accommodate some syllabic differences brought about by the setting of different lyrical blocks to the same compositional blocks, but this is not necessarily the case in every instance. One could argue that this data feature is similar in some way to 'internal rhyme', because both can occur when songwriters include subtle levels of variety in what can be broadly recognised as repeated sections. 'Embellishment within an otherwise repeated block' is recorded as a melodic characteristic in 41.67% of the songs in the overall sample but in 50% of the songs in the internal rhyme subset. The appearance of one is not directly influenced by the other (melodic embellishment/internal rhyme) so they could be said to be linked as part of a general practice of increased levels of variety. Indeed, the average number of chords used in the songs in this subset is 9.91 compared to a sample average of 9.16, and the average total number of compositional blocks used in the subset is 3.39 compared to a sample average of 3.16. Neither of these figures are dramatically higher than the sample average, but it is the fact that more than one of the average figures pertaining to variety of content are higher that is significant.

So - to surmise - interrogation of the subset of songs that feature internal rhyme has led to the following suggestions:

- Songs that make use of internal rhyme are highly likely to feature another rhyme-related characteristic, and fairly likely to feature two or more other such characteristics. The use of internal rhyme seems to be related to a more general sense of rhyme variety.
- Songs featuring internal rhyme are more likely to also feature 'embellishment (of melody) within an otherwise repeated block' which is arguably a related practice.

- Songs featuring internal rhyme are likely to have higher than average chord totals and use more than the average amount of total compositional blocks. This again points towards a sense that the use of internal rhyme is related to small amounts of increased levels of variety in other parts of the songwriting.

4.13. Addressing Expectations About Relationships Between Music and Lyrics

The third research question in the introduction asks:

3. How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics? How do these patterns relate to expectations about style and genre?

The answer to this is slightly unclear for two reasons. Both are informed by the volume and variety of data produced by applying the framework. Firstly, the data does not appear to produce straightforward correlations between data features. This could be because of the amount of data produced pertaining to both music and lyrics for a relatively small sample (by big data standards). It could also be down to the fact that different data features are expressed in different ways, so wholesale data-led synergies are less likely (looking at the relationship between a numerical data feature such as percentage dissonance and a finite typology data feature such as 'lyrical characteristics', for example). A more creatively sympathetic hypothesis however, is that songwriters express significant variety in their practice and this prevents us from saying that lyrics affect music or vice versa, when in fact songwriters control both.

Secondly, many of the data relationships discussed here come to light as a result of the application of the framework itself. For example, the case study directly above looking at the impact of the presence of individual lyric characteristics on other data features looks at relationships between musical and lyrical phenomena that are defined by the framework. This produces synergies that are unique to the framework and that are essentially answers to a question that one might otherwise not think to ask.

Another point for consideration is the fact that certain individual data features such as the number of compositional or lyrical blocks, the length/size of blocks and their proportional relationship to song running times are inherently informed by elements of the structural relationship between music and lyrics in those given songs. As such, the way that certain structural expectations might exist about songs can be both examined and reconsidered by the way that the framework removes hierarchical terms such as 'verse' or 'chorus'.

Similarly, expectations or hypotheses about the levels of repetition within songs as evidenced by lyrical and musical data proportions (another metric original to this thesis) can be seen as inherently involving a synergy of music and lyrics. Since the sample shows a significant range for this data feature, from highly repetitive to through-composed, any expectations about levels of repetition are more likely to be related to genres, or individual practitioners rather than to all songs.

4.14. Examining Subsets Rather Than The Whole Dataset

The case studies in this chapter have examined a number of ways of exploring the dataset produced for an initial sample of songs. From a methodological perspective, different approaches to interrogating the data and analysing it have been demonstrated, including making comparisons between two related features or between one individual feature and many others.

When dealing with the whole sample dataset, average figures, standard deviation and range provide context for individual data. Mean figures become more reliable with a bigger dataset, so certain kinds of questions would be better answered by the dataset continuing to grow.

Another approach that was introduced in this chapter was using standard deviation from the mean as a way of establishing outliers for given data features, then examining the subset formed by this. This allows for a more manageably in-depth analysis of individual songs or groups of songs – contextualised by their membership of the subset as defined by the given data feature (variety of rhyme patterns being the example in this chapter).

The following chapter takes on this approach, looking in detail at subsets defined by data in order to examine how this approach can be used to explore characteristics of style.

5. Data Relating To Style – Data Feature Subsets

5.1. Data Feature Subsets

Examining data features in the context of the entire dataset is useful for drawing conclusions about general tendencies in songwriting practice, and perhaps more pertinently, to get an idea of the average outcomes for various features. The advantage of this is that features of individual songs can be understood in terms of the extent to which they tend towards the norm. For instance, a figure for the average relationship between a single compositional block and the total running time of a track across an entire dataset is an original way of expressing something about general form and proportion in songs. Clearly, these average outcomes will become more meaningful as the size of the dataset grows, and it is arguable that the current amount of data is only indicative at this stage (although for those data features whose outcome's frequency distributions tend towards a normal distribution, it can be said that the mean outcomes at least are a fairly reliable indication).

Another way of organising or filtering the data that has some instant outcomes or conclusions is to examine discrete subsets. By examining subsets of the data by artist/songwriter or by style, it is possible to start to draw conclusions about characteristic traits of individuals or groups. As discussed in the chapter on methodology, the term 'style' will be used broadly in this context to refer to the way certain data patterns might emerge for discrete groups of songs, but also how data patterns (alluding to tendencies in practice) might be used to define groups of songs. If subsets are defined by certain characteristics, then it is possible to tease out the effect of that characteristic on the other data features within that subset. This allows the researcher to ask more specific questions about styles and genres, and with the contextual background (where appropriate) of the whole dataset.

As a reminder, consider the second research question outlined in the introduction:

2. What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs? Furthermore, can this approach be used to explore characteristics of styles or genres through sample field choices?

Where the previous chapter dealt with the first part of this question, this chapter and the one that follows will address the second. The following is a series of case studies that make use of the dataset in this way as examples of potential applications of the framework.

5.2. Methods of Categorisation

The various case studies presented in this chapter and the one that follows deal with musical and lyrical features that might be categorised in of themselves. That is to say, certain data features are more likely to indicate trends or correlations because of the nature of the individual features. Those features that deal with structure (number of compositional blocks/size of compositional blocks) and average figures are examples of this, not simply because the data itself is expressed numerically, but because the phenomena referred to are related to size, proportion and frequency. One might refer to these features as organisational, compared to other data features that are concerned with the occurrence or otherwise of specific characteristics.

Many of the data features recorded as multiple selection characteristic typologies capture details that seem to be more meaningful once a subset has already been established. Some of the lyric characteristics that are recorded are to do with the organisation of material (repetition for emphasis, alteration of rhyme scheme in an otherwise repeated block etc.) whereas some require a level of interpretation (metaphor for instance). The fact that quite different types of characteristic are being recorded as part of the same data feature makes this better suited to analysis as part of a smaller set.

The case studies that follow fall broadly into two categories:

1. A subset is formed based on data features, and from this starting point the songs in the subset can be discussed in this context. These case studies will include looking at those songs that have a lyrical data proportion of 100% (no repeating lyrical blocks), examining the songs in the sample dataset that have the most compositional blocks, and those songs that are written by groups of people rather than single songwriters or songwriting duos. These initial parameters are used to form the subset, and then the data within the subset can be examined and the discussion can also be opened up to consider the provenance of the songs as well as other stylistic or cultural factors that might be said to link the songs in the given subset.
2. Examining the songs of specific artists, bands or songwriters in discrete subsets. Average data figures for the subset can be compared to the overall sample to get a sense of how these songs as a group compare to a 'norm'. Also, one might discover synergies and correlations more easily with a smaller group of songs, and then follow these through to examine whether these occurrences do in fact relate to a sense of individual style or identity for the given artist or band. This will be the focus of chapter six.

5.3. Songs with a lyrical data proportion of 100% - A Link to Folk

There are 28 songs in the sample with a lyrical data proportion of 100%. As previously discussed, there is some room for debate as to the usefulness of this statistic, however it does point towards some stylistic characteristics of some individual writers. Five songs by Paul Simon feature in this group ('Bookends' (1968), 'El Condor Pasa' (1970), 'For Emily Wherever I May Find Her' (1966), Kathy's Song' (1965) and 'The 59th Street Bridge Song' (1966)), and all of these would be described quite comfortably as lyrically through-composed in spite of featuring repeated compositional blocks. This implied lack of choruses could be described as a practice derived from songwriting from the folk tradition. All of the songs listed above were written by Simon for Simon and Garfunkel who were ostensibly a folk duo.

Indeed, the idea that a lyrical data score of 100% might be an attribute of folk-derived music is reinforced by the other songwriters that appear in this group. Bob Dylan and James Taylor songs appear in this list and certainly belong to the same broad group of sixties/seventies folk songwriters. Norah Jones and Jesse Harris contribute three songs either together or separately that come from Norah Jones' first album *Come Away With Me* from 2002 which is an album that draws influences from folk/Americana as well as jazz. Neil Finn is also included in this group and whilst his songwriting for Crowded House is known for having a Beatles-esque melodic/harmonic sensibility, he has discussed how his band Split Enz (who he wrote songs for before forming Crowded House) were heavily influenced by Lindisfarne and other folk groups (ABC, 2014). Three Eagles songs by Don Henley and Glenn Frey also feature in this list, similarly American folk music underpins the country-rock sound of that band. The song 'Gypsy' (1982) by Stevie Nicks also appears in this group, whilst it does not necessarily feature a folk-influenced sonic aesthetic, it arguably harks back to Nicks' time writing and performing folk music prior to her being part of Buckingham Nicks and subsequently Fleetwood Mac.

Six of the 28 songs in this group are by Chuck Berry. The Chuck Berry songs featured in the dataset are characterised by a great deal of statistical similarity for metrics relating to structure, harmony and melody informed by his tendency to make use of the 12 bar blues form (or slight alterations of this). Regarded as one of the forefathers of rock and roll, Berry's songs are rooted singularly in the blues tradition. In the sense that blues is a part of the American folk tradition, the Chuck Berry songs in this list further point towards the link to folk. Three songs by Bill Withers and one by Jimi Hendrix also feature in the list, both writers whose practice is heavily influenced by blues music.

In conclusion, if we recognise blues as a folk-derived genre, 26 of the 28 songs in the dataset with a lyrical data proportion of 100% are written by folk or folk-related artists. The remaining two are 'Up the Junction' (1979) by Glenn Tillbrook and Chris Difford which is remarkable for its linear lyrical form and 'Souvenir' (1974) by Billy Joel which is better described as a vignette than being derived from a folk tradition. Indeed, the unusual brevity of this song is indicated statistically by it having the highest combined lyrical data proportion (100%) and compositional data proportion (81%) – the song comprises of a single iteration of one compositional block and a single instrumental compositional block.

5.4. Non-Repetition of Lyrical Blocks/Repetition of Individual Words

It is worth noting that the apparent lack of repetition implied by a lyrical data proportion of 100% is on a rather macro level – it is not to say that there is not a level of repetition of individual words or phrases. In this way this measure is different to the distinction between different types of word count used traditionally in linguistic analysis. Indeed, this is an example of the originality of some of the measures here, but more importantly another example of the way the musical setting of the lyric, or rather, the musical organisation of the lyric, is intrinsically involved in even apparently basic data such as word counts.

Interestingly, songs that are included in this sub-set often feature sufficient levels of repetition of individual words for these to be recorded in the 'key words' category which requires an individual word's iterations to make up at least 5% of the uttered word count. In some cases, this can be explained by a relatively small word count, where a single repetition of a word is sufficient for its iterations to make up more than

5% of the overall word count. Perhaps not unsurprisingly the three songs with the smallest word counts are examples of this: ‘Souvenir’ by Billy Joel (48), ‘The Long Day Is Over’ by Norah Jones (33) and ‘Bookends’ by Paul Simon (36). In ‘Souvenir’ the last lyrical line is repeated but set to different melody and harmony to give a certain sense of finality. Because of the low word count in this song, each word in the final line is recorded as a key word. In ‘Bookends’ however, there is only one key word: ‘time’, and in the case of this song the single word itself is repeated for a different purpose:

Time it was
And what a time it was
It was a time of innocence
A time of confidences

Here the repetition of the word ‘time’ is more of an example of word-play as a poetic feature rather than the emphatic repetition of a whole line.

15 of the 28 songs with 100% lyrical data proportions feature at least one word from the song title in the key words column. This is a smaller proportion (53.57%) than the overall percentage for the dataset (65.33%) but given that by definition none of these songs feature what could be considered a chorus this is significant.

5.5. Sectional Variety – Songs With The Most Compositional Blocks

One of the features that characterises Red Hot Chili Peppers’ work, in the context of the framework, is the relatively high number of compositional blocks used in their songs. This level of sectional variety has an impact on other features. If one is to look more generally at the idea of sectional variety, or the use of a higher number of compositional blocks as a stylistic trait, does it highlight any common practice between songwriters who do this?

Tab. 5.1.

Number Of Total Compositional Blocks	Frequency	Frequency As A Percentage of the Sample
1	12	4%
2	61	20.33%
3	107	35.67%
4	87	29%
5	28	9.33%
6	5	1.67%

The mean number of total compositional blocks is 3.24, and it is clear from the table above that the vast majority of songs make use of either 2, 3 or 4 compositional blocks (85% of songs in the dataset). The 33 songs that make use of 5 or 6 compositional blocks will form a subset in order to see what features these songs have in common other than a higher amount of sectional variety.

Tab. 5.2. Songs with a total of 5 Compositional Blocks:

Song Title	**Writer**
In Germany Before the War	Randy Newman
Mexico	James Taylor
One Of God's Better People	Robbie Williams/Guy Chambers
The Chain	Stevie Nicks/Christine McVie/Lindsey Buckingham/Mick Fleetwood/John McVie
Don't Dream It's Over	Neil Finn
World Where You Live	Neil Finn
Distant Sun	Neil Finn
Witchy Woman	Bernie Leadon/Don Henley
New Kid In Town	Don Henley, Glenn Frey

She Loves You	John Lennon/Paul McCartney
All You Need Is Love	John Lennon/Paul McCartney
Don't Look Back In Anger	Noel Gallagher
So Far Away	Carole King
The Difficult Kind	Sheryl Crow
My Favourite Mistake	Sheryl Crow/Jeff Trott
Home	Sheryl Crow
Let Down	Thomas Yorke/Jonathan Greenwood/Philip Selway/Colin Greenwood/Edward O'Brien
No Surprises	Thomas Yorke/Jonathan Greenwood/Philip Selway/Colin Greenwood/Edward O'Brien
Around The World	Anthony Kiedis/Flea/John Frusciante/Chad Smith
Get On Top	Anthony Kiedis/Flea/John Frusciante/Chad Smith
Californication	Anthony Kiedis/Flea/John Frusciante/Chad Smith
The Zephyr Song	Anthony Kiedis/Flea/John Frusciante/Chad Smith
America	Paul Simon
Nice Guys Finish Last	Billie Joe Armstrong
Child In Time	Ian Gillan/Ian Paice,/Jon Lord/Ritchie Blackmore/Roger Glover
Highway Star	Ian Gillan/Ian Paice,/Jon Lord/Ritchie Blackmore/Roger Glover
Bad Medicine	Jon Bon Jovi/Ritchie Sambora/Desmond Child
Fire	Jimi Hendrix

Tab. 5.3. Songs with a total of 6 Compositional Blocks:

Song Title	**Writer**
Walking Man	James Taylor
South Of The Border	Robbie Williams/Guy Chambers
Say You Love Me	Christine McVie
Can't Stand Losing You	Sting
Livin On A Prayer	Jon Bon Jovi/Ritchie Sambora/Desmond Child

Before even looking at other specific features, the provenance of many of these songs could be significant. There are ten songwriters in this list that have more than one song in this subset (sometimes as co-writers). This suggests that higher levels of sectional variety are a feature of the style of individuals or groups of individuals

Neil Finn contributes three songs to this subset, and looking at the ten songs he has written or co-written in the overall sample, he uses an average of 4 compositional blocks (significantly higher than the sample average of 3.24). Three of the songs in this subset were written by Sheryl Crow or by the partnership of Sheryl Crow and Jeff Trott. Sheryl Crow contributes ten songs to the total dataset either as a solo songwriter or with collaborators. The average number of compositional blocks used in these ten songs is 3.7. However, songs written by either Crow on her own or partnered with Jeff Trott make use of an average of 4.6 compositional blocks, compared to an average of 2.8 when she is working as part of a different or larger songwriting team. This gently supports the idea that using higher levels of sectional variety could be a stylistic preference of individuals.

Given that these songs feature higher levels of sectional variety from a compositional perspective, one might expect higher levels of lyrical content. The average word count (content) for this subset is 161.75, which is higher than the sample average of 156.86, but not dramatically so given that the range for this feature is 538 (33-571) words. Similarly, the average word count (uttered) is higher at 242.03 compared to 225.03, but again, given a range of 655 (33-688) this is not a particularly significant discrepancy. The average number of lyrical blocks used in these songs is 6.06, which is higher than the sample average of 4.883 by a more statistically significant amount than either of the word counts.

Tab. 5.4.

Data Feature	Mean for Subset (5 or 6 Total Compositional Blocks)	Mean for Whole Dataset	Discrepancy as Proportion of Range for Data Feature in Whole Dataset[30]
Word Count (Content)	161.75	156.86	0.91%
Word Count (Uttered)	242.03	225.03	2.5%
Number of Lyrical Blocks	6.06	4.88	13.11%

An interesting comparison to be made from the table above is the significant difference between the discrepancies as a proportion of the relative ranges for word count (content) and the number of lyrical blocks. The word count (content) is the sum of the individual word counts of each of the lyrical blocks, disregarding repetition (the uttered word count is simply the number of words heard by the listener from start to finish). As such, a significant increase in the number of lyrical blocks within a subset, alongside a negligible increase in the amount of lyrical content necessarily implies that the average word count of individual blocks for this subset is lower than average. It is worth reiterating that the process of defining compositional blocks is linked to the repetition or otherwise of lyrics, so there is a constant link between lyrical and musical content in terms of how structural qualities are assigned by this framework.

The data for this subset suggests that songs with higher numbers of discrete musical sections are also likely to feature higher numbers of lyrical sections, but not a higher level of overall lyrical content. In fact, the data seems to suggest that there is some

[30] The range for the data feature is 538. The discrepancy between the mean for word count (content) for the subset and the whole sample is 4.89 (161.75 minus 156.86). 4.89 is 0.91% of 538.

sort of compensatory content phenomena at play whereby songs with higher levels of sectional variety seem to feature fewer lyrics on a block-by-block basis.

The average number of rhyme patterns employed by the songs in this subset is slightly higher than the overall average (2.52 compared to 2.12), but perhaps not by as much as one might expect given that this group features higher numbers of discrete sections. In this case it is not sufficient to look at the mean figure to get a sense of what is happening here. Consider that this subset is defined by the total number of compositional blocks, which can include instrumental blocks. As an example, 'Highway Star' (1972) by Deep Purple features 6 compositional blocks, but only 2 rhyme schemes. The fact that one of only five songs with that many discrete sections features less than the average number of rhyme schemes can be partly explained by the fact that three of the compositional blocks are instrumental. Part of the rhapsodic quality of this song is the level of musical invention and compositional detail in between the sections of the song that have lyrics – indeed there are four different tonal centres, a higher than average number of chords and notable intervallic jumps of a major 9th. It is clear for this song that the increased level of sectional variety is related to some extremes in other features, if not all.

17 out of the 33 songs in this subset do feature higher than average levels of variety in terms of rhyme structure. In some cases this might be put down simply to the increased number of sections ('My Favourite Mistake' (1998) by Sheryl Crow/Jeff Trott features 5 compositional blocks with lyrics, and features 5 different rhyme schemes), but another feature: 'alteration of rhyme scheme in otherwise repeated compositional block' is frequently the reason for increased numbers of rhyme schemes. Of the 17 songs in this subset that feature higher than average rhyme scheme totals, 12 of them have this characteristic. It is possible to have numerous rhyme schemes in spite of few compositional blocks (this would inherently mean multiple lyrical blocks of course) so it stands to reason that there is not a clear positive correlation between number of compositional blocks and number of rhyme schemes. A conclusion that could be

drawn from this is that the concept of variety within songs is multi-faceted. A song with many compositional blocks could be said to feature sectional variety and a song with more than the average number of rhyme schemes could be said to feature variety in the lyrical structure. Songs that feature both these characteristics are varied in different ways.

