

# A Rhythmic Analysis of Rap - What can we learn from 'flow'?

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## ABSTRACT

This thesis provides a novel investigation into the rhythm of rap, using data from six local Christchurch rappers. The background focus was to provide a linguistically-informed description of the hip-hop term *flow*, in which *rhythm* plays a major role. Prior theories on characterising rhythm were discussed to determine what would be the most suitable method for the analysis of rap. The Pairwise Variability Index (PVI) algorithm seemed the most suitable candidate, that characterised rhythm by measuring durational variability. An auditory analysis was carried out first, where I attempt to describe the *flow* of each rapper based on my perceptions, and the relevant aspects discussed in the thesis. The PVI algorithm was then used, using a script run through Praat, to produce metrics for each of the rappers in my data. Stress and error counts were also manually quantified and stress percentage was calculated for each rapper. Overall PVI scores from the data were higher than prior measures of NZE speakers, though the setting and performance of acapella freestyle is quite different to data examined previously. With the nPVI scores showing many correlations to the auditory analysis, results seem promising. A larger-scale perceptual study would yield considerably more validity for this notion however.

# Chapter I: Introduction

## 1.1 Purpose and goals of investigating rap rhythm

This thesis investigates rap rhythm using the Pairwise Variability Index (PVI). *Flow* is a term well recognised in hip-hop culture; it is widely referenced in rap music and used by members of the hip-hop community. This research discusses the aspects of rhythm surrounding *flow* and then attempts to produce metrics for the elements of *flow* that can be measured. This research stems from a personal interest in rap, and an attempt to marry it with linguistic rhythm research. Though rap (more generally hip-hop culture) has received attention in sociology and socio-phonetic fields (Blanchard, 1999; Hall, 2011; Persaud, 2011; Speer, 2014; Dorreen, 2015; González, 2016), this research fills a gap thus far in the linguistic and rhythm related research, as rap has not undergone any detailed rhythmic analysis.

The research questions of this thesis are:

- RQ1.** What is *flow*, and what aspects of *rhythm* are involved in its definition?
- RQ2.** Can viewing rap from a perceptual standpoint accurately interpret aspects of rhythm?
- RQ3.** Does the PVI serve as a suitable approach for analysing rhythm in rap?

The thesis is structured as follows. In **Section 1.2** I discuss the background and origins of hip-hop culture, and the emergence of rap in South Bronx. In **Section 1.3** I introduce *flow*, a term used heavily in hip-hop and rap, and the area of focus for this research. In **Section 1.4** I describe the different settings and arenas in which rap occurs, and how they influence or constrain the *style* as well as the *content* of raps that that are produced. In **Section 1.5** I describe rap in different regions of the world, including the hip-hop scene in New Zealand and Christchurch, and the associations that have developed between regions and rhythmic (or *flow*) styles used by rappers hailing from such regions. **Section 1.6** covers rhymes and ‘rhyme schemes’, with descriptions of some rhyming patterns employed by rappers.

In **Chapter II** I discuss the background literature on rhythm research that my thesis will draw from, such as *isochrony* and language based research, the rhythm-class hypothesis, and prior research using PVI measures. In **Section 2.1** I begin with theories of *isochrony* and the typological classification of languages. In **Section 2.2** I briefly discuss subsequent theories that attempted to characterize rhythm, and the gaps found in searching for *isochrony*, before continuing in **Section 2.3** to discuss the method and metric that I will be using, namely the Pairwise Variability Index. In **Section 2.4** I discuss the study my data is drawn from (Dorreen, 2015), before continuing to discuss other studies on New Zealand English in **Section 2.5**, and finally discuss some studies that employ the PVI in musical research. **Chapter III** discusses the methodology of the study, including the procedures and software used in my analysis. I then present the results of my analysis in **Chapter IV**, and discuss them in **Chapter V**. Specifically, I compare the PVI measurements of rap with prior PVI measures, and attempt to outline the aspects of rhythm that are measurable in *flow*. Finally, I will present any conclusions and suggestions for future development of this work in **Chapter VI**.