Tab. 5.5.

Feature	Whole Sample	Songs With 3 or More Compositional Blocks
Average Number of Chords	1.15	1.2
Average Chords Per Bar	9.16	11.42
Average Percentage Dissonance	10.25%	28.81%

One might also look at how the idea of variety applies to the harmony used by songs with more compositional blocks. The average number of chords per bar for this subset is 1.2, essentially the same as the whole sample average of 1.15, with a similar range to the whole sample. In short, there is no evidence that harmonic density is related to the number of compositional blocks. The average number of chords used by songs in this subset is higher. This stands to reason as the higher number of discrete sections provides a higher likelihood of greater harmonic variety, although there are some examples that counter this.

'Nice Guys Finish Last' (1997) by Greenday, for instance, makes use of sectional variety as a strategy for retaining interest whilst using a limited number of chords (6 in total). In many respects the song is an example of fairly standard pop-punk songwriting, with a verse, pre-chorus and chorus that all use a limited number of chords in one key. The separate instrumental sections feature the same chords but arranged in different orders, and played with different rhythms. This could be an example of genre leading certain compositional choices. Greenday records rarely feature extended guitar solos for instance, where the interest comes from the melodic invention of the soloist but often over the verse or chorus chords, so a separate compositional section is not required to maintain interest. In a genre where those types of guitar solos are perhaps incongruous, a different strategy for maintaining interest is required, and additional compositional variety (albeit using the harmonic elements that have already been established) is one such strategy.

There does seem to be a relationship between songs with more compositional blocks and the use of more complex chord voicings. There does not seem to be any obvious connection between these two features so this correlation is interesting as it perhaps suggests something about the practices of certain songwriters – that maybe those who seek sectional variety are more likely to use more colourful chords.

5.6. Songs Written By Three Or More Songwriters – 'Group Writers' Subset

A previous observation about some differences between Sheryl Crow songs that seemed to be related to co-writers led to this line of investigation into a subset of songs written by three or more songwriters. At 47 songs this makes up just under a sixth of the whole dataset.

These songwriting groups fall into the following categories:

- Bands where each band member is credited as a songwriter: Stevie Nicks/Christine McVie/Lindsey Buckingham/Mick Fleetwood/John McVie (Fleetwood Mac), Kurt Cobain/Chris Novoselic/Dave Grohl (Nirvana) Thomas Yorke/Jonathon Greenwood/Philip Selway/Colin Greenwood/Edward O'Brien (Radiohead), Anthony Kiedis/Flea/John Frusciante/Chad Smith (Red Hot Chili Peppers), Billie Joe Armstrong/Tre Cool/Mike Dirnt (Greenday), Ian Gillan/Ian Paice/Jon Lord/Ritchie Blackmore/Roger Glover (Deep Purple). Radiohead, Red Hot Chili Peppers and Deep Purple have every band member named as a songwriter for every track in the dataset, whereas for the other groups some songs are credited to one or two other band members but not the whole band (Billie Joe Armstrong, Kurt Cobain, Stevie Nicks etc.).

- Different combinations of the members of the same band are credited differently for individual songs: for instance, Eagles (Don Henley/Glenn Frey accompanied variously by Randy Meisner, Don Felder and Joe Walsh respectively).
- Solo Artists accompanied by a songwriting team: Robbie Williams/Eric Bazilian/Desmond Child, Sheryl Crow/Wyn Cooper/Bill Buttrell/David Franci Baerwald/Kevin Gilbert etc.
- Certain band members accompanied by outside songwriters Jon Bon Jovi/Ritchie Sambora alongside Desmond Child and Holly Knight respectively.

Considering structure, there is a not insignificant increase in the employment of instrumental compositional blocks in this subset, with these songs using an average of 0.61 instrumental blocks compared to 0.42 – including the song that uses the highest number of instrumental blocks in the sample ('Highway Star' (1972) by Deep Purple, which uses 3). Interestingly, when this subset is reduced further to just those songs described in the first group above (every member of a band is credited as a writer) this average figure goes up further to 0.79 which is a significant proportional increase. This suggests quite strongly that songs written by whole bands tend to emphasise the importance of separate instrumental sections, which is, perhaps, not surprising. The average overall running time of the songs in this subset is higher than for the sample average, which is perhaps related to this.

The logic here is that individual writers in a band context are likely to write for their role within the band, which is bound to have an impact on how integral instrumental parts and indeed sections are to the composition. In many cases in this context the process of writing the song and coming up with its arrangement are done simultaneously. Whilst this framework is concerned with the primary domain elements of the song's composition, it is notable that a supposed difference in writing practice can have a visible impact on data outcomes in this way. With songs written by a bigger group, but where the roles of the individuals involved are defined only as songwriters, it stands to reason that instrumental sections and arrangement elements might be decided upon in a more utilitarian manner.

It appears that the increase in the number of instrumental sections in this subset is not necessarily at the expense of lyrical content. From a structural variety perspective, these songs feature a slightly higher number of lyrical blocks than the sample average (5.21 compared to 4.88). The average word counts for this subset are also higher, for both types of word count (content and uttered). However, when the subset is reduced again, the figures expose a discrepancy:

Tab. 5.6.

	Whole Sample	'Group Writers' Subset (More than 3 writers credited)	'Whole Band' Subset (The full line-up of a band is credited)	'Group Writers' Subset Minus 'Whole Band' Subset
Mean Word Count (Content)	156.86	162.51	143.15	213.15
Mean Word Count (Uttered)	225.03	246.81	214.35	331.69
Mean Number of Lyrical Blocks	4.88	5.21	5.14	5.38

Dividing the 'Group Writers' up into two further subsets produces some interesting statistics about the amount of lyrical content in these songs, and some marked differences in practice. Whilst it is fair to say that the increase in instrumental sections is accompanied by a slight increase in lyrical content for the initial subset of 47 songs, these mean figures do not tell the whole story. As is made explicit in the table above, the overall increase in mean word counts for this subset is in spite of these figures actually being lower than average for 34 out of the 47 songs (The 'Whole Band' subset which is contained within the 'Group Writers' subset). The mean word counts are dramatically higher for the remaining 13 songs. This is in spite of the fact that the 34 songs in the 'whole band' subset feature songs by Red Hot Chili Peppers, which, as discussed previously, feature high levels of lyrical content. This demonstrates that the songwriting practice of Red Hot Chili Peppers (in regards to lyric writing especially) is unusual not only in the context of the whole sample, but also in the context of bands who appear to credit writing roles in a similar way. Furthermore, the fact that the mean word count figures for the 'whole band' subset are lower than the sample average in spite of this subset including songs with much higher than average figures demonstrates that the songs in the subset *not written* by Red Hot Chili Peppers must have significantly less lyrical content than average.

Based on the data above, the following could be suggested:

- Songs written by three or more writers are likely to feature higher levels of sectional variety both musically and lyrically.
- Songs written by three or more writers in a 'whole band' scenario are more likely to emphasise the use of separate instrumental sections, and feature less lyrical content.
- Songs written by three or more writers, but not in a 'whole band' scenario, are likely to feature higher levels of lyrical content both in terms of actual content (the number of words) and sectional variety (the number of lyrical blocks).

Based on some of the discrepancies discovered between the two different groups within this overall subset it seems logical to explore the data for these groups independently, especially the 'whole band' subset, given that it constitutes 11.33% of the whole dataset (34 songs). Given that it has already been established that the mean word count for this subset is lower than average, and that there is a greater tendency in this subset for instrumental blocks to feature, one might think this could have an inverse effect on the number of compositional blocks used with lyrical content. However, the mean number for the 'whole band' subset is 3.06 compared to a sample average of 2.84. One might point to the fact that within this group of songs, the material by Red Hot Chili Peppers might skew this mean upwards, however that appears to be mainly the case with lyrical blocks, and the mean word counts (which, although they are less than the whole sample means, are brought up considerably by the fact that the RHCP songs have notably high word counts and make use of notably high levels of lyrical sectional variety). There are some examples elsewhere in the 'whole band' subset of songs with higher than average numbers of compositional blocks (w/lyrics) but word counts that are significantly lower than average.

'No Surprises' (1997) by Radiohead, for instance, is a song the makes use of 1 instrumental block, and 4 compositional blocks that have lyrical content, which is a relatively high level of sectional variety. The word counts however are 79 (content) and 112 (uttered). This is an example of a band emphasising the importance of instrumental sections, as well as sectional variety in general, but with a lower volume and density of lyrical content.

In spite of the higher numbers of compositional blocks for this subset, some of the figures concerned with harmonic content remain largely representative of the sample as a whole. The average number of chords used in a song is 8.5, compared to the sample average of 9.16, and the average number of chords per bar is essentially the same as the sample average (3.14 compared to 3.13). On one hand this suggests that these writers tend to make a typical amount of harmonic material (as evidenced by the number of chords used and the harmonic rate) go further in terms of variety (as evidenced by the higher number of compositional blocks).

An issue that should be considered for the observations made about this subset, is that the data might be affected by the relatively small number of bands represented in this group. Whilst numerically, the number of songs makes up just over a tenth of the whole sample, because of multiple contributions from the same group of writers, only 6 bands are represented. Whilst there is some stylistic variety within the six bands (Deep Purple, middle era Fleetwood Mac, Red Hot Chili Peppers, Nirvana, Radiohead and Greenday), the fact that RCHP and Radiohead contribute 10 songs each, some of the findings for the subset are likely to be heavily influenced by the individual practices of these bands. Nevertheless, this caveat is given in the context of being critical about the data with the sample at its current size. The suggestions above about the amount of sectional variety and use of instrumental sections are more positive indications that this method can produce data outcomes for subsets that are linked to the practicing methods of writers or groups of writers.

5.7. Exploring Characteristics of Styles or Genres Through Sample Field Choices

These case studies illustrate a small number of ways that the data might be used to address the question of style. Using lyrical data proportion as a method of defining a subset provides a context for categorisation that is unique to this methodology, given that is uses a metric that is original to the framework. Philosophically, the fact that the link to a genre (in this case folk) was made after the subset was formed is significant, as it means that the data outcomes lead the exploration.

The relationship between music and lyrics is embedded within discussion of songs with a 100% lyrical data proportion as well as sections 5.4. and 5.5. where structural data features are used to determine the subsets as these metrics are inherently defined by this relationship. Examining songs that make use of a high number of compositional blocks (a context provided by the existence of the larger sample dataset) allows for the definition of a group of songs that are related by a stylistic element of their songwriting – something which is separate to genre. It is encouraging that observations about genre as well as style have been made in this chapter as it shows that the framework can be used to inform research into, for instance, the elements of genres or individual styles that are dictated by songwriting rather than arrangement or production.

One of the intentions of designing a new way of presenting data about songs is to provoke different discussions. Using information about the provenance of songs (in this chapter focusing on the number of writers) provides a different context for a discussion of style. This subset includes some data that poses questions about songwriting practices, or rather, how these practices influence outcomes. This theme is continued in the following chapter, where songwriting style or arguably, songwriting voice is explored through the examination of individual artist, band and songwriter subsets.

6. Data Relating to Style: Band/Artist Subsets

6.1. Band/Artist Subsets

Where the previous chapter dealt with subsets defined by data features, the subsets discussed in this chapter are defined by the artists or bands who performed them. The case studies below include discussions of songs by Chuck Berry, Red Hot Chili Peppers, and Crowded House. The framework's use as a tool for dispassionate comparison of groups of songs is illustrated in an investigation of songs by Stevie Nicks and Christine McVie in Fleetwood Mac that demonstrates the commonalities and discrepancies in their relative practice as evidenced by the songs included. There is also a case study of Randy Newman songs examined in the context of a Peter Winckler essay on "Randy Newman's Americana" (1988) to demonstrate how the framework might be used as a basis for analysis to complement other methodologies. Finally, a subset of songs by Radiohead is considered in the context of literature written about the band and their approach, to address the second part of the third research question from the introduction, about how patterns in the data relate to expectations about style and genre.

6.2. Identity and Songwriting Style Case Study – Chuck Berry Subset

There are 11 Chuck Berry songs included in the dataset, recorded between 1956 and 1964. There are some remarkable levels of consistency in the data recorded for his songs.

The average running time of the songs in this subset is 151.27 seconds, which is considerably shorter than the sample average of 224.6 seconds. It is also worth noting that five out of the 11 songs in this subset have an almost identical running time

(142/143 seconds). All 11 songs are in 4, which isn't particularly unusual given that 85% of songs in the sample are – nevertheless it is another example of consistency.

The average duration of a compositional block in this subset is 15.9 seconds, less than the sample average of 21.31 seconds. The average number of bars that comprise a compositional block in this dataset is 11.6, which is greater than the sample average of 10.1. Therefore, this indicates that the Chuck Berry songs in this subset have faster than average tempi. On the subject of consistency, it is worth looking at the frequency with which certain total numbers of bars per compositional blocks are recorded for this subset:

Tab. 6.1.

Number of Bars per Compositional Block	Frequency
4	2
8	2
12	14
16	1
24	1

The average number of bars (11.6) is informed by 70% of compositional blocks consisting of 12 bars. This is a level of structural consistency that is not seen elsewhere in the sample for individual songwriters.

Harmonically, what could be described either as high levels of consistency, or an extreme lack of variety produces some interesting statistics. Ten out of the 11 songs in the subset use three chords in total, and the remaining song uses only two. Functionally these chords are all the same: chords I, IV and V, and in the case of the song that uses only two chords: I and V. Because of this functional relationship there is a direct relationship between harmonic classification and percentage dissonance for this subset. It seems as though when arranging these songs it was decided to either approach chords I, IV and V either all as major chords or all as dominant chords. As such all the songs in this subset have a percentage dissonance average of either 100% or 0%. The addition of the minor seventh chord tone in the songs with percentage dissonance of 100% means that the three songs with 0% have a harmonic classification of 1, whereas the eight with 100% average percentage dissonance have a harmonic classification of 2. It is the lack of functional variety in the harmony employed that leads to such a clear relationship between these two features, and this is unique to this subset.

The average number of lyrical blocks used in this subset is 5.18, compared to a sample average of 4.91, similarly the average content word count for this subset is 179.1 compared to a sample average of 156.86. The average number of total compositional blocks for the sample is 3.24 and the average for this subset is much lower, at 1.91. So, the averages that indicate the amount of lyrical content show figures that are slightly higher than the sample averages, but this is in the context of figures relating to musical content and harmonic variety being in some cases significantly lower than the sample average. Also, as noted previously, the songs in this subset all have high lyrical data proportions – indeed six out of the 11 songs have a lyrical data proportion of 100%. This is another indicator of lyrical variety at a lyrical block level. It follows that the level of variety exhibited in the lyrics of Chuck Berry's songs can be said to be inversely related to the level of variety in terms of harmony and structure.

The term 'variety' is used above in the context of how sectional repetition informs the two types of word count used in this framework. However, semantic variety is a different matter. For this subset there can be said to be a level of overall variety, evidenced by 20 out of the 22 semantic classifications being selected at least once for these 11 songs. The two semantic classifications that aren't used in this sub set are 'Quantity and Number' and 'Warfare and Hunting'. The semantic classification 'Religion and Beliefs' is only selected once, for the song 'Promised Land' (1964) -

because of the two references to 'the promised land' in the lyrics: the historical context of this phrase is biblical even though it's usage in this case is not ostensibly religious. As a tangential point – this particular piece of data might be informative for a researcher considering the narrative of African-American musical forms in the nineteen-fifties and sixties. Typically this narrative includes the inter-related nature of gospel and blues music in the formation of soul and rhythm and blues. The general lack of ostensibly religious lyrics, or semantic elements that have a religious etymology in Chuck Berry's songs could indicate something about Berry's place within this narrative for a researcher interrogating the interaction between artists and audiences at that point in history.

The most frequently used semantic fields in this subset are 'Motion and Transportation', 'Possession and Trade' and 'Social Relations'. Each of these appear eight times (72.72% of the subset) although not always together. One song in which these semantic fields are employed together is 'Almost Grown' (1959) and this section of the lyrics encapsulates the interaction of the three semantic fields:

I don't run around with no mob
Got myself a little job
I'm gonna buy me a little car
Drive my girl in the park

The application of the semantic typology is straightforward in this example. The references above to 'a little car' and the verb 'drive' come from the 'Motion and Transportation' field. 'A little job' and 'buy me' come from 'Possession and Trade' and 'don't run around with no mob' and 'my girl' refer to 'Social Relations'. In a way, this short verse is a microcosm of the central themes of much of Chuck Berry's lyric writing. Thomas Collins (2019) writes about how Berry is "particularly adept at conveying visual, auditory and tactile phenomena" (p. 25), and Gregory Sandow (1987) refers to Berry as a "poet of practical life" (p. 1). These observations are informed by more than just the semantic groups that the words used fall into, but they are not directly contradicted by the data outcomes here. Berry consistently references modes of transport, particularly cars and generally in the context of actually travelling, rather than just the ownership of them (although this theme also features). In terms of 'Social Relations', there are frequent references to teenage romance and young love in the songs included in the subset. A meaningful discussion of the social context of this material is for another study, what is important here is that the application of the framework to these songs indicates high levels of consistency in Berry's lyrical style, and this data outcome would certainly help to contextualise a discussion of his lyrical themes.

The lyrical rate used in this subset provides another example of consistency. The average words per bar figures for this subset are clustered closely around the mean for the whole dataset (3.11 words per bar). The lowest figure for this subset is 2.53, and the highest is 4.47, although other than this one outlier ('Let It Rock' - 1959) the other ten songs all fall within 0.75 words per bar of the mean. The range for this subset is 1.94 words per bar compared to a sample range of 7.49. The relatively small range, particularly of 10 out 11 of the songs, is of interest here in terms of an indication of consistency.

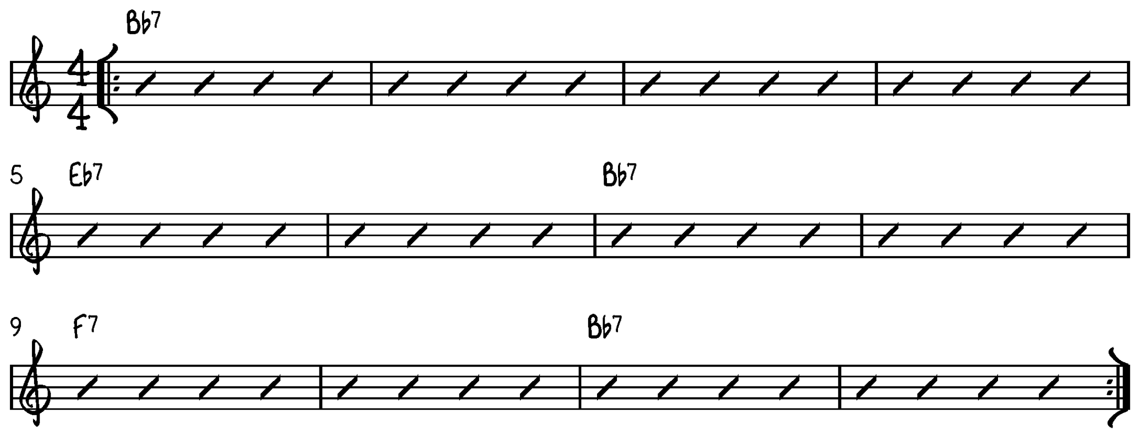
There are further examples of consistency evidenced by the melodic characteristics column. 90.9% of the songs in the subset feature 'blues notes' and the same number feature a 'frequently repeated phrase'. 81.81% feature both. 5 out of the 11 songs feature 'embellishment within an otherwise repeated block', and a range of other characteristics feature (9 out of the 15 possible characteristics in the typology feature in this subset). The predominant use of 'blues notes' and 'frequently repeated phrase' as characteristics should be considered alongside the relatively small range of figures for words per measure, as this combination gives a clear indication of some key features of Berry's style of song melody writing. For the five songs that feature 'embellishment within an otherwise repeated block'[31], this feature is entirely related for this subset to lyrical data proportion. All five songs that feature this melodic characteristic also have a lyrical data proportion of 100%. This is a logical synergy, since none of the lyrical blocks are repeated for these five songs, but several of the compositional blocks are. It stands to reason that some embellishment or alteration is likely to occur to facilitate slightly different numbers of syllables in what is an otherwise repeated musical section.

The average number of rhyme schemes employed in this subset is 1.36, compared to a sample average of 2.13. As a proportion of the subset 72.72% of these use only one rhyme pattern compared to 23.67% for the whole sample. 18.18% of this sample features two rhyme patterns compared to 40.33% of the whole sample. The fact that Berry tends to use fewer rhyme schemes can be viewed alongside the consistency with which he re-uses some fairly basic musical structures, again there is a logical synergy here. Furthermore, one can see a clear link between the number of bars used in compositional blocks and the actual rhyme patterns themselves. Rhyme patterns that are organised in multiples of three feature regularly in this subset: AAA, AABBCC and ABCBDB. These rhyme patterns feature in songs that also feature at least one compositional block that is 12 bars in length, so there is a clear link between the musical structure and the lyrical setting, and a level of consistency in terms of how this is done. Interestingly one of the songs that features two rhyme schemes is 'Almost Grown' (1959) which features AABB and AA rhyme schemes, alongside two compositional blocks of 8 and 4 bars length respectively. However, but for lyrical repetition which necessitates two separate blocks being recorded, these two blocks when played one after the other (as they are throughout) form a 12 bar block with an AABBCC rhyme scheme.

[31] This refers to a repeated *compositional* block rather than a lyrical block.

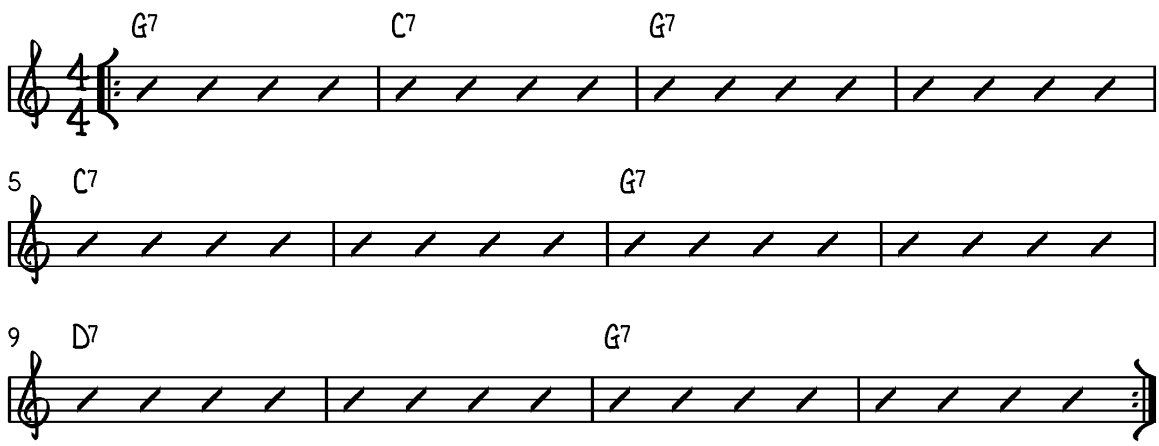
Consistency in the lyrics in this subset is coupled with consistency in data outcomes concerned with form. A notable statistic that shows up in this subset is a figure (0.4167) for 'chords per bar' that is recorded for five out of the 11 songs. There is a logical reason for this, as this describes the 5 chords used in arguably the most basic form of 12 bar blues, that Berry appears to favour:

Fig. 6.1. 12 bar blues form with 0.4167 chords per bar (e.g. 'Johnny B. Goode' - 1958)



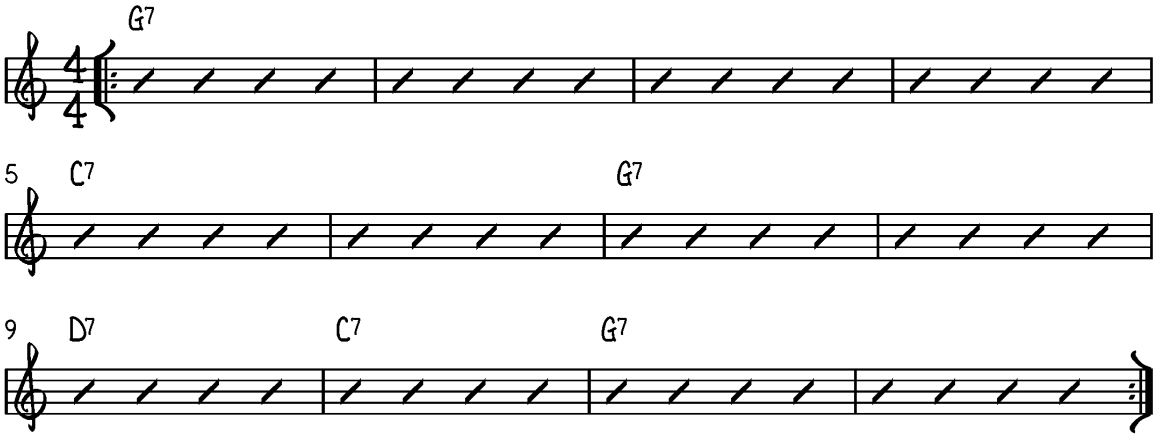
There are other examples of essentially the same form with small alterations that can be indicated by a 12 bar block with a certain chords per bar figure, for instance where this figure is 0.5833:

Fig 6.2. 12 bar blues form with 0.5833 chords per bar (e.g. 'Roll Over Beethoven' - 1956)



A Blues connoisseur may note that a figure of 0.5833 chords per bar would also result with the version of the blues form that leaves out the move to the sub-dominant on bar 2, but instead uses the sub-dominant on bar 10 and the dominant on bar 12. Equally a figure of 0.5 would occur as a result of the following version, which is arguably the most common in guitar-led blues:

Fig. 6.3. Common blues form with 0.5 chords per bar



Based on the evidence of the 11 songs in this subset, it appears that Berry tends to dwell on the dominant on the 10th bar of the form rather than moving down to the sub-dominant.

The repetition of the figure 0.4167 chords per bar is notable as an example of a single data feature that could indicate something further about a stylistic/structural feature of a compositional block – a pleasing outcome. Incidentally, the average rate of chords per bar for this subset is 0.4636.

In the context of the 300 song sample many of the observations made about this subset might be seen as specific to Chuck Berry. However, considering those patterns and synergies that can be explained by the predominant use of 12 bar blues form in his songwriting style, this subset could be considered more generally representative of blues/rhythm and blues songwriting in general. Although at some level the selection of songs in the sample was arbitrary, the methodological decision to try to select work by songwriters from a range of eras and styles (as much as is possible in 300 songs, whilst seeking to use multiple songs by individual songwriters) is proven useful by this case study. In terms of the future use of the framework, this subset of songs can be seen as representative of the style or sub-genre, and indicative of how certain elements of style can be indicated by data outcomes arrived at by the use of the framework.

As for Chuck Berry as an individual songwriter, data outcomes for this subset can allow one to draw conclusions about his particular style. It is possible to surmise that Chuck Berry songs are likely to feature the following:

- No more than three chords in total
- A compositional block that is 12 bars in length
- A block with a harmonic rate of 0.41667 chords per bar
- The use of only one rhyme scheme, with lines of two bars in length
- 'Blues notes' and 'frequently repeated phrases' in the melody
- A lyrical density of about three words per bar
- Themes of 'motion and transportation', 'possession and trade' and 'social relations' in the lyrics

'Johnny B. Goode' (1958) and 'No Particular Place to Go' (1964) both feature all of these characteristics. As an interesting aside, at the time of writing, these two songs are in Berry's top five most streamed songs on Spotify and Apple Music. Given that these streaming statistics began to be collected over 50 years after the release of these songs as singles, this gives an indication of which of Chuck Berry's songs are most popular in their contemporary context as historical pieces. Is it a coincidence that the songs that appear to be the most crystallised examples of Berry's style are amongst those that are most listened to in a retrospective context? Clearly there are other social factors that affect streaming figures (Berry's second most streamed song is 'Run Rudolph, Run' (1959) – streaming statistics for Christmas-related songs have a set of rules of their own!) but nevertheless this is an example of how outcomes from the data gathered by using the framework can be considered in other contexts.

This quite specific blueprint for an individual songwriter's style is easier to compile when the songwriter in question is so consistent, but nevertheless it is a musically meaningful outcome of a data analysis. Even more so when one considers that for each of these key features of Berry's style it is also possible to comment on how they compare with the rest of the dataset. The fact that a number of the features (e.g. the use of three chords, the use of blues notes etc.) are seemingly obvious traits to the informed listener is a positive one, as this indicates that the data produced by the framework tallies with experience and gives credence to those measures that are more statistically expressed (words/chords per bar etc.).

6.3. Identity and Songwriting Style Case Study – Red Hot Chili Peppers Subset

The 300 song sample includes ten songs by Anthony Kiedis/Flea/John Frusciante/Chad Smith – the longest lasting lineup of Red Hot Chili Peppers. The ten songs come from a period of time of over a decade, with 'Under The Bridge', 'Suck My Kiss' and 'Give It Away' coming from 1991's *Blood Sugar Sex Magik'* and with 'Get On Top', 'Scar Tissue', 'Around The World' and 'Californication' all coming from 1999's *Californication*. The subset is completed by 'The Zephyr Song', 'Universally Speaking' and 'By The Way' from the album *By The Way*, released in 2002.

This subset has already been mentioned as a group with some specific lyrical characteristics, especially with regards to words per bar. The highest rate of words per bar of any song in the whole sample belongs to this group: 'Give It Away' which has an average rate of 8.183 words per bar, featuring one lyrical block with a rate of words per bar of 12.25 (also the highest in the sample for a single block).[32] The

[32] This is mentioned in Chapter 4.2.

average rate of words per bar for this subset is 4.65, which is considerably higher than the sample average of 3.11.

This subset has an average rate of words per second (the uttered word count total divided by the number of seconds the track runs for) of 1.315 compared to a sample average of 1.033. This difference should be considered in the context of the range of results for this measure (0.201 words per second to 2.45 words per second) and the fact that a dominant proportion of the data results are scattered very closely about the mean. As such it is fair to state that, both on a block-by-block basis and in 'real terms' over the course of a whole song, high levels of lyrical density or a high lyrical rate are a feature of Red Hot Chili Peppers' songwriting practice. To consider a degree of variety rather than simply a volume of lyrics, a range of other data features can be examined.

At the most fundamental level, one can consider the number of compositional blocks employed in this subset. The average number of compositional blocks with lyrical content used by the songs in this subset is 3.5, as opposed to a sample average of 2.84. The average number of total compositional blocks including instrumental blocks is also higher than the sample average (4.3 compared to 3.24), in fact, by a more considerable margin. This leads to two related conclusions:

1. The songs in this subset feature a level of sectional variety that is higher than average.
2. They also make more use of instrumental sections than is usual.

This idea of higher than average levels of sectional variety also seems to be the case lyrically: the average number of lyrical blocks for this subset is 6.1 compared to a sample average of 4.91. All of the songs in the subset feature a number of lyrical blocks that is higher than this average, with two songs featuring 7 lyrical blocks ('Get On Top' and 'The Zephyr Song') and 'Californication' has 10 lyrical blocks – the highest number recorded in the sample. This is another example of the highest figure for an organisational lyric-related feature belonging to this subset.

Casually, a listener or fan of Red Hot Chili Peppers might suggest that a strong stylistic feature of their songs is the juxtaposition of rap-influenced vocal sections with more (in the context of pop and rock) traditionally melodic sections. Examining the types of lyrical characteristics recorded as being used in this subset, it seems that this supposition is reinforced by the data. Arguably, certain lyrical characteristics could be said to be related to rap. In particular: 'single note', 'two notes' and 'frequently repeated interval'. Seven out of the ten songs in this subset feature one of these melodic characteristics, compared to 16% of the overall sample. If the definition of rap-related melodic characteristics is narrowed down even further to: 'single note' and 'two notes' - on the basis that whilst a frequently repeated interval can be a feature of rap, it is also very often a feature of melody in general - then this comparison is even more stark. Seven out of ten songs in this subset feature one of these two characteristics compared to 4.667% of the songs in the whole sample, or put another way, 50% of the songs that feature one of these characteristics come from 3.33% of the whole sample. The same seven songs from this subset are still affected, because the appearance of the 'frequently repeated interval' characteristic only appears concurrently with the 'two notes' characteristic, as in 'All Around the World' where the two 'notes' essentially alternate to give a sense of inflection for emotional emphasis as well as a sense of punctuation in the rap sections. In this song, this feature occurs in compositional block A. The 3 lyrical blocks that are set to this compositional block feature a very high rate of words per bar (7.75, 8.125 and 8.125 respectively), further reinforcing the idea of a rap influence.

If one were to make a similar generalisation about what characteristics might indicate more typical pop or rock melody writing, one might suggest 'pentatonic melody', 'scalic' melody or 'arch-like' melody. Six out of the seven songs with 'rap-related' melodic characteristics in this subset also feature one of these 'typical melody' features. The song that doesn't also feature one of these other three characteristics ('The Zephyr Song') does feature an 'undulating' melody which, by definition, has to occur separately (in a block-by-block sense) to the 'two notes' and 'frequently repeated interval' characteristics also recorded for this song.

This idea of lyrical sections with rap-related characteristics being juxtaposed with lyrical sections with more traditional pop melody characteristics also gives some context to the levels of lyrical density (or words per bar) in this subset. In general it has already been noted that the mean words per bar figures for this subset are higher than the sample average. However, this fails to recognise that certain songs also show large disparities between compositional blocks for this data feature – reinforcing the notion of this stylistic juxtaposition. 'Get On Top' for instance has an overall rate of words per bar of 3.8 which is higher than the sample average of 3.11 but not dramatically so, but this only tells part of the story. This song features 7 lyrical blocks set to 4 different compositional blocks. The first lyrical block, the only one set to compositional block A, features only 1.5 words per bar. There are 2 lyrical blocks set to compositional block B that both have a rate of 2.75 words per bar, and compositional block D has one iteration where the rate of words per bar for the accompanying lyrical block is 2.1. Compositional block C by comparison has lyrical blocks set to it that feature much higher rates of words per bar: 5.75, 5.625 and 6.125. This then is an example of a song that contributes to an overall sense that Red Hot Chili Peppers songs feature a higher than average rate of words per bar on a whole song average basis but that on a block-by-block basis the data shows further evidence of stylistic juxtaposition.

Fig. 6.4. Compositional Blocks A and B of 'Get On Top' (1999) by Red Hot Chili Peppers

The idea of variety, and sectional variety in particular, is further reinforced by examining the data for harmonic features. As a general feature, this subset features the use of multiple tonal centres far more frequently than is usual for the larger sample. The mean number of tonal centres for the ten RHCP songs is 2.1, which is significantly higher than the sample average of 1.23. 20% of the songs in this subset use only 1 tonal centre compared to 80% for the whole sample. 50% use 2 tonal centres compared to 16.67% for the whole sample, and 30% of the songs use 3 tonal centres compared to 3% for the whole sample. This reinforces a sense of general harmonic variety throughout these songs, however viewing the number of tonal centres used alongside the harmonic classification of the songs gives a further sense of variety at a compositional block level.

Half of the songs in this subset make use of multiple tonal centres, but only feature harmonic material characterised as harmonic classification 1. The songs in question are 'Give It Away', 'Californication', 'Around the World', 'The Zephyr Song' and 'By The Way'. Since harmonic classification is defined within the confines of a single compositional block at a time, where songs have this combination of characteristics it means one of two things musically:

1. All of the harmonic material is diatonic, and the song features a wholesale key change/key changes.

2. All of the harmonic material is diatonic within individual blocks, but different blocks are in different keys.

For all five of the songs in this subset the latter is the case. In the case of 'Around the World' the compositional block that would most likely be described as the verse is simply in a different key to the chorus. In the case of both 'By The Way' and 'Give It Away' however, a tonal centre shift occurs when moving to an instrumental compositional block. Both of these songs use 5 lyrical blocks which, although average for the whole sample, is relatively low for the RHCP subset. However it seems that a sense of compositional variety is provided by the use of not only a discrete instrumental compositional block, but one that is in a different key. The experiential result of this is obviously not only an exciting shift as original key is left behind as the instrumental section starts, but (as is the case for both of these songs) the sense of return when the original tonal centre is assumed for another iteration of one of the previously stated compositional blocks with lyrics.

Within this subset there is an example of an unusual feature that happens only once in the whole dataset. In the song 'By The Way' the first compositional block that is heard has the following lyrical block (lyrical block 1) set to it:

'Standing in line to see the show tonight,
And there's a light on,
Heavy glow,
By the way I tried to say I'd be there,
Waiting for,'

In regular terminology, this lyrical section might be described as a chorus as it occurs multiple times, and sometimes is followed by all or part of an alternate chorus (lyrical block 2). What is unique to this song (in the context of the dataset) however is that these two lyrical blocks are not only repeated but set to 2 different harmonic accompaniments at different points in the song. The alteration of the harmony takes the form of simply swapping one diatonic chord for another (vi for iii in this case) and adding a diatonic passing chord at the end of the phrase, however this is sufficient for it to be recorded as a separate compositional block and has a subtle, but tangible effect on the relative atmosphere of iterations of the choruses.

This is an example of a feature of the Red Hot Chili Peppers' songwriting practice that demonstrates structural invention. Since this setting of lyrical blocks to multiple compositional blocks only occurs once in the whole dataset, this is a demonstrable example of idiosyncrasy in their practice. One advantage of discussing this phenomenon in the context of the framework is that this interesting feature has been highlighted as a statistical outlier, which is not only what drew this observation in the first place, but it also gives an accurate sense of this being an unusual approach, even though it is a relatively simple idea.

6.4. Comparing Stevie Nicks and Christine McVie

Considering the distinction made in the introduction between what might be called primary and secondary domain song elements, it is interesting to consider how much of what accounts for the recognisable style of certain bands or artists is in the core of the songwriting, and how much is to do with arrangement and production. Fleetwood Mac are an example of a band with a large catalogue of material spanning over decades. Within the initial sample are 13 Fleetwood Mac songs from a ten-year period from 1977-1987, when the band's success was at its zenith in terms of album sales. The albums from this period include *Rumours* (1977), *Tusk* (1980) and *Tango In The Night* (1987) and each album is often celebrated for having a certain sound. A characteristic of the band's approach is that songs were contributed by different individuals within the band, and within the 13 songs in the sample 5 are written by Stevie Nicks, 7 are written by Christine McVie (including one co-written by Robbie Patton and one co-written by Eddie Quintela), and one is written by them both with Lindsey Buckingham, the other principle songwriter in the group in this period.

In a feature on McVie in the Guardian in 1988, John Cooper wrote:

> As for her fellow chanteuse Stevie Nicks, McVie believes that they both profit by the contrasts between their voices. "We don't compete with each other: We're so different in songwriting and style…Stevie's a lot tougher and harder in her voice. I enjoy sweetness in music." (Cooper, 1988)

Whilst it is not clear whether Cooper and McVie are referring to the timbre or grain of the two individual voices or the idiosyncratic songwriting approach, there is a clear indication here of an accepted divergence in songwriting style. This case study demonstrates how the data presented can be used to suggest some conclusions about stylistic commonalities and differences between the two.

Fleetwood Mac Songs Featured in the Dataset:

'I Don't Want To Know' (1977) – Stevie Nicks
'Dreams' (1977) – Stevie Nicks
'Sara' (1979) – Stevie Nicks
'Fireflies' (1980) – Stevie Nicks
'Gypsy' (1982) – Stevie Nicks
'Say You Love Me' (1976) – Christine McVie
'Think About Me' (1979) – Christine McVie
'Everywhere' (1986) – Christine McVie
'Hold Me' (1982) – Christine McVie/Robbie Patton
'Don't Stop' – (1976) – Christine McVie
'Songbird' – (1977) – Christine McVie
'Little Lies – (1987) – Christine McVie/Eddy Quintela
'The Chain' – (1977) – Christine McVie/Stevie Nicks/Lindsey Buckingham

In terms of structure, the McVie songs use, on average 2.85 compositional blocks with lyrics and 3.57 compositional blocks in total. In relation to the rest of the sample dataset this means McVie uses almost exactly the mean number of compositional blocks with lyrics, but more instrumental blocks than average (the sample average is 3.26). Nicks uses fewer compositional blocks, and in fact uses 3 compositional blocks in each of the songs recorded, with just one 1 instrumental block also on 'Dreams'. Although the average numbers of blocks used by McVie are close to the overall sample average, there is a much greater variety song-to-song than in the case of the songs written by Nicks. 'Hold Me' and 'Little Lies' for instance only feature 2 compositional blocks, whereas 'Say You Love Me' features 6 in total, including 2 instrumental blocks.