## 1.2 Hip-Hop roots

### 1.2.1 MCs and DJs

The South Bronx in the early 1970s was a poverty-stricken, and swiftly deteriorating borough of New York. An economic depression was occurring in the region, and it was experiencing one of its most severe cases of urban decay. During these troubled times, an entire subcultural movement emerged, known as hip-hop. Hip-hop encompasses multiple art forms including, DJing or turntabling, MCing or rapping, breakdance or B-boying, and graffiti art (Blanchard, 1999). The original art of MCing is reported as having Jamaican origins, where ‘*deejays*’ would chant and sing to an instrumental rhythm (or ‘*riddim*’). This is known as ‘Jamaican toasting’, as deejays would often tell tales of heroism in their toasts. Many internet articles discuss the importance of recognizing Jamaica’s influence on the true roots of MCing, and by extension, rap (Indie Music Listeners Staff, 2014; Hall, 2011; Pollard, 2004), though it is difficult to determine whether the Carribean Island nation had any influence on its emergence

in the US.

MCing emerged in the South Bronx of New York through the Black American communities and youths. The South Bronx was where the idea of having an MC was developed and popularised in the US – the role of whom is to form some level of rapport with the crowd and maintain a high energy to keep them moving. They would also *rap* short rhymes (also known as bars, from musical terminology) in time and in intensity with the beat. Other elements such as breakdancing and graffiti are also strongly linked to hip-hop culture (González, 2016), and these elements as well as the musicians present in the scene at the time are synonymous with its inception.

### 1.2.2 Where rap began

On August 11<sup>th</sup> in 1973 DJ Kool Herc was credited as the first to play the same track on two turntables to extend a certain section of the song (PBS, 2008), This is a technique known as ‘*looping*’ and is an integral part of DJ performances today. Though he is the main DJ referenced, other DJs at the time also helped shape and develop further turntable techniques such as breaking and scratching, and used these beat manipulation techniques to effectively turn the record player into an instrument that allowed them to alter and modify existing songs. This expanded into using two turntables to mix two songs at the same time.

Combining the correct elements without producing jarring overlaps or going out of time requires much skill and practice. Techniques used in electronic music and DJing today can be traced back to the roots of turntablism in hip-hop which eventually became digitalized and now can be done without vinyl – leading to a reduction in the use of the term ‘turntablism’, and a shift to using the term DJing<sup>1</sup>.

Coke La Rock was a partner of DJ Kool Herc and one of the first people to deliver their rhymes as a party MC<sup>2</sup>. These started out with basic rhymes as well as basic shout outs to people in the crowd or members of the crew, and then developed into poetry and rhymes that involved ingenuity and circumstance. Both Herc and La Rock are recognized as being innovators during the inception of hip-hop and rap (Reeves, 2008). It still took time after this for rap to leave the warehouse and block party settings, as record labels did not consider it

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<sup>1</sup> Derived from the phrase ‘disc-jockey’.

<sup>2</sup><https://genius.com/Coke-la-rock-the-first-rap-ever-lyrics>, ‘*The First Rap Ever*’ as reported by DJ Kool Herc



more than a fad for a time. Though there are other claims for the title, ‘*Rapper’s Delight*’ is the track credited as the first true hip-hop record, released by The Sugarhill Gang in 1979. It was a 14-minute hit that topped popular music charts with its funky beat and catchy hook, and helped spur the development of one of the biggest and most diverse music genres today.

*“I said a hip hop the hippie the hippie  
To the hip hip hop and you don't stop  
The rock it to the bang bang boogie  
Say up jump the boogie to the rhythm of the boogie, the beat”  
– Wonder Mike of The Sugarhill Gang, *Rapper’s Delight*<sup>3</sup>*

The example above reflected the more basic rhymes found when rap was still emerging, and references to the strong influences of funk and jazz that were present at the time. Lord Jamar, a known rapper of the group Brand Nubian, also references the influence of jazz music, and discusses how hip-hop didn’t directly bring anything new to the table in terms of the music at first, but rather reinvigorated old funk and soul music because kids would rap over their parent’s old vinyl records (Ice-T, 2012); “...so hip-hop didn’t invent anything, but hip-hop *RE-invented everything*” – Lord Jamar (*Brand Nubian*)<sup>4</sup>. In these early years of hip-hop, because the emphasis was on the party scene and MCing, lyrics and the beats were often quite upbeat and geared towards generating an energetic and jovial party vibe – the funk and jazzy beats also helped to contribute to this.

### **1.2.3 Progression of rap content**

After rappers<sup>5</sup> took the focus to studio production and achieving more mainstream success, they began writing more introspective lyrics and discussing street life for black youths at the time. The South Bronx experienced severe urban decay in the 1970s due to multiple factors, such as – the effects of ‘*white flight*’<sup>6</sup>, the building of the Cross-Bronx Expressway

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<sup>3</sup> <https://genius.com/Sugarhill-gang-rappers-delight-lyrics>, The Sugarhill Gang – *Rapper’s Delight*

<sup>4</sup> Brand Nubian was a hip-hop group that formed in 1989, they released six albums, four of which made the Billboard 200. Their debut album *One for All* is also acclaimed as one of the most popular hip-hop albums of the 90s.

<sup>5</sup> Also referred to as music artists or simply ‘artists’ in modern pop culture

<sup>6</sup> An American term describing the migration of people with European backgrounds moving from mixed urban areas to more racially homogenous suburbs

(Ploschnitzki, 2013). which dislodged thousands of residents from their homes<sup>7</sup>, and an increasingly vicious cycle of insurance fraud propagated by white landowners. In the latter case, landowners would exploit the plunging property prices, by insuring properties then burning them to claim insurance money, sometimes while they were still occupied. This led to remaining residents resorting to burning down vacant houses themselves, and a major increase in violent crime ensued in the area lasting till the early 1980s. Street gangs and drug dealing rings became prevalent and youths often got caught in this cycle simply as a means of survival.

*“You feel the ambiance, y'all niggas just rhyme  
By the ounce, dough accumulates like snow  
We don't just shine, we illuminate the whole show, you feel me?  
Factions from the other side would love to kill me” – Jay-Z<sup>8</sup>*

Here Jay-Z makes multiple references – to the audience *feeling* his music on a deeper level than other rappers that simply form rhymes, to selling drugs to make money, to his aim to reflect and tell a complete story (illuminate the whole show) – and discusses animosity from rival drug dealers or gangs who want to eliminate the competition.

Social research on the roots and development of hip-hop culture have traced its African origins, also encompassing elements from the period of slavery, who some feel is central to understanding the ideological roots of some lyrics that have emerged in rap (Persaud, 2011). The content of rap may be considered a manifestation of ‘a form of resistance to the subjugation of working-class African-Americans in urban centres’ (Blanchard, 1999, p. 2). The presence of violent content and discussion of oppression, is often a reflection of a rapper’s experience or even immediate life. Tupac Shakur (stylized as 2Pac, who also goes by the pseudonym, Makaveli) is an iconic name in rap. He grew up in East Harlem, New York where his mother and father were active militant members of the Black Panther Party, a special interest group that fought for racial equality (Amaru Entertainment, 2002)<sup>9</sup>. Many of his raps discussed the racial intolerance and oppression against the lower class inflicted by the establishment and police force. Another known rapper, Nas, grew up in Queens, New

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<sup>7</sup> <http://www.nycroads.com/roads/cross-bronx/>, a detailed article on the development of the Cross-Bronx Expressway

<sup>8</sup> <https://genius.com/Jay-z-dead-presidents-ii-lyrics>, Jay-Z – Dead Presidents II

<sup>9</sup> Amaru Entertainment was founded by Tupac Shakur’s mother, as a legitimate record label for the release of Tupac’s work, it uses his middle name ‘Amaru’ in the title.

York, and has been cited as one of the greats for his incredible storytelling, and portrayal of street life through metaphorical wordplay and intricate lyricism. Ice Cube grew up in Compton, California, helped popularise ‘*gangsta rap*’ on the West Coast and gained huge success with his punchy lyrics and harsh political statements in his raps. However, as rap has grown in popularity and geographic range, the conscious subject matter found in a large proportion of rap music is being overshadowed by much of the rap music (especially post-millennium) found in the mainstream spotlight – which is criticized for the use of vulgar language, the inclusion of sexual and offensive content and sometimes misogynistic themes. I will discuss this in more detail in Section 1.4.