The size of the compositional blocks (in terms of the number of bars they are comprised of) used by the two writers demonstrates another difference of approach. In this case it is McVie that shows the greater level of consistency.

Tab. 6.2. Size of Compositional Blocks in Christine McVie Subset

Number of Bars in Compositional Block	Frequency	Frequency as a percentage
4	3	12%
6	2	8%
8	13	52%
12	1	4%
16	6	24%

This shows a strong tendency for blocks to be made up of phrases that are multiples of 4 bars in length (92% of the blocks in this subset) and a very clear mode result of 8 bars in length. All of these songs are also in 4, demonstrating a very strong tendency for McVie to make use of regular, 'square' phrases.

Tab. 6.3. Size of Compositional Blocks in Stevie Nicks Subset

Number of Bars in Compositional Block	Frequency	Frequency as a percentage
8	4	25%
12	1	6.25%
14	1	6.25%
16	3	18.75%
18	2	12.5%
20	1	6.25%
24	1	6.25%
32	1	6.25%
40	1	6.25%
42	1	6.25%

This table shows far more variety in terms of the shape and size of compositional blocks, and also (because of the greater numbers of bars being shown here) either less repetition, or at least repetition of more substantial sections. 'Gypsy' and 'Fireflies' to an even greater extent, feature large compositional blocks relative to the rest of the sample. 'Fireflies' has a rather meandering quality which might be explained by the size of these compositional blocks (or vice versa). Because this data comes from using the framework's definition of a compositional block, these are observations about process in a secondary sense only – because one cannot be certain that the way that structure is ascribed by the framework after the fact is necessarily the way the writer themselves was approaching it.

Looking at the relationship between harmony and melody in the songs gives a sense of how the two writers' styles, whilst structurally different, can contribute to the canon of the same group. Both writers use predominantly diatonic harmony, in fact, of the 13 songs by Fleetwood Mac in the sample, only 'Don't Stop' by McVie and 'The Chain' (by McVie/Nicks/Buckingham and not in the separate subsets) use harmony from harmonic class 2. Nicks' harmonic vocabulary as recorded in the sample is exclusively diatonic. Coupled with this is a tendency to use pentatonic melodies at some point in the song (in nine out of the 12 songs between the two writers – including six out of the seven songs by McVie). In terms of melodic range, the average for McVie's songs is 13.29, and 14.8 for Nicks, with a collective average of 13.92 – which is just under the sample average of 14.78. From this data, it would be fair to say that both writers are conservative in their approach to harmony and melody.

Within the parameters of their collective use of diatonic harmony and pentatonic melodies within a limited range, there are still some slight stylistic discrepancies between the two. Nicks, for instance, is likely to make use of detached melodies. See the example below, in the song 'Sara' where there are frequent breaks in the melodic line that are longer than the melodic cells themselves.

Fig 6.5. Excerpt from 'Sara' (1979) written by Stevie Nicks for Fleetwood Mac

McVie on the other hand demonstrates a tendency to juxtapose the frequent repetition of a phrase or interval with either arch-like or scalic passages elsewhere in the melody.

On average, both writers use a similar number of chords in their songs. Given the tendency for the songs to be diatonic, it is perhaps not surprising that this average is less than the overall average for the sample. Nicks uses 6.2 chords per song on average compared to McVie's average of 6.28 (the sample average is 9.16 chords per song). There is, once again, a discrepancy of application between the two writers in spite of their very similar average. Each of the songs in the McVie subset use 6 chords except for 'Say You Love Me' which uses 8. Nicks on the other hand is much less consistent by comparison, using 3, 5, 5, 7 and 11 chords in total for different songs. Whilst the number of chords used by the two might be less than the sample average, their averages for percentage dissonance are higher: McVie with an average of 14.37% and Nicks with an average of 33.47% compared to a sample average of 10.25%. Whilst songs by the pair are likely to use fewer different chords than the norm, they are more likely to make use of chord voicings that include diatonic extensions. The average harmonic rates (chords per bar) of the two writers are marginally higher than the sample average (1.14) with McVie having an average of 1.17 and Nicks 1.21.

If one were to look at the word count data features for their combined output in the context of the band, the average content word counts and uttered word counts would be very close to the overall averages for these features, however this would be as a result of a balancing between the two writers. Nicks consistently includes a greater number of lyrics in her songs, see Table 6.4. below:

Tab. 6.4.

	Average Word Count (Content)	Average Word Count (Uttered)	Average Rate of Words Per Bar
Stevie Nicks	165.2	234.6	2.1
Christine McVie	123.6	201	2.83
Whole Sample	157.41	225.03	3.11

In terms of combined style, it is fair to say that a less than average lyrical density is a feature of both writers. In spite of her songs featuring a greater number of words than average, Nicks' musical setting of lyrics is generally sparse compared both to McVie and the general average. This is consistent with previous observations about her tendency to use longer compositional blocks and detached melodies.

Considering lyrical characteristics, 83.33% of the songs written by both writers use direct address (four out of the five Nicks songs and six out of seven McVie songs). McVie also makes frequent use of 'alteration of rhyme scheme within an otherwise repeated block' (in four out of seven songs). Whilst this characteristic features in roughly half of all the songs in the overall sample, it is interesting considering how consistent McVie is with the application of other aspects of structure and form that she is less so when it comes to rhyme.

Semantically, each of the songs by Nicks and all but one of the songs by McVie feature 'emotion' as a theme. This particular theme is the only consistent one in the McVie songs, however four out of the five songs by Nicks also feature themes to do with nature (under 'physical world' and 'animals').

In summary, the following could be said about the combined styles of the two writers:

- Songs by McVie and Nicks are likely to make use of diatonic harmony and pentatonic melodies and to be written in 4.

- Whilst songs by the pair are likely to use fewer different chords than the norm, they are more likely to make use of chord voicings that include diatonic extensions beyond a triad.
- The melodic ranges and harmonic rates in songs by the two are neither greater or lesser than average.
- Song lyrics are likely to make use of direct address.

As mentioned previously, Nicks and McVie are not the only writers to have contributed songs to the Fleetwood Mac canon, but nevertheless, this analysis could contribute something of interest to a discussion on the band's output, or their significant success. The fact that some of this data is so unremarkable (in that it features no obvious outliers or discrepancies compared to the whole sample) means that someone looking to ascertain reasons for their success would be directly signposted to other aspects of the band's recordings and performances to find answers, such as the sonic quality of records or stylistic nuance, or cultural context.

As for the two writers individually, within the scope of the stylistic parameters mentioned above there are a number of individual discrepancies. Songs by Stevie Nicks could also be said to be characterised by the following:

- Songs generally consist of 3 compositional blocks. These blocks are likely to vary in size, and are often significantly larger than the average block.
- These songs are likely to use detached melodies.
- A varied amount of harmonic material (the total number of chords used), and there is a higher likelihood than average that the chords used will have extensions beyond a triad.
- A use of semantic themes relating to nature (either 'physical world' or 'animals')

Songs by Christine McVie could be said to be characterised by the following:

- Overall, songs use an average number of compositional blocks, but the number of compositional blocks used per song is more varied than Nicks, and McVie is more likely to use instrumental compositional blocks. These blocks are highly likely to consist of numbers of bars in multiples of four.
- Songs will be likely to use 6 chords in total, with a higher than average likelihood that chords will use extensions beyond a triad (but not as likely as Nicks).
- A tendency to use frequently repeated phrases or intervals in the melody as well as either arch-like or scalic melodic shapes.
- The amount of lyrical content is likely to be less than average, and likely to feature alterations of the rhyme structure where multiple lyrical blocks are set to the same compositional blocks.

This case study cannot constitute a significant blueprint for defining the relative songwriting styles of the two writers in question due to the relatively small sample of songs, nevertheless this should serve as another demonstration of the kind of interrogation that can be conducted using the framework as a tool.

6.5. A Study of Idiosyncratic Style – Randy Newman

The sample dataset includes ten songs written and recorded by Randy Newman over a period of 27 years from 1968 to 1995.

Randy Newman Subset:

‘Cowboy’ – 1968
‘Baltimore’ – 1977
‘Feels Like Home’ – 1995
‘Dixie Flyer’ – 1988
‘I Think It’s Going To Rain Today’ – 1968
‘Gainsville’ – 1995
‘I Love To See You Smile’ – 1989
‘Sail Away’ – 1972
In Germany Before The War’ – 1977
‘Louisiana 1927’ - 1974

In his article “Randy Newman’s Americana” (1988), Peter Winkler wrote that “Randy Newman’s music has a distinctive and instantly recognizable sound, yet it deliberately draws elements from other musical styles, especially those evoking older American popular music” (p. 1). He examines a number of elements of Newman’s music in this context, considering both music and lyrics, including formalist aspects of analysis concerned with harmony and melody and the link to barbershop music, and American ‘parlor’ music. He also considers elements of the arrangements and orchestrations with links to early twentieth-century American composers and performance elements with links to blues, jazz and soul music from a more instinctive, interpretative perspective.

He qualifies his assertions about style in Newman’s music later in the article:

> Many pop artists of the seventies, eager to establish a sense of authenticity, would assemble a style out of disparate elements and then stick to it – for example, Bruce Springsteen’s synthesis of the epic ‘wall of sound’ of early sixties pop, the raunchy attack of Southern soul bands, and the poetic aspirations of singer-songwriter lyrics. Less typical are stylistic chameleons like Billy Joel or Randy Newman, who adapt whatever style seems most appropriate to the meaning of a song. The danger in such eclecticism is that it

> can degenerate into mere stylistic pastiche (which sometimes happens in Billy Joel's case). Newman's distinctive approach and persistent irony usually help him avoid this pitfall. (p. 16)

Given that a substantial piece on elements of Newman's style exists (albeit written before three of the songs in the subset) that includes both elements considered by the framework and otherwise, it is a useful exercise to analyse the data in this subset to see what the outcomes have in common with Winkler's analysis, and where the two approaches produce different conclusions.

One of the first general observations that emerges from examining the data in the Randy Newman subset is the level of organisational variety that is in evidence. Firstly in terms of rhythmic organisation, in spite of the fact that the use of quadruple metre is the most common, which is consistent with the rest of the sample, 40% of the songs in this subset use more than one metre compared to 10.67% in the whole sample. In terms of the number of compositional blocks used, the average number of compositional blocks with lyrical content is 2.6 which is slightly lower than the average, whilst the average number of total blocks is 3.4, compared to a sample average of 3.26. This shows that Newman uses more instrumental blocks than the norm established by the whole dataset.

Looking at the average number of blocks used is only part of the analysis however, because this average comes about as a result of the varied range of numbers for individual songs. This is also the case for the size of individual blocks, which varies greatly (both for instrumental blocks and otherwise). Take the comparison between 'Baltimore' and 'Dixie Flyer' as an example. 'Baltimore' uses only 2 compositional blocks, of 16 and 8 bars respectively: an arguably typical verse/chorus relationship. 'Dixie Flyer' on the other hand makes use of three compositional blocks with lyrics of 17, 16 and 34 bars respectively as well as an instrumental block of 18 bars: a stark contrast to the square, typical, pop song form of 'Baltimore'.

In the concluding section of his article Winkler writes: "I may have given the misleading impression that Newman's style is fixed and unchanging. In fact, there have been significant changes…and in his most recent work he uses synthesisers frequently, and his harmonic language more often uses the sorts of modal progressions found in mainstream rock" (1988, p. 24). The implication that the use of synthesisers is radical is perhaps of its time, and given that Winkler was writing in the middle of the period that the songs in the subset I am reviewing were written, I would say that the data here suggests an amendment to this assertion. It would appear that what is fixed is the changing and varied nature of Newman's songwriting style – even without considering arrangement and orchestration.

The information gathered from the songs in this subset does not suggest any trends developing over time. In fact, some of the most stark discrepancies in terms of structure and stylistic approach appear to occur concurrently. Consider 'Baltimore' once more, alongside 'In Germany Before the War'. Both come from the same album: *Little Criminals* released in 1977.

'Baltimore' consists of just 2 compositional blocks, one of 16 bars' length, and one of 8 bars' length. These blocks conform to typical verse and chorus characteristics in that there are three iterations of Block A, with three separate lyrical settings and 2 iterations of Block B with the same lyrical block set to them each time:

Fig. 6.6. Block Structure of 'Baltimore' (1977):

- Comp. Block A – Lyrical Block 1 – 16 bars
- Comp. Block A – Lyrical Block 2 – 16 bars
- Comp. Block B – Lyrical Block 3 – 8 bars
- Comp. Block A - Lyrical Block 4 – 16 bars
- Comp. Block B – Lyrical Block 5 – 8 bars

Compositional block A's harmonic structure consists of the same 2 bar repeated cycle, and any instrumental link sections between iterations of the compositional blocks consist of this material, which given its provenance within one of the compositional blocks with a lyrical element, does not constitute a separate instrumental block. Structurally, this looks like a basic pop/rock song – in fact, with the absence of a third section (i.e. a bridge/middle eight etc.) this is arguably even less structurally complex than the majority of pop songs.

'In Germany Before The War' however, there is quite a stark structural difference. Four compositional blocks are featured as well as a distinct instrumental block with the following structural narrative:

Fig. 6.7. Block Structure of 'In Germany Before The War' (1977).

- Instrumental Block IA – 2 bars
- Comp. Block A – Lyrical Block 1 – 8 bars
- Comp. Block B – Lyrical Block 2 – 7 bars
- Comp. Block C. – Lyrical Block 3 – 8 bars
- Comp. Block B – Lyrical Block 2 – 7 bars
- Comp. Block D – Lyrical Block 4 – 4 bars
- Instrumental Block IA – 2 bars

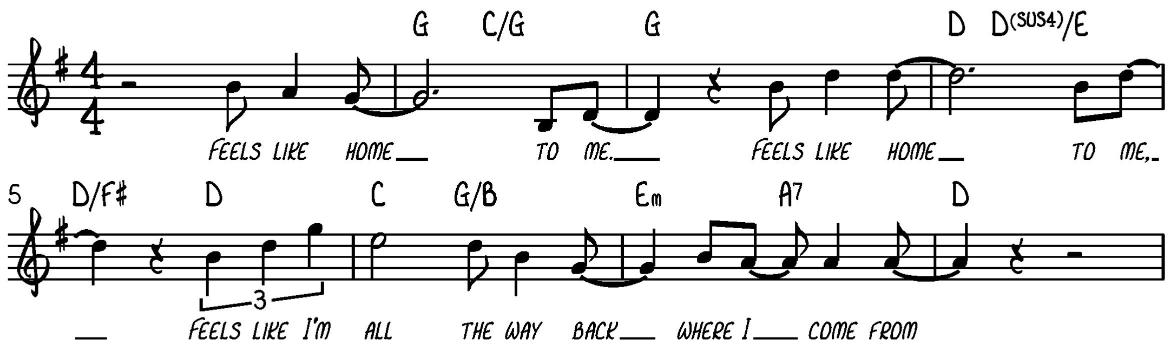
Before even considering the nature of the music within these blocks, it is already clear that this is a structure that, although still strophic, is much less typical. The relationship between Compositional Block B and Lyrical Block 2 appears chorus-like, and it is to an extent in the context of recording of the song, but the fact that there is less of a sense of typical verse-like repetition on a musical level this sense of 'chorusness' is somewhat compromised. Similarly the use of a completely distinct instrumental section (which incidentally is in a different time signature to really emphasise its independence from the other parts of the song) to bookend the composition is somewhat atypical, if not unique, in a pop or rock context.

The relationships between the various blocks in terms of proportion are also less neat than in 'Baltimore', in terms of the number of bars that constitute a block. Duration of blocks must also be considered when comparing the two songs in terms of structure and proportion, as the tempo has a particular impact when comparing these two. Block A in 'Baltimore' is 16 bars in length, and its duration is 38 seconds, compared to Block A in 'In Germany Before The War' which although 8 bars' length is 39 seconds long. So not only does one song have more content in terms of the number of blocks, this is in light of the fact that these blocks are not necessarily any shorter/smaller. This is borne out when one compares the compositional data proportion of the two songs (the total duration of the various compositional blocks, divided by the total running time of the track expressed as a percentage). 'Baltimore's is 23% compared to 'In Germany Before The War', which has a compositional data proportion of 62.16%. In general, Newman's songs have relatively high compositional data proportions – essentially they use less repetition than the norm. 6 of the top 20 figures for this data feature in the sample dataset are Randy Newman songs. However, to return to one of the points being outlined here, both 'Baltimore' and 'In Germany Before The War' appear on the same album in spite of one ('Baltimore') being ranked 80 of 300 for compositional data proportion (as the sample dataset) and 'In Germany Before The War' 294 of 300. This supports an assessment that Newman's use of a variety of compositional approaches (with structure and structural narrative being highlighted here) has been a general part of his practice rather than the result of a stylistic shift over time.

In spite of the range of structural approaches evident in this subset, which includes a variety of levels of harmonic rate, there is a consistency of approach on a song-by-song basis in terms of the type relationships between the chords used. It is common in the application of the framework for different blocks within the same song to have different harmonic classifications, but in this subset this is not the case. For a start, no single compositional block is completely diatonic. Beyond this, every block in each song has the same classification (either 2 or 3) – demonstrating a level of consistency of harmonic approach within the variety demonstrated.

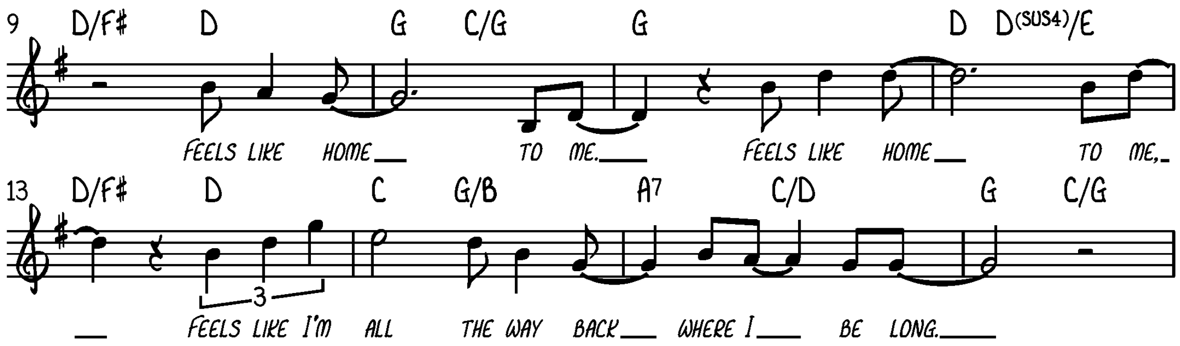
Where blocks use harmony from classification 2, it is often in passages that are predominantly diatonic but for the use of secondary dominants at certain points in the progression. The excerpt below from 'Feels Like Home' is a typical example:

Fig. 6.8. Excerpt from 'Feels Like Home' (1995)



It is the appearance of the A7 chord in the sixth full bar of the chorus here that determines that this progression belongs to the framework's harmonic classification 2. Other than this chord the rest of the harmonic material is entirely diatonic. This use of a dominant chord on the second degree as part of a II-V-I progression is a strong indicator of Newman's style, especially when the melody note/s it accompanies remain, as they do in this case, within the home key. There is no requirement for this harmony to be used instead of its diatonic alternative, but for the subtle increase in tension its presence elicits just before the dominant chord. It is interesting to note how the treatment of chord II contrasts with the treatment of chord V in the answering phrase:

Fig. 6.9. Excerpt 2 from 'Feels Like Home' (1995)



If the use of the A7 rather than its diatonic alternative (Am7) creates some tension prior to the dominant chord this is then followed by the use of C/D (or D9sus4) as an alternative to V or V7, which, with its absence of the leading note, makes for a smoother, less tense transition to chord I. Stylistically this is recognisable in other American songwriters' practice – notably James Taylor, who frequently swaps the diatonic minor 7 chord/ii7 for II7 towards the end of a section, when accompanying mostly major pentatonic melodies.

Half of the songs in the Newman subset use harmonic vocabulary from classification 3, and examples of this include bold juxtapositions of tonic major and minor harmonic vocabulary in the same block (as in 'I Think It's Going to Rain Today') and even at the same time in 'In Germany Before the War'. Other examples of harmonic classification 3 vocabulary include the use of chromaticism and parallel non-diatonic shifts as seen in this excerpt from 'I Love To See You Smile':

Fig. 6.10. Excerpt from 'I Love To See You Smile' (1989)

Even without the chromatic movement within the chord voicings, the nature of the relationship between the chords in this excerpt in terms of their function is sufficient for the harmony here to be described as classification 3.

There is another pattern linked to the harmony that emerges from the data in the subset, and that is to do with the relationship between the harmonic classification of the song (bear in mind the earlier observation that the classification of individual blocks is uniform throughout songs in this subset) and the amount of lyrical material:

Tab. 6.5. Relationship between harmonic classification and lyrical content:

Song	Harm. Class	Word Count (Content)
Cowboy	3	48
I Think It's Going To Rain Today	3	76
Sail Away	3	94
In Germany Before The War	3	124
Gainsville	2	126
Baltimore	2	130
I Love To See You Smile	3	145
Louisiana 1927	2	160
Dixie Flyer	2	167
Feels Like Home	2	183

There is a strong correlation between the use of harmonic vocabulary from classification 3 and a lower word count. In the context of the subset alone, the table above has the word counts ordered low to high, and other than 'I Love To See You

Smile' there is a clear indication that Newman is more lyrically economical when the harmonic language being used is more involved. In relation to the whole sample, every song in this subset that belongs to harmonic class 3 has a word count that is less than the average word count (156.86).

Winkler highlights a specific quality in Newman's work:

> Newman's economy (one is tempted to say minimalism, but that would be simply a trendy, avant-garde interest in repetitive musical processes; the kind of simplicity Newman practices is in an older tradition that includes figures as disparate as Beethoven, Webern and Count Basie) can be seen in all aspects of his work. (1988 p. 24)

From a songwriting perspective, the varied harmonic movement of 'In Germany Before the War' and 'I Think It's Going to Rain Today' and the linear, rhapsodic, recitative-like opening section of 'Gainsville' could hardly be described as minimalist. However, elements of the data in the subset do support the idea of economy. In the most basic sense, the songs included here are relatively short. The average running time of a track in this subset is 210.9 seconds, with one ('Cowboy') as short as 161 seconds. The average is not dramatically less than the sample average of 224.6 seconds, but the durations of individual compositional blocks gives some important context. The average duration of a compositional block (including instrumental blocks) in the subset is 31.26 seconds in length, significantly higher than the sample average of 21.31 seconds. 22 of the 34 compositional blocks are longer in duration than the sample average (some significantly so: 'Gainsville' features a compositional block that lasts for 111 seconds – the longest in the whole sample). An average compositional block duration that is significantly higher than the norm coupled with an average total running length that is less than the norm leads to a sense of fewer iterations of individual blocks than is normal: a type of structural economy. This is reinforced by the relationship between the content word counts and uttered word counts (the lyrical data proportion) for this subset. Eight out of the ten songs have a lyrical data proportion greater than the sample average, which further underlines that Newman tends to re-iterate blocks less than the norm, both lyrically and musically.

In spite of the fact that structural repetition appears to occur less than the norm in Newman's songs, as a lyric characteristic, 'repetition for emphasis' occurs in every one of the songs in the subset. Since this is the most common lyric characteristic in general, this is not particularly notable, but it is interesting to note the variety of ways this particular device is utilised by Newman.

The repetition of the single word 'lonely' in the third section of 'I Think It's Going to Rain Today' is an example of a dramatic setting of a lyric for obvious effect:

Lonely,
Lonely,
Tin can at my feet, think I'll kick it down the street
That's the way to treat a friend

Each line above is set to 2 bars of accompaniment – such that the repetition of the word 'lonely' is made all the more stark, ostensibly underlining the statement.

In 'I Love To See You Smile' there is an example of repetition for emphasis that is used in a number of his songs, where the final line of a section is repeated at the end of the song as a sort of final punctuation. See the final verse:

In a world that's full of trouble.
You make it all worthwhile,
What would I do if I didn't have you?
I just love to see you smile.
I love to see you smile.

In terms of the relationship between the lyrics and the music, the first four lines of this excerpt are encased in a compositional block that has been stated previously, and the final line is a repetition of the final two bars (it is a caveat in the defining of compositional blocks that such a repetition does not constitute a separate block since it is an obvious re-use of previously stated compositional material).

In the chorus of 'Baltimore' there is an example of two layers of repetition within a repeated lyrical block (the chorus) where not only are two lines repeated, but the final phrase is repeated again:

Oh, Baltimore,
Man, it's hard just to live,
Oh, Baltimore,
Man, it's hard just to live,
Just to live.

A final example comes in 'In Germany Before the War' where two very similar, but crucially different lyrical blocks are used.

I'm looking at the river but I'm thinking of the sea,
I'm thinking of the sea,
I'm looking at the river but I'm thinking of the sea

I'm looking at the river but I'm thinking of the sea,
I'm thinking of the sea,
Thinking of the sea

The initial repetition of 'I'm thinking of the sea' in the first block is set to a descending sequence that is reminiscent of a nursery rhyme, but crucially doesn't fulfil the expectation of the third repetition that seems inevitable and is made more uncomfortable by the dissonant harmonic setting and minor melody. The third line follows a similar pattern of initiated, but incomplete repetition that further underlines this feeling of unease which is designed to underline the peril of the character of the little girl who is introduced in the following lyrical block.

In the second excerpt, the third iteration of 'thinking of the sea' occurs, set to the expected sequential melody, but then the lyrics cease while the same accompaniment from before continues – another permutation of unfulfilled expectation. This is Newman playing with repetition deliberately to synthesise a sense of absence.

This case study is another example of how the data produced by the application of the framework can be used - in this case to support, refute or contextualise other analyses. To re-iterate a point that has previously been made, the philosophical purpose of this method is not to answer every possible question about a song or group of songs, or to claim that the elements considered by this framework are the only ones that matter, but rather to contribute something concrete and comparable to the study of songs and the practice of songwriters.

6.6. Crowded House Subset

The overall sample includes data for ten songs released by Antipodean band, Crowded House, with songs taken from throughout the ten years they were releasing material, beginning with songs from their first, eponymously titled, album released in 1986, to their final album: *Recurring Dream* which was a compilation album that included new tracks. All ten songs were written by Neil Finn, and two which were co-written by Neil Finn and Tim Finn: 'Weather With You' (1991) and 'Four Seasons In One Day' (1991).

Looking at the songs in this subset in terms of structure, we can see that there is a tendency for the songs to have greater than average levels of sectional variety, with an average number of compositional blocks (with lyrical content) of 3.4 compared to 2.84 and an average total number of compositional blocks of 4 compared to 3.26. This subset is one of only four groups of songs by the same band/artist whose songs included in the sample dataset uniformly consist of three or more compositional blocks with a lyrical component, the other three being Bon Jovi, The Beautiful South (songs written by Paul Heaton and Dave Rotheray) and Red Hot Chili Peppers. Every other artist or band's songs that form part of the sample include at least one song with only 2 compositional blocks with a lyrical component.

This increased level of sectional variety is in spite of an average duration of song, that at 221.2 seconds is slightly less that the sample average of 224.6 seconds. The average compositional block (including 6 instrumental blocks) lasts for 23.03 seconds, which is higher than the sample average of 21.31. Shorter than average song durations, higher than average block durations and a higher number of total blocks all contribute to a sense of these songs being less repetitive than the norm. Indeed, the average musical data proportion for this subset is 42.68%, which is significantly higher than the sample average of 31.25%. The lowest musical data proportion in this subset is 29.46%, showing that even the most economical use of compositional material in this group of songs is not much less than the overall average. Incidentally there is no sense of the musical data proportion increasing or decreasing over time:

Tab. 6.6.

Song Title	Year	Musical Data Proportion
Weather With You	1991	29.46%
Private Universe	1987	29.5%
Mean To Me	1986	30.1%
Locked Out	1993	30.61%
Don't Dream It's Over	1986	40.68%
Instinct	1996	45.45%
Distant Sun	1993	45.65%
Not The Girl You Think You Are	1996	52.8%
Four Seasons In One Day	1991	54.76%
World Where You Live	1986	67.74%

Whilst considering levels of repetition or otherwise, the average lyrical data proportion for this subset is also higher than the norm: 82.15% compared to a sample average of 71.44%.

Continuing to focus on the structural element of Finn's songs, there is a high level of variety in terms of the musical length (size or shape) of the various compositional blocks. From a total of 40 compositional blocks, no fewer than 15 different bar lengths are recorded, ranging from 3 bars to 31, demonstrating a willingness to vary section lengths (much more so than, say, Christine McVie).

Looking at various data features pertaining to both music and harmony, this set of songs can be said to be rich in content – especially given the shorter than average duration of the songs. The average number of chords used, the average number of tonal centres, the average melodic range, number of lyrical blocks used and number of rhyme patterns used are all higher than for the rest of the sample. The average word count (content) is 172.3 compared to 156.86. The average uttered word count for this subset is less than for the rest of the sample (209.7 compared with 255.03) –

but then this would be expected given how high the average lyrical data proportion figure is for this group of songs.

Although both average figures for this subset are higher than the norm, the average number of lyrical blocks used is only marginally higher, whereas the number of rhyme schemes used is more significantly higher than the sample average (2.5 compared to 2.13) – as ought to follow, given an almost average number of blocks with an increased number of rhyme schemes, the lyrical characteristic 'alteration of rhyme scheme within repeated block' is recorded for nine out of ten of the songs.

Finn's approach to rhyme schemes is noteworthy due to how varied it is. The average number of rhyme schemes for the subset might be higher than the norm, but the subset features songs with 0-5 rhyme schemes inclusive, the most variety for this data feature as recorded by a single songwriter.

Variety of approach is a factor that emerges in the data pertaining to both musical and lyrical elements in this subset. In the ten songs in this subset, 13 out of 18 possible lyrical characteristics are recorded as being used. All five of the characteristics not used are rhyme variants (alliteration, double/dactylic rhyme,oblique/forced rhyme, imperfect rhyme, limerick).

It is noteworthy that Finn frequently alters the rhyme structures within songs – demonstrating a tendency to be creative and expressive with the placement of rhyme (reinforced by his recorded use of internal rhyme also) but seems to limit this to the use of single-syllable rhyme or assonance. It is almost as though there is a contrast between the simplicity in terms of the types of rhyme used with some complexity in terms of how the rhymes are ordered or arranged.

The idea of a juxtaposition between a straightforward approach to one element of lyrics with a more creative application of another is further highlighted by considering how little Finn uses Non-Standard English or Vernacular (in only one out of the ten songs – compared to this characteristic's use in 63.67% of the overall sample). As an example, consider these lyrics from 'Don't Dream It's Over' (1986):

Now I'm towing my car,
There's a hole in the roof,
My possessions are causing me suspicion,
But there's no proof.

There is a poetic, figurative element to the lyric that is rich in imagery, but the discourse is standard in terms of its syntax and vocabulary.

On the subject of the harmonic language used – the relationship between the chords in particular – there is a different type of variety to that demonstrated by other writers that have been examined previously in this chapter. Randy Newman, for instance, made use of harmonic language from all three harmonic classifications defined by the framework, but with uniformity within each song (the harmonic classification for the various blocks within the same song are the same). With Neil Finn this is not the case, with an approach that seems to vary more on a block by block basis. Take the song 'World Where You Live' (1986) as an example:

- Block A – Harm. Class. 1
- Block B – Harm. Class. 2
- Block C – Harm. Class. 3
- Block D – Harm. Class. 2
- Block IA – Harm. Class. 1

Harmonic vocabulary from Harmonic Classification 3 is only recorded in this subset in this one song, however the use of two tonal centres is recorded three times in this dataset which is proportionately higher than the use of multiple tonal centres in the rest of the sample by more than 10%. This also contributes to a sense of harmonic diversity in Finn's songs. This sense of contrast between blocks is a feature of Finn's songs and is a contributing factor to the experiential element of how his style might come across to an audience, especially in terms of the order in which blocks occur and re-occur to give the songs their sense of narrative.

As stated previously, the songs in this subset use a higher than average number of compositional blocks, and lower than average levels of sectional repetition and on closer inspection, it is possible to see examples of how Finn develops material thematically even in what are described by the framework as separate compositional blocks. In 'World Where You Live' for example, compositional block D features much of the same melodic/harmonic/lyrical information as compositional block B (which is essentially the chorus) except that some of it is ordered slightly differently and then followed by a coda-type section. Because of the different order this is recorded as a separate block even though there are chorus-like features within in this section. This is an example of Neil Finn's frequently through-composed approach to structure.

'Not The Girl You Think You Are' (1996) features a final section (compositional block C) that uses only lyrics that have already been stated but arranged in a different order, and set to some new harmony and with different phrase lengths. This is very definitely a separate compositional block, but also an example of thematic development on a sub-block level.

In the song 'Instinct' (1996), compositional block C consists of what feels like a middle 8. It is followed by a lyrical block similar to that which constitutes the chorus, but set to different harmony and with an altered melody, followed by a further passage that is new to the song at this point, with no direct return to either of the previous compositional blocks. This is an example of an almost classical approach to thematic development. I would argue that this approach to structure and development of themes is what gives Finn's songs a sense of idiosyncrasy rather than the actual musical vocabulary used.

Fig. 6.11. Compositional Block B of 'Instinct' (1996) by Crowded House

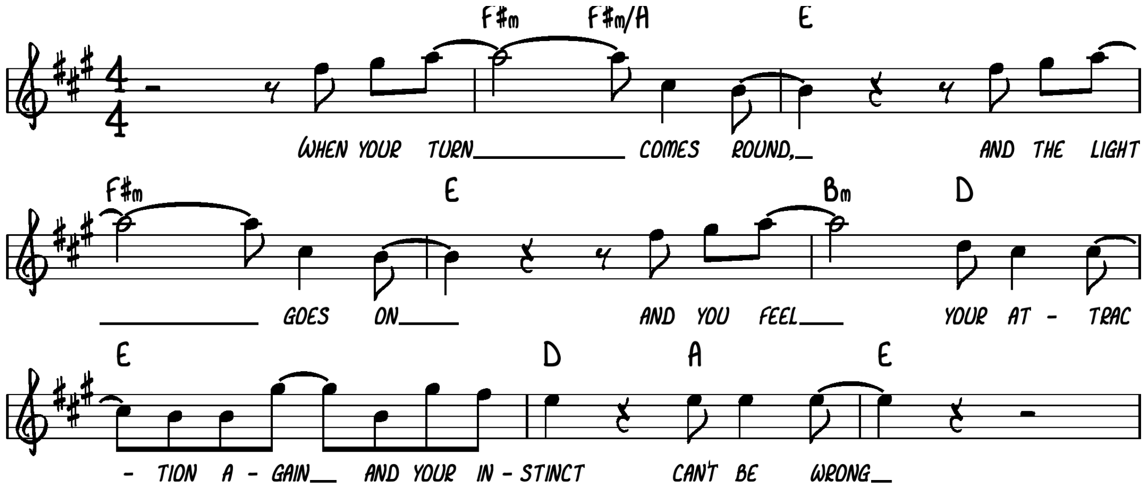
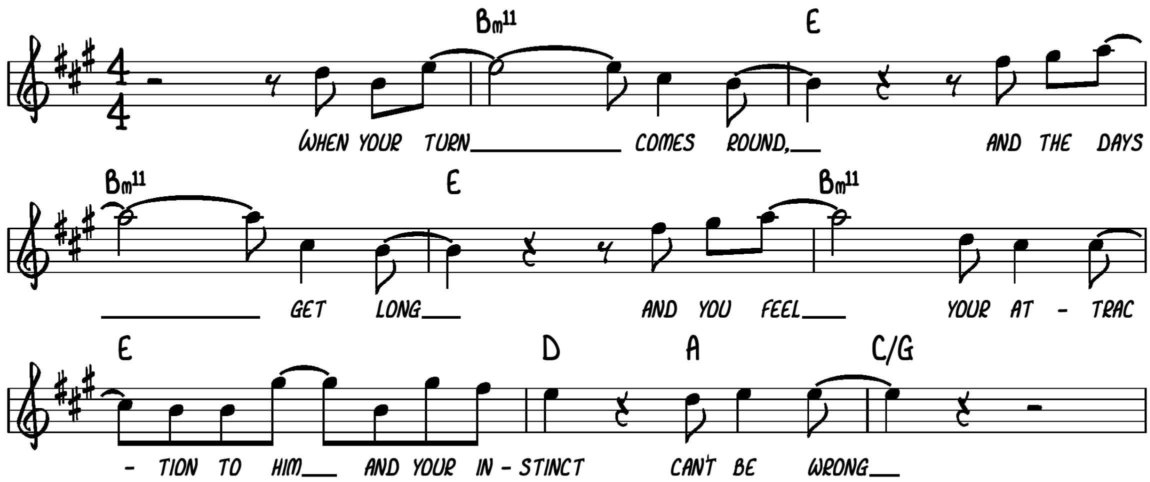


Fig. 6.12. Part of Compositional Block C of 'Instinct' (1996) by Crowded House that re-uses melodic and lyrical material from the previous block



In 'Four Seasons In One Day' (1991) there is a further example of Finn's approach to thematic development. Compositional block C brings melodic parts back that have previously been used but with an altered structure. Fragments of the material are being reused, but in such a way that a separate compositional block is formed, giving a sense of both development and familiarity.

Finally, Weather With You (1991) features an interesting bridge-like section (compositional block B) after the first verse (compositional block A) which is followed by a return to the second verse (compositional block A with a separate lyrical block set to it) This all occurs before the first iteraton of what would be considered the chorus (compositional block C in this instance). The song also features a three-bar codetta that is a sufficient departure from previous choruses to be described as a discrete compositional block (compositional block D).

Some of these examples of unusual songwriting practice would not necessarily be highlighted by simply examining the data. Taking the last example, 'Weather With You', the song features 4 compositional blocks, one with multiple lyrical settings (verse), one with multiple iterations with the same lyrical setting (chorus), one that occurs only once (a bridge or middle section) and a short coda-type section. This combination of blocks making up the compositional material of the song is not in itself unusual, but the ordering of them is.

This is a stimulus for two points of discussion. Firstly, should future applications of the framework include some sort of note of how the compositional blocks are ordered? The interesting approach to thematic development in Neil Finn's songs was noticed here by myself as I applied the framework, and the idea that some of this practice is unusual is anecdotal rather than supported by data. In the case of these songs, the order in which certain blocks occur (and indeed the non-repetition of certain types of musical sections) is part of what gives a sense of the writer's style. However, in the initial stages of designing the framework and establishing what it was that constituted the core material of a song it was decided that examining the constituent parts would be sufficient. Incidentally, in practice, compositional blocks have been recorded in the order they first occur, and this is the same for lyrical blocks – although this doesn't give a sense of the order in which reiterations of certain blocks occur, and similarly the presence of instrumental blocks also clouds this. Because of this practice it is possible to filter out the other examples of songs where the same phenomenon occurs as in 'Weather With You' – that is to say a 'bridge'-like section occurs before a chorus type section and is not then re-iterated. So in the dataset one would look for songs where there is a single lyrical setting of the second recorded compositional block (B) and that block does not then reoccur. Other than 'Weather With You' this occurs in five other songs, so in total in only 2% of the framework. It is statistically unusual. Furthermore, with some of the other examples, their presence in this group can be explained by other phenomena: 'Love Me Do' by The Beatles features such a block, but in the context of an AABA song structure. If the sample dataset contained more songs from before the nineteen-fifties there is a good chance there would be a higher number of songs in this group (indeed the typical B section of the traditional 32 bar 'chorus' would be referred to as the 'bridge' long before this term was re-appropriated for use as a tertiary section in modern pop and rock songs). Another song in the group: 'Like A Rolling Stone' (1965) is there because of an unusual phrasing discrepancy between the first 'chorus' and the following two choruses, which are 2 bars (one lyrical line longer) which is a subtle detail, but not quite the same phenomenon. 'El Condor Pasa' (1970) features in this group as it features an unusual (in the context of strophic pop songs and in the dataset) A-B-A structure. The anecdotal report that 'Weather With You' seemed to have an unusual structure seems to be reinforced by the information in the dataset, even without a specific way of recording block order.