#### **1.2.4 The use of *sampling***

In the documentary released in 2009 titled “*Something from Nothing – The Art of Rap*”, director and executive produce Ice-T interviewed a number of known rappers from all over the US. Two of the rappers interviewed were Lord Jamar and KRS-One, who were present in the early years of hip-hop and rap, and they described aspects of Black American life while hip-hop was emerging. Access to musical instruments was also being reduced in schools at the time, states Lord Jamar, largely due to socioeconomic factors. This meant that kids were making use of their parents’ old records in record players and turntables, then rapping over those (Ice-T, 2012). The use of old records as instrumental tracks to rap over formed the foundation for *sampling*, a technique used commonly in modern electronic and hip-hop music. This means taking certain segments of a song – sometimes just a single bassline section or main melody section – and using that section in a different song or mix. In electronic music, samples are often used in combination with innovative elements, so the artist may use the sample in combination with other elements to produce an entirely new song; or they may create a ‘remix’ – that is to recreate the feel of the original song whilst adding some elements to make it its own version of the song<sup>10</sup>. The latter form is often used to convert songs to be more playable in a nightclub setting (e.g. radio edits). Early hip-hop DJs used samples in combination with techniques in warehouse party settings to keep the energy going longer. One example of this is Afrika Bambaataa & Soulsonic Force’s hip-hop

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<sup>10</sup> The website [www.whosampled.com](http://www.whosampled.com) is an excellent resource for seeing the range of *samples* used in popular songs, and exactly what samples are used in which sections; the chain can be surprisingly extensive (WhoSampled.com, 2017).

track, “*Planet Rock*” (1982) – the beat and bassline of which are now quite iconic, and elements of which have been sampled 363 times.

### 1.3 An introduction to *flow*

*Flow* is a term synonymous with hip-hop and in particular, rap. Ask any rapper or regular listener in the context of the genre and there is a high chance they will at least recognise the term. *Flow* is used in hip-hop to refer to a rapper’s rap, but can be based on a number of factors – speed, rhythmic structure, rhyme patterns, vocal style, delivery style, etc. Most often rap is likened to spoken-word poetry, the main difference being that usually it is performed to a beat. In this section I discuss what aspects are considered important in *flow* from existing literature and knowledge from rappers through their music or interviews. I also identify the elements of rhythm I aim to measure in my own research.

The best representative for a description of *flow* is that posed in Paul Edwards’ book ‘*How to Rap*’ – which includes quotes from interviews with notable rappers in the industry, including Murs, Immortal Technique, Big Daddy Kane, Tech N9ne, Havoc (from Mobb Deep), Aesop Rock, B-Real (Cypress Hill), Pusha T, and Vinnie Paz. Edwards provides a comprehensive breakdown and description of all the elements of rap. *Flow* is described in his book as encompassing simply the **rhythm** and **rhymes** used; “...unlike the rhythm of a poem, a song’s flow has to be in time with the music—the rhythm of the lyrics must fit with the basic rhythm of the music (Edwards, 2009, p. 63). Quotes cited from many notable rappers discuss the importance of *flow*:

“It’s down to attaching flow to the beat.... Like Bruce Lee said, if the water is in the jug, it becomes that jug. If water is in that bowl, it becomes that bowl.” – Sean Price

“[Jay-Z’s track] “Money, Cash, Hoes”—the song ain’t really about nothing, really he’s just rhyming. But the thing that catches your ear is that flow—it’s the way he rides the beat that makes me like the song” – Royce Da 5’9”<sup>11</sup>

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<sup>11</sup> Quote for Sean Price, (Edwards, 2009, p. 64), and for Royce Da 5’9”, (Edwards, 2009, p. 65)

Examining *flow* outside the context of rap, it is defined as ‘a steady or continuous stream or supply of...something’<sup>12</sup>. Most likely this would lead you to imagine a river or some form of liquid flow. Applying the analogy to rap provides an appropriate description of qualities that one would aspire to in producing a good rap – a steady or continuous stream of lyrics, but in time with a beat. According to Edwards however, rhythm in the context of *flow* does not only encompass properties such as speed or consistency, but also rhyme. Other aspects that come under the title of **delivery**, such as – breath control, enunciation, syncopation and the use of pitch and tone. Rappers can employ different delivery styles and *flow* styles to fit a certain song, beat, or genre, but this is limited by vocal range and ability. Eminem for example displays completely different styles if you compare his song Mockingbird against Mosh. Both these songs are from the same album Encore (2004), but have wildly different *flows* and delivery style due to the content. The latter is an aggressive ‘diss’ track (described later) directed at the former President Bush. Eminem employs a harsher tone and the pitch is raised considerably so he can almost shout the lines. The pace of the rap is slower than is typical of him, to match the slow-marching beat. He uses a lot of stressed vowels, especially at the end of lines, for impact and emphasis. Mockingbird however is a far more sentimental track where he discusses his relationship and struggles with his wife and daughter. His pitch drops to set a more serious tone, which also allows him to be more melodious and better convey emotion in the rap. The rap in Mockingbird is also incredibly connected, i.e. there are few gaps between sounds, and few pauses for breaths. Some rappers are quite consistent and often identifiable by their rhythmic styles or patterns in addition to their voice, but many rappers will also vary their rhythms between or within albums and songs. *Flow* is emphasised by many rappers as of a greater priority than semantic content, though both are considered necessary to a good rap song; “*It’s all about styles, just the way you’re getting your subject across. If people can’t feel how you’re saying it, it doesn’t even matter what you’re saying.*” – *Havoc, Mobb Deep* (Edwards, 2009, p. 65).