The second point of discussion leads on from the first. The ability to anecdotally report that a certain phenomenon was unusual was made possible by the regimented nature of the data extraction process. An unexpected, but autoethnographically significant outcome of following a uniform process of breaking songs down to their constituent parts has been the way that the terminology employed in the application of the framework can affect one's implicit analysis of a given song. That is to say, when analysing any text, the chosen framework for analysis is likely to highlight the importance of certain phenomena over others. In a very basic sense, the process of dividing songs up into sections with a strict set of rules as to how this was to be done serves a primary purpose of ensuring parity across a dataset and the avoidance of the data being skewed by presupposed hierarchical ideas about types of sections. However, from the perspective of self-reflection, this came to serve a secondary purpose of helping frame an understanding of how a song was constructed during the data collection (framework application) process itself. Throughout this process notes were made on musical or lyrical phenomena that were noticed as a result of applying the framework, but that would not necessarily be apparent from the data. These notes were used above to report on Neil Finn's approach to thematic development, which was unique in the songs included in the sample set.

To conclude, the following can be said about the Crowded House songs discussed here (and the following suggestions made about Neil Finn's songwriting style):

- Songs feature higher than average levels of sectional variety, as evidenced by higher than average total compositional block figures. This artist subset is one of only four where all songs have three or more compositional blocks with a lyrical component.
- Songs could be said to be comparatively rich in content, with average figures higher than the sample averages for total chords used, number of tonal centres and melodic range as well as content word counts and total numbers of blocks as mentioned above.
- The average duration of songs in the subset is shorter than for the whole sample, and feature less sectional repetition than the norm as evidenced by an average compositional data proportion of 42.68% compared to 31.25%.
- Similarly, the songs feature higher than average lyrical content, but less than average sectional repetition of lyrics.

- A sense of variety in this subset is informed by a large range of different block lengths, as well as high numbers of characteristics recorded for both melodic and lyrical characteristic typologies. This is also the case for lyrical subject matter as evidenced by 17 of the 22 semantic classifications being recorded in this subset.
- Many of these songs feature a creative and subtly subversive approach to structural narrative and sub-block thematic development that is not necessarily indicated by the data (although there are examples where this is the case – the 'bridge' in 'Weather With You) but was certainly highlighted by the regimented nature of the data extraction process.

6.7. Radiohead - Addressing Expectations About Relationships Between Music and Lyrics

In the previous chapter it is suggested that although it is difficult to use data generated by applying the framework to make wholesale statements about relationships between specific music data features and lyric data features, this data can be used effectively to discuss data pertaining to music and lyrics together in the context of style and genre.

A reminder of the third research question posed in the introduction:

3. 'How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics?

One of the conclusions drawn from reviewing existing literature was that the design of the framework would require the invention, or original definition, of a variety of typologies and classifications in order to generate data. Although literature exists that highlights the importance of the relationship between music and lyrics, objective and quantitative techniques for song-related data extraction that could be directly implemented were few. The same can be said of hypotheses about this relationship in the sense of how certain music-related elements of songs relate to lyric-related elements in a general sense. Another way of addressing this question is to compare data from discrete artist subsets within the larger sample field with analytical literature about the given artist/band that deals with both music and lyrics.

The 300 song sample includes ten songs by Radiohead. Four songs in this subset come from 1993 album *Pablo Honey* and six from the 1997 album *OK Computer*. This provides a useful case study for investigating an idea posited by more than one author; that Radiohead's music became more complex or ambitious from their first release onwards. An obvious caveat here is that Radiohead have a significant catalogue of material recorded post-1997. However, the data available in the sample allows for an interrogation of Mariam Taton Letts' (2010) assertion that: "Radiohead exhibited fairly steady stylistic growth from their first album, *Pablo Honey* (1993), through *The Bends* (1995) and *OK Computer* (1997), adding increasingly complex layers of production effects to an essentially guitar-driven sound" (p. 28). Clearly the data produced by the framework will not tell us anything about the purely sonic elements of the records in question, but can be used to investigate the idea of stylistic development from the perspective of song analysis. Brad Osborn (2016) makes an even clearer distinction about Radiohead's stylistic development from *OK Computer* onwards:

> Listeners sufficiently steeped in the stylistic conventions of 1990s rock music will simply not find Radiohead's first two albums—Pablo Honey (1993) and The Bends (1995)—perceptually salient relative to their music from OK Computer (1997) onward. Nearly all of the music on the first two albums conforms too closely to stylistic expectations. Highlighting some examples of these conventional timbres, forms, rhythms, and harmonies used in Radiohead's pre-1997 music will help to contextualize the marked gestures heard in those domains from OK Computer onward. (2016, p. 74)

In other words, Osborn suggests that a shift in style occurs from *OK Computer* not only in terms of sonic, arrangement elements, but also in the core songwriting itself.

The use of data extracted through the application of the framework is illustrative in this instance. The decision to use this subset was made after the sample had been generated and the fact that this subset includes songs from the two albums *Pablo Honey* and *OK Computer* is happenstance, but it provides an opportunity to indicate how the data might be used to discuss expectations or assertions. Any average statistics generated for either album are accurate for the songs that represent the albums in question in this subset, rather than for the album as a whole, as such no total conclusions can be drawn but there are some results that seem to suggest trends.

Looking at one of the most basic data features, song length, would seem to reinforce the notion of a stylistic shift, in terms of comparison to the norm. The average running time for the songs from *Pablo Honey* is 237.25, which is slightly higher than the sample average of 224.6. The average duration of songs from *OK Computer* goes up to 262.83, suggesting an overall shift to longer songs. However, the average does not tell the whole story here. The range for duration for the songs from *Pablo Honey* is 132-325, whereas there is a smaller range for songs from *OK Computer* (229-299). So although the songs in general seem to get longer on *OK Computer*, there is less variety in song duration. Duration is a basic metric, although it does tell us something about overall form, and the range of results that contribute to a mean average could be more relevant when considering the idea of consistency or variety as stylistic tenets.

Osborn mentions 'form' as one of the elements that undergoes stylistic change from *OK Computer* onwards, and this is supported by the number of total compositional blocks used in songs from the two albums. The mean number of compositional blocks total for *Pablo Honey* is 0.01 less than the sample average of 3.26, but essentially right on the average, whereas the average for *OK Computer* is significantly higher at 4 (significant given the narrow range for this data feature across the full sample).

The results for Musical Data Proportion and Lyrical Data Proportion can also inform a discussion about style relating to structure and form (100% mean there is no sectional repetition/repetition of a block). The mean Musical Data Proportion for *Ok Computer* is 35%, which is only slightly higher than *Pablo Honey's* mean of 32.57%. Given that the mean for the whole initial sample for this data feature is 31.25% and the sample includes a few instances where songs have musical data proportions into the 80s and 90s this indicates that for this metric, Radiohead's practice is rather typical. Although the increase in the mean from one album to the other might suggest that the songs on the later album make less use of repetition, it is worth mentioning that the range of results for *Pablo Honey (*17.79%-43.94%) is greater than that for *OK Computer (*19.57%-40.17%). Whilst the songs on the latter album might be slightly less repetitive, the variety of approach on the first album seems to be greater. However, all of the data for this particular data feature is relatively close to the overall mean result and although this supports the assertion that the songs on *Pablo Honey* conform 'closely to stylistic conventions', there is not sufficient evidence that *OK Computer* is dramatically different. The mean figures for lyrical data proportion suggest that the use of repetition in lyrics actually gets greater, or rather tends more to the norm (71.44%) on *OK Computer (*74.55%) than on *Pablo Honey* (76.48%). Of course, these data features deal with the idea of repetition on a somewhat macro scale, and the figures here do not recognise anything about the content within the blocks themselves.

Looking more closely at the individual compositional blocks that make up the songs in these subsets reveals a formal characteristic that supports Osborn's claim. Every compositional block in the songs included here from *Pablo Honey* is made up of a total number of bars that is a multiple of 4. In fact every compositional block that has a lyrical setting is either 4, 8 or 16 bars in length, with the addition of a single instrumental block of 12 bars length. There is much more variety exhibited in the songs from *OK Computer,* with only 62.5% of the blocks having a total number of bars that are a multiple of 4. Furthermore, whereas there are only 4 different lengths of block present in the songs from *Pablo Honey*, the songs from *OK Computer* feature ten different lengths of block. This supports the idea of a shift from conventional to less conventional practice.

Harmony is one of the elements mentioned by Osborn as a marker of a stylistic shift that can be examined by data generated by the framework. The data available here does show a significant shift in the overall nature of some of the harmony used. The songs included in this subset from *Pablo Honey* are characterised by an economic approach to harmony, with an average number of chords used per song of 6.5 compared to *OK Computer*'s average of 10.17 and a sample average of 9.15. This supports an argument of a general change, but it doesn't entirely support the assertion that *Pablo Honey* features conventional practice and *OK Computer* is less conventional, given that the average in this case is closer to the sample average for the songs from *OK Computer*. Of course, the framework uses a number of metrics to record harmonic elements and the figures for Percentage Dissonance do seem to support Osborn's hypothesis. The songs from *Pablo Honey* have an average percentage dissonance (the proportion of the harmonic vocabulary used that has voicings more complex than a triad) of 24.02% compared to 65.06% for *OK Computer* and the sample average of 30.28%. Both albums feature songs with harmony that is completely, or almost completely triadic ('Karma Police' from *OK Computer* has a percentage dissonance of 5.21% and 'Stop Whispering' from *Pablo Honey* is entirely triadic), so there is a level of variety within both albums for this data feature. However, the general tendency seems to be that the use of upper extensions of chords (or more complex harmonic colours) develops from being exploited less than the general average on Radiohead's first album, to being used significantly more than average by their third. Similarly, the proportion of blocks that feature non-diatonic harmony increases from 38.5% for *Pablo Honey* to 58.3% for *OK Computer.*

By examining the lyrical characteristics data feature, an argument contrary to Osborn's can be made. Not only do the songs from *Pablo Honey* feature a slightly higher number of different lyrical characteristics across the subset (eight compared to seven) than *OK Computer*, but the earlier album features more atypical characteristics. Of the seven characteristics featured in the songs from *OK Computer*, only one (Simile) features in less than 20% of the sample, whereas the songs from *Pablo Honey* feature three characteristics that feature in less than 20% of the sample (Simile/Oblique Rhyme/Profanity) and can therefore be considered less conventional characteristics.

To re-iterate, the data used for this case study is made up of incomplete album susbsets, so any data trends that can be seen as contradictory to the assertions made in the research cited above must be considered accordingly. The average figures for individual data features here may very well not be fully representative of the two albums discussed here and as such this cannot be viewed as any sort of definitive review of Radiohead's practice - rather it is indicative of how the data might be applied once gathered. There are other data features that might be considered in a more in-depth case study, but up to this point some conclusions might be drawn about this subset of songs when considered in the context of an expectation about Radiohead's music as articulated by Osborn and Letts. The data derived from applying the framework to the (admittedly incomplete) group of songs from two albums does not fully support the argument that Radiohead's music moves from the conventional to the unconventional within the parameters of the framework. Some data features could be said to support this expectation, although a number could be seen to contradict the idea that the practice becomes less conventional from one album to the other (where mean averages from the sample dataset are used as generic conventional indicators for pop/rock music) or indeed the idea that the practice demonstrated on *Pablo Honey* was particularly conventional in the first place.

The fact that the data discussed here provides a mixed message does not necessarily mean that the expectation or hypothesis is unfounded or incorrect – it might help to highlight the extent to which a sense of stylistic shift in Radiohead's music is driven by sonic elements that are not captured in data extracted through application of the framework. One might apply another analytical method to confirm this, and this is one example of how the framework could be used – as one of a number of analysis tools that might be employed to address such questions.

6.8. Points of Comparison

Throughout this chapter, comparison is a recurring theme. Perhaps this is most obvious in the section on Stevie Nicks and Christine McVie, where direct comparison between the two songwriters was the ostensible aim. Nevertheless, comparison is still a theme in the Chuck Berry case study, where the level of consistency exhibited in his songwriting is remarked upon in the context that such levels of statistical consistency are not exhibited in other artist datasets. The case studies of the Randy Newman and Radiohead subsets compare the interpretations of the data with other analyses of these artists' work, in a way that hopefully starts to demonstrate the place this methodology might have in the wider world of music analysis.

This chapter demonstrates a number of ways in which data generated by the framework's application can be used to discuss the discrete songwriting styles of individual artists of bands. The large quantity of data (of different types) produced for each song means that examining smaller numbers of songs can lead to more specific conclusions, but the whole dataset remains an important asset for contextualising the data included in these subsets.

The case studies that make up this and the previous two chapters constitute proof of concept and reflect what was an exploratory process. In testing the data, ideas emerged about future applications of the framework/dataset and important considerations about the sense of reliability of the data in a control dataset might be affected by the inclusion of certain genres that were (unintentionally) excluded from the initial sample. These ideas are explored in the chapter that follows.

7. Further Applications of the Framework

The previous chapters have demonstrated the framework's usefulness by exploring data outcomes through a series of case studies. This is intended to be demonstrative rather than an exhaustive list of possible applications. As such, the notion of the framework being applied to research projects and music analysis questions in the future is implicit. This chapter explores some potential applications and deals with some ideas that came about during the process of analysing the data collected for the sample dataset.

Similarly, the case studies that follow are exemplar, and have been chosen as a result of conversations with colleagues, or questions posed at forums where this research has been discussed. Two of the following examples have been decided upon in response to apparent stylistic omissions in the initial sample field, in this case hip-hop and other contemporary forms of electronic music. Their inclusion here is to give a sense of how the framework could be used in future, rather than an attempt to revise elements of the data analysis in previous chapters.

Section 7.3. considers how the framework might be used to populate a larger dataset than the current sample, with reference to the fields of content analysis and M.I.R.

7.1. Hip-Hop In The Context of The Framework

Whilst the number of songs used seems to have been sufficient to generate a great deal of meaningful data, and certainly to demonstrate how subsets can be examined and explored, with 300 songs it was inevitable that some genres, styles and eras would not be represented within the initial sample. One such unrepresented genre is hip-hop.

With regards to extracting music and lyric data from hip-hop records, a significant issue to consider is the anachronistic provenance of much of the material. That is to say, in practice, many hip-hop records are produced through a process of bricolage, using various samples to build a track as well as recording new material specifically (often programmed percussion and most crucially, vocals). This leads to songwriting credits on rap and hip-hop records often being shared by culturally unexpected groups of people. An example is Jay-Z's 1998 release 'Hard Knock Life (Ghetto Anthem)' where the writing credits are shared between Shawn Carter (Jay-Z) and the Broadway musical theatre composer/lyricists Charles Strouse and Martin Charnin. The record uses a pitch-shifted sample from a cast recording of 'It's The Hard Knock Life' from the musical *Annie* (1972) as its chorus. Another example, 'Touch The Sky' by Kanye West feat. Lupe Fiasco from 2005 features a songwriter being credited on a record produced after their death. Kanye West, Justin Smith and Wasalu Muhammed Jaco (Lupe Fiasco) are credited alongside Curtis Mayfield. Various slowed-down samples from 'Move On Up', written and recorded by Mayfield in 1971 make up much of the track's accompaniment. This instance is perhaps less problematic, since the sampled track only contributes to the harmonic element of the resultant song. In another example, 'I Know Where It's At' (1998) by All Saints, features a sample from 'The Fez' (1976) by Steely Dan. As such Donald Fagen and Walter Becker should be (and are) credited as co-writers in their capacity as writers of the original track from a legal perspective, however in real terms the sample is chopped up and reconstituted in such a way that the chord changes occur in a different order and with a different rhythm, so that the All Saints track only retains some of the timbral/textural quality of the initial record.

The chorus of 'Hard Knock Life (Ghetto Anthem)' would be recognised as an entire compositional and lyrical block within the song, in this instance the contribution made by the sampled track is compositionally and lyrically significant. The design of the framework is such that it should be possible to extract music and lyric data from the record regardless of the method of production. The framework has been used to extract data from 'Hard Knock Life (Ghetto Anthem)' and the data generated suggests that:

- Hip-Hop/Rap songs can have music and lyric data extracted from them in the same way as songs from other genres, regardless of the method of production.
- There may be stylistic markers in the data generated that are typical of this genre.
- Universal mean averages for data relating to lyrics may be affected by the inclusion of more songs from this genre in a control dataset.

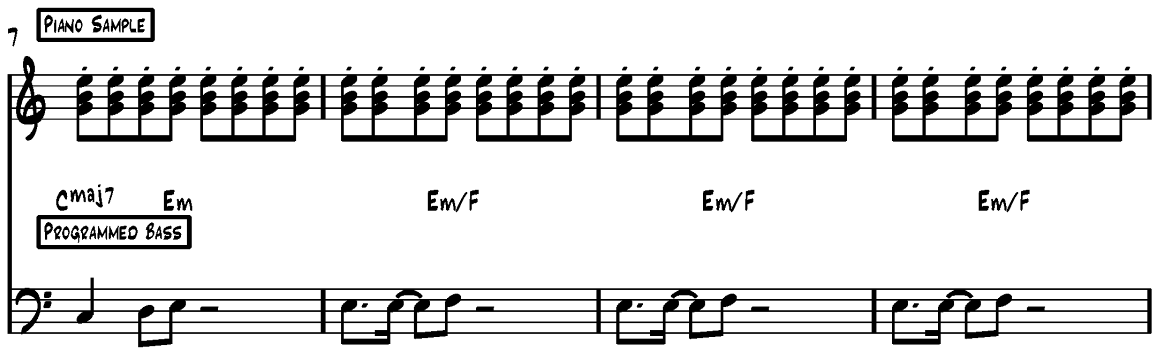
Fig. 7.1. – 'Hard Knock Life (Ghetto Anthem)' Chorus Accompaniment

The record opens with a short introduction that uses compositional material from subsequent compositional blocks (therefore not a separate instrumental block) before the aforementioned chorus plays, featuring vocals sampled from the original Broadway Cast recording of the show *Annie*. The track also features programmed drums and bass as well as the staccato piano part above. The four bars in Fig. 7.1. represent the harmonic detail of compositional block A, which is the only repeated compositional block. The song features three other compositional blocks, and no instrumental blocks. This total of 4 compositional blocks is not unusual, however the fact that the harmonic data for compositional blocks B, C and D is identical is indicative of hip-hop characteristics that are directly related to the method of production.

Tab 7.1. Data relating to harmony for 'Hard Knock Life (Ghetto Anthem)'

	Length (Bars)	Duration (Seconds)	Harmonic Classification	Percentage Dissonance	Chords Per Bar
Comp. Block A	4	12	1	9.375	1.75
Comp. Block B	16	48	1	56.25	1.75
Comp. Block C	16	48	1	56.25	1.75
Comp. Block D	16	48	1	56.25	1.75

Fig. 7.2. Accompaniment for Verses of 'Hard Knock Life (Ghetto Anthem)'



The four bars of accompaniment in Fig. 7.2 are repeated to form the backing for all of Compositional Blocks B, C and D, which could casually be referred to as the verses between the chorus where Jay-Z raps. This accompaniment is formed by looping the first bar of the piano part from Fig 7.1 throughout all of Fig. 7.2, and copying bar 2 of the bass part of Fig. 7.1 into bars 3 and 4 of Fig. 7.2 also. This literal copy and paste method is typical of hip-hop production, and leads to identical harmonic information being extracted for different compositional blocks.

Verses are typically recognisable in the dataset as compositional blocks with multiple lyrical blocks set to them, however in this song, each of compositional blocks B, C and D are musically distinct in spite of making use of an identical accompaniment. This is because of the melodic shape, and in particular the rhythm of the melody in the rap verses. In spite of being limited in terms of the number of different notes sung in the melody (Jay-Z's vocal style on this recording consists mainly of making use of a single repeated note followed by an occasional lower note for the purposes of inflection or emphasis, using the same repeated interval throughout the blocks/verses), each block is rhythmically distinct. It appears that the level of rhythmic interest is increased to compensate for the lack of interest in terms of pitch.

This is a good example of how the framework can be used to interrogate ideas such as variety or complexity in subtle ways. As shown by Fig. 7.1 and Fig. 7.2, the amount of musical material that this song consists of other than the vocal melody is minimal, and using traditional terminology, the song consists only of a chorus, and rap verses over the same two bar loop. For the purposes of some research, this level of detail might suffice, but the distinction between how 'verses' are typically recognised and the rules in place to define compositional blocks in the context of the framework allows for a different sort of structural complexity to be recognised. Although this song is only one example, since it is stylistically representative of especially Jay-Z's output, and arguably of other artists in his genre, it is reasonable to say that not only is the use of framework able to produce meaningful data about rap songs, but it might in fact be a tool that helps the intricacies of the genre to be highlighted.

Given that it has been established that the detail in this song comes from the melody part rather than the accompaniment, it follows that this will have some baring on how data about the lyrics compares to other songs, and the existing sample field as a whole. The only material in the sample dataset that features rap characteristics is that by the Red Hot Chili Peppers. A close look at their material as a subset in an earlier chapter showed that their songs feature some of the highest rates of words per bar (lyrical density) of the whole sample. It was hypothesised that this was because of the rap-like quality of many of the compositional blocks, and as such one would expect that 'Hard Knock Life (Ghetto Anthem)' would also exhibit high levels of lyrical density, and this is indeed the case. The overall rate of words per bar is 9.64, higher than any other average rate in the initial sample (the highest rate in the initial sample being 8.18 – 'Give It Away' (1991) by Red Hot Chili Peppers). On a block-by-block basis, Lyrical Blocks 2, 3 and 4 (the rap sections) have rates of 10.38, 10.06 and 10.88 respectively. These would be the second, third and fourth highest lyrical density figures if included in the sample, with only one other block having a higher rate (12.25 – also in 'Give It Away').

Of course, steadier tempi naturally allow for a higher number of words per bar. As a side note, one might argue that measuring words per second would give a more accurate idea of lyrical density from an experiential perspective. However, measuring words per bar retains something of the compositional integrity of the data feature – in other words, different performances at different tempi would still have the same number of words per bar, but not necessarily the same number of words per second. However, the data extracted through applying the framework includes measuring the duration of a compositional block as well as its length in bars – so this measurement is possible. As an illustration, take the highest rate of word per bar for a single block in the initial sample – 12.25 in 'Give It Away'. This occurs in what is Lyrical Block 2 of the song, which has a word count of 49. It is set to a compositional block of 4 bars length, but 10 seconds duration. This would give a rate of 4.9 words per second, compared to a rate of 12.25 words per bar. Compare this with the highest rate of words per bar in 'Hard Knock Life (Ghetto Anthem)': 10.88. This occurs in Lyrical Block 4 of the song, which has a word count of 87, and is set to a compositional block of 8 bars length, and 16 seconds duration, giving a rate of words per second of 5.44 compared to 10.88 words per bar. Because of the tempo discrepancy, 'Hard Knock Life (Ghetto Anthem)' arguably features a higher lyrical density.

Unsurprisingly, given the high rates of lyrical density, the word counts (both in terms of content and the total uttered word count) are high relative to those in the initial sample. The content word count (the total word counts of each lyrical block) is 443, compared to an initial sample average of 156.86. 'Tangled Up In Blue' (1974) by Bob Dylan is the only song in the initial sample with a higher content word count (571). In spite of the apparent stylistic differences between the two, the comparison that is drawn between the two by virtue of their word counts presenting as data outliers is an interesting one. It highlights a potential similarity between rap and folk, in that there is arguably an emphasis on lyrical content, evidenced in the context of the framework by their high content word counts and reinforced by real world experience of these genres being typically narrative-driven. A key difference however, is the way that a set melody is adhered to for the verses of the 'Tangled Up In Blue', compared to the rhythm and inflection discrepancies between the rap verses of 'Hard Knock Life (Ghetto Anthem)' that account for the higher number of compositional blocks. In summary, one could hypothesise that both folk and rap songs might be stylistically recognisable by higher than average content word counts, but rap is more likely to see these lyrical blocks set to a higher number of compositional blocks. One song as an example of a genre is clearly insufficient – however this is a further example of how the rigidity of application in the definition of compositional blocks, and the inherent relationship between music and lyric that informs this lends weight to apparently simple metrics such as word counts.

The predominant melodic characteristics noted for this song are 'single note melody' and 'frequently repeated interval', which is consistent with the assertion above about Jay-Z's vocal style in the verses. This is juxtaposed with a sample from the chorus of the song 'It's A Hard Knock Life' which features children singing in a high register.

This accounts for the unusually large range of 27 semitones. There are only two songs in the initial sample with a greater range ('Homebound Train' (1988) by Bon Jovi, and 'Child In Time' (1970) by Deep Purple, both with a range of 29 semitones). In a sense, the 'range' data feature is something of a blunt object in that it simply measures the number of semitones between the highest and lowest melody notes sung on the source recording. Upon inspection, the implications of this for these two songs are very different. The big range of 29 semitones on 'Homebound Train' and 'Child In Time' are achieved by the same lead singer, which is contextually very different to what occurs on 'Hard Knock Life (Ghetto Anthem)'. Nevertheless, this is not to say that recording the melodic range of songs is not useful. In the case of both of these songs, one might be drawn to investigate them more closely in their capacity as data outliers in the context of this data feature, at which point one can see that their similar range outcomes come about through different circumstances. This is philosophically consistent with the approach of designing and applying the framework, in that discussion about contextual elements is lead to by notable data outcomes.

Parts of this record come from another song compositionally, but the extent to which this is problematic is dependent on the research question. Part of the framework's initial design was that it can be used to produce data about the *result* of a songwriting process (i.e. the eventual song) rather than the process itself. The data results can be used to inform debate. In the case of this song, there are certain melodic characteristics that are typical of Jay-Z's style that have been recorded, (the repeated use of a single note, a frequently repeated interval) in spite of the fact that the sampled chorus does not feature these characteristics. This is an advantage of using multiple selection typologies for certain data features in terms of recognising stylistic trends, because another Jay-Z song might make use of a sample or specifically composed chorus that has different melodic characteristics again, but this would not be to the exclusivity of recording those same characteristics in the rap verses - that is to say, it would be possible to recognise the common features even if there is also a variety of other characteristics song-to -song.

It is positive to observe how the uniform application of the framework can produce data about apparently very different genres in such a way that the actual result of what might be very different processes can be evaluated. The advent of sampling technology through the eighties and nineties that lead to the birth of hip-hop was a democratising force. One might look to the 'copy and paste' element of sampling and the examples above (Ex. 1 and Ex. 3) and suggest that the amount of musical material is limited, but the effect of this in the context of the data produced by the framework is that the overall percentage dissonance for 'Hard Knock Life (Ghetto Anthem)' is 44.53%. This is much higher than the initial sample average of 10.25%. The 'dissonant' chords that contribute to this statistic are the Cmaj7 and Em/F chords that are repeated throughout compositional blocks 2, 3 and 4 (in Ex. 3). In practice this harmony occurs as a result of the independence of the 1 bar loop of an E minor chord played on piano and the programmed bass part underneath it – but the framework produces data based on what is there, rather than how it came to be there. As such it can be used as a tool to objectively challenge (or reinforce) accepted ideas about complexity or variety in certain styles.

The outcomes of extracting data from 'Hard Knock Life (Ghetto Anthem)' highlight a discrepancy between the robustness of the framework as a tool and the fitness for purpose of the dataset produced from the initial sample. Looking to the future applications of the framework in terms of dealing with bigger data, it is clear that the dataset would need to be greatly increased in terms of the number of songs in order that the general averages for each data feature can be more universal and provide a more meaningful comparison for individual songs. The data for the quantity of lyrics and the lyrical density of this song suggests that a greater number of hip-hop or rap songs in the dataset would move the means for these features upwards, and this in turn poses the question of representation in the dataset. If certain styles are likely to have specific effects on overall averages and the distribution of data for certain data features, then it is important that these styles are not over or under-represented in a larger dataset.

7.2. Other Forms of Electronic Music

Given that the prevalent use of sampling technology in hip-hop could have implications for the structure of songs, and how the framework recognises these structural elements, it is worth considering how other forms of popular music that stem from this philosophy are contextualised by applying the framework. The development of house music from the eighties onwards and the subsequent various sub-genres of what became known generally in the mainstream as dance music in the nineties was initially informed by similar compositional processes and philosophies as hip-hop. These include an emphasis on the use of sampling or sequencing technology, and from a compositional perspective, the frequent use of short repeated cells of music. Arguably the compositional intent of these composers/producers would be different to songwriters in the more traditional sense, but the design of the framework is such that if a piece of music has a sung component, the framework can be applied.

'Around The World' (1997) by Daft Punk was highlighted by Colin Morris (2017) in his TEDx talk on the notion of 'lyric compression', as the song with the highest level of lyric compression, or lyrical repetition. As discussed in the literature review, Morris seemed to equate this high level of lyrical repetition to musical repetition in general. The framework has been applied to 'Around The World' to investigate how a song that is an extreme example of a certain lyrical practice compares to the rest of the initial sample.

The sketches below show the essential musical content that makes up the song. The limited amount of melodic and lyrical material is immediately evident, the entire melodic content for the song consists of a two-bar phrase (which is iterated twice in Compositional Block A). This melodic phrase is accompanied by three different harmonic structures which accounts for the fact that there are three compositional blocks in spite of only one melodic cell being used throughout. The various instrumental interludes throughout the track make use of the accompanying material from the three compositional blocks.

Fig. 7.3. – Compositional Block A

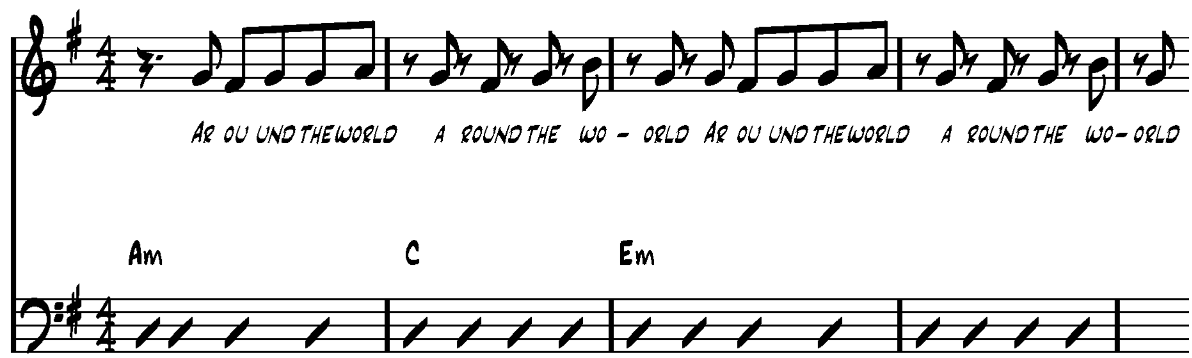


Fig. 7.4. – Compositional Block B

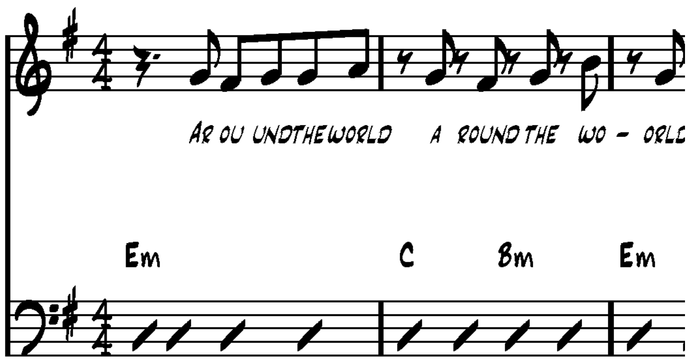
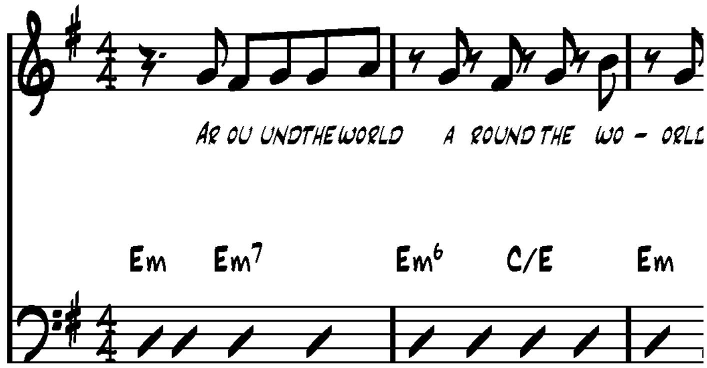


Fig. 7.5. – Compositional Block C



Lyrical Block 1

Around the world,

Around the world

Around the world,

Around the world

Lyrical Block 2

Around the world,

Around the world

One might question the fact that two separate lyrical blocks are recorded given that lyrical block 1 above is essentially two iterations of lyrical block 2, but the rules governing what constitutes a lyrical block (in terms of the relationship between compositional blocks and lyrical blocks) result in this unusual situation.

In total, the entire compositional material of the song consists of 8 bars of music, of 16 seconds in total duration. With a track running time of 429 seconds, this produces a musical data proportion (total duration of a single iteration of each compositional block divided by the total running time of the track) of 3.73%, which is lower than the lowest score for the initial data sample (6.99% for 'Promised Land' (1964) by Chuck Berry), and considerably lower than the sample average of 31.25%.

'Around the World' also features a very low lyrical data proportion figure (related to Morris' 'lyric compression', but distinct due to the way lyrical blocks are defined and then used to derive this figure) of 4.05%. The sum of the word counts of the two lyrical blocks being 18, compared to the uttered word count of 444. This is much lower than any figure in the initial sample, the next lowest being 22.4% for 'Three Little Birds' (1997) by Bob Marley.

Comparing these two songs experientially, the difference is not just significant statistically – 'Three Little Birds' makes the most of limited lyrical material, but still in the context of what feels like a verse/chorus structure. 'Around the World' on the other hand uses the lyrical/melodic content in a very different way. The constant, almost meditative repetition of the melody line serves to highlight the changes in the accompaniment when they occur, making them more significant events. Although the use of sung material means that 'Around the World' can be analysed as a song, the anomalous nature of some of the data produced by applying the framework is appropriate when one considers the compositional philosophy of the composers. The use of a limited number of ostinati with subtle changes to small details are compositional tropes employed by house and techno-inspired electronic composers, and this record is an example of a song that is also one such piece.

In a similar way to the previous case study on hip-hop and rap, albeit at the other end of the scale in terms of lyrical content, the inclusion of more material of this type would undoubtedly have an effect on some of the mean figures for many of the data features of an increased dataset. This further highlights the importance of a representational approach to selecting songs if a future application of the framework is to develop a dataset that can give mean figures and data distribution that are meaningful for *all* songs. Having said this, establishing such an approach would be a vast project in itself – well beyond the remit of this thesis.

7.3. The Potential Effect of The 'Post-Chorus Hook' of the 2010s

The sample dataset features songs from a sufficiently varied timescale in order to be able to demonstrate how the framework can be used to discuss era-related data patterns. However, the fact that the most recently written song in the sample dataset was written in 2002 (for the purely pragmatic reason that this was the most recent material in the cache of transcriptions used) does mean that songwriting trends that may have come into existence since that point do not currently contribute to the sense of what is typical or atypical in the context of the whole dataset (e.g. the average number of compositional blocks).

An example of such a phenomenon is the emergence of what can be called the 'post-chorus hook' in recent years. Predominantly used in vocal-led records released by producer/artists this technique comes from the idea of the 'drop' in post-dubstep electronic dance music (E.D.M.) related genres, where the music builds in anticipation of a central moment of excitement, where often a memorable melody part, making use of a notable timbre is accompanied by (typically) the heaviest rhythmic groove of the record. Often the build section will feature absences in parts of the sonic field that are then densely occupied when the drop occurs. This structural trope has since birthed the concept of the 'anti-drop' where the arrangement vocabulary of the anticipatory build is followed by a less satisfactory resolution and excitement is derived from the perceived subversion of expectation.

The 'post-chorus hook' is successfully applied in commercial pop music whose production techniques and sonic pallet is derived from E.D.M., where listeners will be familiar with this vocabulary. In this instance, a compositional block with a repeated lyrical setting (a chorus in the nomenclature of the framework) is followed by a prominent instrumental section with a dominant melody part.

The reason this is worth commenting on (after all, the framework has a mechanism for recording instrumental blocks) is the prominence of these sections from an experiential perspective, and also that the way these sections are used demonstrates a stylistic approach to structure.

The use of instrumental sections in a stylistic context can be examined in the existing data set for individual writers. For instance, Billy Joel can be recognised as using more of these sort of sections than is usual. The ten songs of his in the sample dataset use an average of 1.1 instrumental sections per song compared to a sample average of 0.42. However, the phenomenon being described here is something different. In order for an instrumental compositional block to be recorded it must comprise of compositional material that is harmonically separate from any of the compositional blocks with lyrics elsewhere in the song. In many cases (indeed for the examples that will be cited shortly) the 'post-chorus hook' being discussed here uses the same chord sequence as one of the other blocks/the other block in the song. In this way, the framework does not recognise this as any different to a situation where there is an instrumental setting of a verse, or a solo over the verse chords. The difference is structural and, arguably, hierarchical. Where a solo over harmonic material that has previously been stated might be used to engender or maintain interest before a return to the chorus (for example) the post-chorus hook typically occurs after the first iteration of the chorus and, crucially, occurs more than once in the song. Provided that this instrumental section does indeed repeat harmonic material from a previous block, then this repetition would not be recognised directly by the framework. In terms of what is recorded – it is indistinct from the scenario described above where a solo is played over the verse sequence. However, if one accepts the premise that the post-chorus hook has a more prominent hierarchical role in the structural composition of a song, then one can hypothesise that this would have an effect on the number of other sections in the song (there would be less).

The song 'Firestone' (2016) by Kygo feat. Conrad Sewell features a prime example of this phenomenon with a basic structure as follows:

Fig. 7.6. Block Structure of 'Firestone' by Kygo feat. Conrad Sewell

- Intro (Compositional Block A)
- Verse 1/Compositional Block A/Lyrical Block 1
- Verse 2/Compositional Block A/Lyrical Block 2
- Chorus/Compositional Block B/Lyrical Block 3
- Chorus/Compositional Block B/Lyrical Block 3
- Post-Chorus Hook (Compositional Block B)
- Verse 3/Compositional Block A/Lyrical Block 4
- Chorus/Compositional Block B/Lyrical Block 3
- Chorus/Compositional Block B/Lyrical Block 3
- Post-Chorus Hook (Compositional Block B)

The prominent melodic hook section that occurs after the choruses makes use of the harmonic structure of the chorus, and as a result the 'post-chorus hook' would not be considered a separate compositional block. These sections make up almost a third of the playing time of the record (which at 4:34 is not a particularly short one) whilst making use of previously introduced compositional material. On first glance this would support a hypothesis that there might be correlation between the use of post-chorus hook sections and a lower than average number of total compositional blocks.

This would be an example of the sort of stylistic phenomenon that might be responsible for gradually altering mean averages for certain data features in the context of a larger dataset in the future. In the case of individual songs (such as

'Firestone' discussed above) or a subset of similar songs this provides another example of how the data generated by applying the framework can demonstrate patterns relating to style alongside other analysis.

7.4. Crowdsourcing Data

A theme that has been present throughout the discussion of the information presented in the initial sample dataset is the limitations of its size. Currently there is a lot of evidence of the framework's usefulness when discussing specific bodies of work, and in terms of general comparisons, those average results from the dataset that are also accompanied by a tendency towards a normal distribution would seem to be sound. Nevertheless, the case studies above have indicated how certain styles and genres that may not be currently represented in the existing data might skew these.

This is not immediately problematic, in that the purpose of the sample dataset was always to be demonstrative. However, now that there is substantial evidence of the kind of data that can be produced through the application of the framework and evidence of the kind of discussions and interrogations it can prompt, it is also right to consider how this dataset might be grown to increase the size of the dataset and the sense of how useful the data included might be.

In the literature review, *Musicbrainz* was discussed as an example of a database that grows as a result of a community of data gatherers. In this case, contributors to the database download the program which they then run their music collections through in order to harvest the data. In this scenario the program is the control that ensures the validity of the information being uploaded to the database. The challenge with the framework is the level of involvement required by the individual gathering the data. There is a fairly high level of musical understanding necessary as a baseline in order to prepare transcriptions or review existing ones, and then beyond this the rules for applying the framework require some attention due to how specific, and in some cases unique, some terminology is to this methodology.

Nevertheless, in line with Krippendorf's assertion that "research techniques should result in findings that are replicable", the framework can be applied by any individual to produce mostly equitable results.[33] A version of the part of the methodology chapter from this thesis could be made available as an online resource alongside the specific examples of the framework being applied to songs, as well as a spreadsheet template download. Contributors could then submit new versions of the spreadsheet template via a link on the same site for moderation.

Whether there would be a significant level of interest in this endeavour remains unseen, but it would certainly be possible. There is a certain reality that gathering of data on a song-by-song basis is much more labour intensive than other more automated data gathering projects, and the number of songs it is possible to include in any future dataset would be relative to this. Having said this, it must be reiterated that the positive outcome of the time and effort required to produce the data is the richness of information generated per song.

7.5. Work In Progress

As stated in the introduction to this chapter, the above is not intended to attempt to revise elements of the analysis presented in previous chapters. Rather, it is reflective of a sense that this is a research approach that can be taken forward and developed. It could be adapted and assimilated into other researchers' work and as such, considering omissions from the dataset that became apparent as a result of the process of conducting this research is consistent with the research aims of this thesis.

[33] For the majority of data features there is no room for interpretation in the data extraction process, however a small number of data features might be interpreted slightly differently by different individuals, such as 'semantic fields'.

The concluding chapter that follows evaluates the extent to which the research questions posed in the introduction have been answered as of the current stage in the development of this approach.

8. Conclusion

8.1. Review of Original Research Aims

In order to draw this thesis to a conclusion it is useful to consider the original aims of the project as stated in the introduction:

1. To explore the inter-connected nature of music and lyrics in songs.
2. To develop a methodology for analysing songs that considers music and lyrics, and the relationship between the two.
3. To develop a framework for extracting information about music and lyrics in songs. This will be concerned with musical and lyrical content, seeking to be as objective as possible.
4. To identify and analyse trends and synergies between musical and lyrical elements of songs in a corpus.

Throughout, these initial aims have provided a valuable through-line and have remained unchanged. Considering the first aim: the exploration of the inter-connected nature of music and lyrics in song has been approached in a variety of ways, but I would argue the most crucial is the way that the relationship between music and lyrics is part of what defines the parameters of the individual data features that comprise the framework.

At an early stage in the process of drafting the framework there was a frequent temptation to try to find 'silver bullet' questions that could somehow crystallise some musical/lyrical synergies and express the outcomes as a single data feature. However, as the thesis developed it became clear that the best way to facilitate research into how the two interact and relate to one another is to include many individual data features pertaining to both music and lyrics to increase the possible number of permutations available to the researcher. This also allows for individual questions asked by the framework to be more tightly defined, which makes for better data from the outset.

It is possible to say that the final research aim has been achieved with a crucial caveat. In the sense of expressing synergies and relationships for the way music and lyrics tend to relate to one another in song *in general*, the initial sample dataset has been used to produce what can be considered as encouraging, early data. For instance, the notion of creating ideas of what the average outcome for certain data features (where mean figures are supported by what appear to be normal distributions) and by extension, expectations about the relationships between those data features. The obvious caveat, which would be true of any such data-led research, is that the control dataset used to derive these figures needs to increase in size in order to enhance the validity of such figures.

In this thesis the sample dataset produced demonstrates the usefulness of the framework as a tool. The outcome at this stage is the framework, and the broader methodology, rather than the dataset. The dataset is prototype or starting point for the kind of better populated dataset that could be used as a resource by researchers.

8.2. Considering The Research Questions – Research Question One

1. Is it possible to develop a tightly-defined methodology that can examine songs holistically (considering music and lyrics together rather than separately)?

The way that the framework is designed and used to extract data about music and lyrics from songs is certainly tightly-defined, but as discussed in chapter three, referencing Cook's comments (1987, p. 2) about knowing what questions to ask, the framework only constitutes part of the methodology. The framework is essentially a tool, but the way that the data is organised, analysed and interpreted is the incisive part of the methodology. The holistic approach mentioned in the research question, in the context of the music-lyric relationship is woven into the design of the framework. To re-iterate an important point made previously in this thesis, numerous data features are inherently defined by the relationship between music and lyrics in individual songs. This means that analysis of data of even these singular data features (such as any data features that are defined on a block-by-block basis) is implicitly considering this relationship. Then at the analysis stage, discrete data features concerning musical and lyrical elements respectively can be explicitly compared. There are different layers to the consideration of the lyric-music relationship in this research.

Chapters four, five and six demonstrate a number of ways that the data can be interrogated. Above, the sample dataset was described as a prototype for a larger dataset, and as such, any findings about that dataset must be viewed as indicative. The case studies in chapter four reveal some mean averages for certain data features as well as frequency distributions that give an emerging sense of what can be considered as normal figures, or conversely as outliers for these features. Whilst this element of the thesis is a work in progress, chapter four explores a range of methods for interrogating the dataset as a whole. The approach taken in chapters five and six seems to produce more tangible analysis outcomes, perhaps because the use of sub-sets means that the frame of reference is more clearly defined.

Arguably, this process of data analysis is not 'tightly-defined' in of itself. The variety of approaches is intended to demonstrate a robust testing of the framework's usefulness, as well as suggesting ways the framework might be used as a tool by researchers. These have been consistent aims of the over-arching methodology from the outset. However: 'is it possible to develop a tightly-defined methodology?' is a separate question to: 'has a tightly-defined methodology been used to demonstrate this?'.

The Chuck Berry case study in chapter six can be used as a discrete example of where a tightly-defined methodology has been used to examine songs holistically. The framework was used to extract objective data about music and lyrics from a set of songs, and this data has been analysed and interpreted to make some assertions about Berry's songwriting. If the research aim of this case study was to 'make conclusions about Chuck Berry's songwriting style using objective data to support these', then the use of the framework and then the data analysis examples given in this case study demonstrably achieve this. Furthermore, the existence of a larger dataset made up of directly comparable data allows for these findings to be put into context. In the case of the Chuck Berry subset, this showed that his songwriting exhibited the highest levels of consistency for certain data features of any songwriter in the dataset.

The most accurate way to answer this question might be to say that it is possible to develop numerous tightly-defined methodologies that use the framework as a tool, and the exact methodology, that is to say, the crucial decisions about how the data is analysed and interpreted, would depend on the aims of the researcher.

8.3. Considering The Research Questions – Research Question Two

2. What trends or relationships can be found to exist between musical and lyrical elements in a sample of songs? Furthermore, can this approach be used to explore characteristics of styles or genres through sample field choices?

As touched on when discussing the research aims, the first part of the second question must be considered in the context of the sample dataset's size. Whilst a number of relationships for the whole sample were identified in chapter four, many of these would have to be considered as indicative until such a time as a larger dataset exists.

Some of the data generated that is concerned with structure and proportion is pleasing. The way the framework is designed means that some new and methodically-derived notions for expressing levels of repetition or reiteration of sections have been developed (musical data proportion, lyrical data proportion etc.). Similarly, figures for the average proportional relationship between sections of songs and their entire duration is another example of a relatively simple idea being expressed in an original way. From a structural perspective, these relationships are central to how songs are composed, and the definition of compositional blocks that governs how this data is derived is based from the outset on the relationship between music and lyrics.

The second part of research question two can be answered more emphatically. Chapters five and six consist of a range of case studies demonstrating how useful the framework is for drawing conclusions about subsets of data ('sample field choices') based on a variety of criteria ranging from artist subsets, to subsets based on conforming to certain results for given data features (i.e. songs with 100% lyrical data proportion and songs with the highest number of compositional blocks). The multi-faceted nature of the framework's application is shown by how these subsets can be examined in of themselves as unique datasets, and how they can also be considered in the context of the larger sample dataset. This use of the framework seems, currently, to be its most successful. This is especially so because of the depth of data available for each individual song and the vast numbers of potential comparisons that can be made between the various data features – smaller groups of songs allow a researcher to see synergies and patterns that would not be recognisable in the context of the entire dataset either because of the sheer amount of data, or simply because a given correlation might only exist for the subset in question.

In terms of addressing style or genre, it appears that the application of the framework is particularly useful in identifying stylistic markers in the practice of individual songwriters. The case studies on Chuck Berry, The Red Hot Chili Peppers, Crowded House and Randy Newman all demonstrated how data collected through applying the framework can result in the recognition of patterns in their practice, and the ability to say that songs by certain individuals are likely to feature certain characteristics, informed by quantitative data. The fact that these sorts of patterns have emerged across different data features and for different artists from the use of a universal framework is positive for two reasons. The fact that the framework that produced the data wasn't designed with any specific artist in mind or with any specific analysis question, the patterns that emerge can be said to be unbiased, which underlines the legitimacy of the outcomes. Furthermore, the fact that such outcomes have emerged in different ways for different groups of artists speaks to the viability of the framework as a research method.

Talking about individual writers, or the patterns in practice for individual artists means addressing elements of 'style'. Genre, however, has proven more difficult to deal with. The first issue is that the genre is a rather loose concept – and a much less quantitative way of dividing up the sample field than setting parameters for data features or by songwriter. There are also high levels of discrepancy when consulting sources to categorise songs in genres. Discogs for instance is a well-used source, but adds to this confusion by referring to both 'genre' and 'style', but in such a way that 'style' is really 'sub-genre'. The same song might be categorised as 'rock' in the genre and then 'alternative rock' in the style bracket. Other songs only feature a value for 'genre' and no value for 'sub-genre' or 'style'. Given that so much emphasis in the design and application of the framework has been to eliminate unnecessary discrepancies that undermine the resultant data, it would seem perverse to base whole case studies on such loose and contestable definitions.

This is not to dismiss the concept of genre classifications. It is a crucial part of popular music discourse and the identity-forming practices that are associated with so many facets of the creation and consumption of songs. Indeed genre is discussed in some of the case studies, notably in the section on songs with a 100% lyrical data proportion where a link to folk is made. Crucially, however, this link to genre was made secondarily. The subset was formed on the basis of quantitative criteria, and the discussion of genre came afterwards when considering the material present in the resultant group of songs.

Another issue related to genre is addressed in chapter seven, where there are case studies that address the under-representation of certain genres and production styles in the original sample dataset – specifically rap/hip-hop and electronic dance music. The way that data extracted from chosen examples compare to the sample dataset supports a hypothesis that some of the average figures for the whole sample would be shifted with greater representation of these genres. As a result, it could be argued that an explicit use of genre as a defining parameter for subsets was not possible, down to the fact that examples of certain more easily definable genres did not make up the sample dataset. Given the relatively small size of the sample (compared to every possible song) and the desire to have certain groups of songs written by the same writers/from the same albums this under-representation of some genres was an inevitability.

In the interest of addressing the research question regarding whether this approach can be used to explore characteristics of styles of genres, it can be said that the answer is affirmative, but with the above caveats about using genre as the defining rule for a subset.

8.4. Considering The Research Questions – Research Question Three

3. How do patterns/synergies that emerge out of objective data analysis relate to expectations about the relationship between music and lyrics?

This question is most directly addressed in chapter six, where the approach taken was to compare analysis data from discrete artist subsets with analytical literature written about that artist that also deals with both music and lyrics. Literature by Brad Osborn

(2016) and Marianne Taton Letts (2010) about the development of Radiohead's style is used to provide a context for this case study. The outcomes of this comparison are intended only to demonstrate how patterns emerge from the data in the subsets produced by applying the framework, rather than to challenge either researchers' work[34], but the case study shows how this approach produces findings that give a different perspective. In the context of this case study on the music of Radiohead one of the main themes is how the framework can be used to determine those elements of style that are dictated by the actual composition of the songs as opposed to textural and timbral elements of the performance and production. This relates back to decisions made about the song elements dealt with by the framework during its inception, informed by Burns' (1987) notion of 'textual' and 'non-textual' elements and Meyer's description of 'primary domain' and 'secondary domain' elements.

A similar approach is also taken in chapter six in the case study comparing analysis of data from a subset of Randy Newman songs with Peter Winkler's 1988 journal article on Newman's songwriting style. As is the case for research question two, the use of discrete subsets provides a more tangible context for discussing how this type of objective data anaylsis relates to expectations about style, not only because of the reasons stated above, but also because the framing of what can be seen as expectations is more specific when referring to specific artists or songwriters.

An important consideration about expectations about the relationship between lyrics and music in a more general sense is suggested in chapter four: that many of the data relationships discussed are prompted by the framework itself, and that the synergies presented are original to the framework. Another factor in identifying trends and synergies is related to the amount of data collected per song by applying the framework, as well as the fact that some individual data features are inherently fairly complex. Data-orientated studies discussed in chapter two by Komarova et al. (2018),

[34] Largely because this case study compares songs from two albums, but the subset does not comprise of either album in its entirety.

Morris (2017) and the scoreahit.com site (2019) report strong data correlations and some clear outcomes. The fact that a higher volume of input data per song seems to reduce the appearance of obvious relationships and synergies is not necessarily a negative outcome. I would re-iterate the creatively sympathetic hypothesis that this promotes the idea that significant variety is exhibited in the practice of writing songs.

8.5. Unexpected Outcomes – Process-Led Analysis

For the most part, the initial aims and intentions of this research project have provided a through-line for the work described in this thesis. The main objectives of the project have remained largely unchanged and due to the data-oriented nature of much of the work the level of autoethnographic reflection is limited. However there have been some unexpected positive secondary outcomes that have occurred at different points that bear noting.

An unexpected, but positive outcome started to become apparent during the process of extracting data for the sample dataset. This process necessitated a regimented and repetitive approach to breaking down songs that was initially useful in terms of becoming more and more time efficient. It is possible for any person with the required level of musical literacy to follow the steps outlined in the methodology to produce the data, but going through the process numerous times resulted in a level of fluency (as any repetitive process would).

The purpose of using an identical process is to produce individual streams of data where the figures for that data feature can be directly and meaningfully compared, but I had not considered how the actual process of extraction would create a comparative context for the researcher doing the extraction. In the Crowded House case study I reflected on how I was able to recognise the placement of a compositional block with certain characteristics as anomalous because of my extended engagement with the data extraction process. That is not to say that these observations are unique, or that one could not make them via another analysis method, but it is relevant that there were frequently compositional or lyrical phenomena present in songs that I was able to recognise and articulate in a different way than before (especially with songs I knew prior to using them as part of the sample) as a result of breaking them down in the way dictated by the framework.

8.6. Unexpected Outcomes - Pedagogy

A longer period of time than initially projected was spent on drafting the framework and making decisions about how it would be used to extract data from songs, and indeed what elements should be considered (happily, this reduced the necessary amount of time spent gathering data). This process required much consideration of how certain terminology was used and how compositional and lyrical elements were to be specifically defined and the definition of a compositional block was one of the most significant hurdles. The goal of defining sections in a non-hierarchical way and avoiding assumptions that might be made about how sections should function as 'verse' or 'chorus' etc. had a useful impact on creative practice.

In my education practice during this time one of my roles has been supervising original projects with students where songwriting is a large component of the work, and one of the challenges of this role is how to encourage and aid an original creative process without forcing one's own preferences and biases on the work. I have found that in the middle stages of songwriting, where an initial idea exists and needs to be developed or added to, referring to 'blocks' rather than loading them with a role too early has been a refreshing paradigm shift and has changed the emphasis of some of the discussions I have had with students about their compositions. Similarly, the process of systematically breaking down songs into constituent parts in the way my framework does is a useful philosophical tool for imagining different ways of arranging and ordering sections or blocks when they have just come to exist.

Furthermore, after the sample dataset was populated and I was starting to find wholesale averages for structural relationships such as compositional data proportion and lyrical data proportion, as well as what outliers for different features looked like, this started to inform different ways of viewing songs. These different (and objective) ways of viewing the composition of songs offered new perspectives (to me) in terms of the suggestions I might make and most usefully the questions I might pose to students to prompt the next stage of a composition process. The influence of this research on pedagogy was not an ostensible aim and is not a principal outcome, but has been a valuable one nevertheless.

8.7. Original Contribution to Knowledge

The most concrete contribution made by this thesis to future research is the devising of the framework itself. On a number of occasions this has been described as a tool, and a range of case studies in chapters four to seven suggest a far from exhaustive list of examples of its use. The central question about the inter-related nature of music and lyrics in song was at the heart of the design of the framework, and this entire piece of research was inspired by a feeling that analyses that consider the various elements of song holistically were relatively few. I propose that the work submitted here contributes in some way to this area of research and also serves as a starting point for further work in the area.

A crucial part of the framework's design was to try to limit the amount that individual interpretation might affect the extraction of data, leading to clear guidelines about how the various data features are to be collected. The descriptive nature of parts of chapter three was necessary to demonstrate why decisions were made to express data features in certain ways, but also to serve as a blueprint for others to use the framework. As demonstrated most clearly in the artist subsets in chapter six, this data-led approach can be chosen for use as part of broader studies of artists or bodies of work. The parameters of the framework are clear and the data extracted through its application is objective, providing research that might also make use of more qualitative approaches with an impartial context.

The originality of the framework is enhanced by the originality of individual data features. The clear parameters for defining compositional blocks are an example of this. Clearly, the notion of dividing music up into sections is not in itself original, but the specific approach used in this research that makes use of the relationship between music and lyrics is. Furthermore, this definition then informs the parameters of other data features. The design of the framework has also led to the coinage of terms such as 'musical data proportion' that describe the 'meta' data features produced by combining two discrete data features (in this case dividing the total track length by the total lengths of the individual compositional blocks). Again, this concept of unique original compositional material is not new, but this very specific way of expressing it, that has the relationship between music and lyrics implicitly embedded in the data, is original to this thesis.

Another original feature of the framework is its scale. Many of the research projects from M.I.R. that are cited in the literature review make use of larger sample fields, but with fewer individual data features (in many cases only a single data feature) per song. The diversity of data outcomes discussed in chapters four to seven is promoted by the significant amount of data extracted from each song when applying the framework. The large number of data features per song generated by the use of the framework exponentially increases the number of potential applications of this research.

Although perhaps the most tangible one, the framework itself is not the sole contribution made by this research. In populating the sample dataset, ranges and averages have been established for various data features. Many of these give a statistical sense of some song elements in ways they have not been expressed previously.

Research question two makes reference to style and characteristics, and chapters five and six show evidence of how the framework and methodology can be effectively used to explore these concepts. It is reasonable to propose that, in the case of artist-specific subsets, this research furthers the work of scholars mentioned here such as Moore, Griffiths and Winkler on the subject of idiolect. The demonstrable research outcomes for the Randy Newman, Red Hot Chili Peppers and Chuck Berry subsets, for example, show that research into the idiolect of songwriters can be enhanced and supported by this research. Chapter three can almost be used as a user manual for implementing the data extraction framework, which can be used immediately to support an interdisciplinary approach to song writing. The way that the framework can be used to harvest information about songs can be used to support research from any of the numerous and varied fields of study relating to pop music and songs that were deliberately set aside in this thesis to produce this result.

Although referred to above as an unexpected outcome, elements of this thesis also contribute to song writing pedagogy. Some of the terminology originated by this work, as well as the practical elements of disciplined interrogation of songs can be used to inform a creative process in a sophisticated but tangible way.

With reference to some of the literature that served as the starting point for this thesis, engaging in this research has contributed to addressing what Agawu referred to as "the marginalization of song as song" (1992, p. 3) from the perspective of song analysis. More generally still, this research contributes to the broader field of popular music research in the sense that song is the "central textual form in popular music" (Shuker, 2001 p. 81) and goes some small way to addressing what Krims described as "the historic failure of music theorists and historians to engage seriously with 'unserious' music" (2003, p. 181).

The amount of data that comprises the sample dataset is such that the case studies that make up the second half of this thesis are far from exhaustive. The intention has been to demonstrate, as much as anything, the potential of such an approach. Some of the conclusions drawn about the individual styles of artists or bands are happy by-products of the process of testing and showing how the data can be interpreted. It is my hope that others may find this approach insightful, and I view this research as the start of a body of work rather than the conclusion of one.

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Berry, C. (1956) Roll Over Beethoven. On *The Definitive Collection.* Santa Monica, CA: Geffen

Berry, C. (1958) Sweet Little Rock and Roller. On *The Definitive Collection.* Santa Monica, CA: Geffen

Bon Jovi, J. (1988) Living In Sin. [Recorded by Bon Jovi] On *New Jersey.* Santa Monic, CA: UMG

Bon Jovi, J, Sambora, R. (1986) Wanted Dead Or Alive. [Recorded by Bon Jovi] On *Slippery When Wet.* Santa Monic, CA: UMG

Bon Jovi, J, Sambora, R. (1988) Homebound Train. [Recorded by Bon Jovi] On *New Jersey.* Santa Monic, CA: UMG

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