Examining *flow* using musical notation is very useful for supporting the description above. The *flow* can be viewed as drum patterns converted into lyrics, which then accompany the instrumental track of the song, i.e. each lyric/syllable in a rap song can be converted into a beat in a drum pattern. Typically, the instrumental track of the song maintains a consistent tempo—it may change for certain sections of a song but for the most part it needs to hold a

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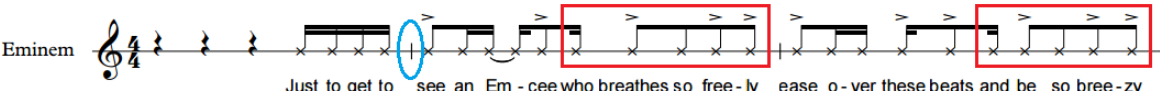
<sup>12</sup> <https://en.oxforddictionaries.com/definition/flow>, definition obtained from the online Oxford Dictionary

consistent tempo for the rapper to synchronize with. The *flow* however can be far more variable, and skilled rappers will often attempt to showcase a variety of *flows* within a song to demonstrate their rapping ability, also to keep the vocal part of it feeling fresh. An example of this is highlighted below:

## "Business"

Produced by Dr. Dre  
Words by Eminem  
Transcribed by Martin Connor

♩ = 97

Eminem 

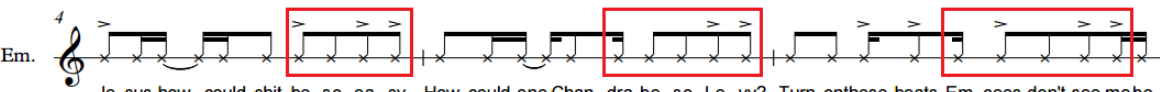
Em. 

Figure 1

Figure 1 displays Eminem’s song “Business”, his vocal sections within the red boxes are identical at the *end* of each *bar* (notated by the crossing vertical line, highlighted in blue), the exception is the third in which the beat prior is slightly longer than the others. The vocal section in the first part of each bar is slightly more variable, but still has many repeated beat patterns, most prominently the splitting of one word into two long beats at the end of the bars; ‘free-ly’, bree-zy’, ‘ea-sy’, ‘Le-vy’. In addition to his rhythmic consistency, the FLEECE vowel (/i/ in General American English) is rhymed around thirty times, apart from the last line in Figure 2.

Em. 

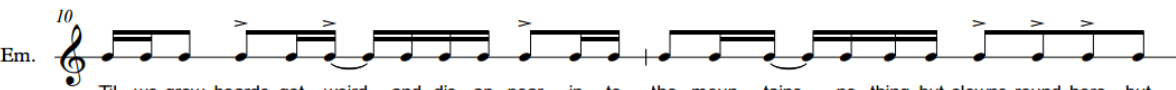
Em. 

Figure 2

Looking at the top line in Figure 2, the first section highlighted in red maintains the final short note at the end of Figure 1 (the double horizontal line represents a sixteenth note, or semiquaver) – the final ‘be-in’ Figure 1, and ‘are’ in Figure 2. He also varies the first two beats in the highlighted sections, while the final longer crochets (or quarter notes) are consistent throughout. The final line in Figure 2 shows the *flow* changing entirely as it is leading into the chorus of the song, while remaining synchronized with the instrumental track of the song. The term syncopation refers to when a rapper uses emphasis on off-beat notes,

which displaces or disturbs the regular rhythm. Rappers use this to vary and alter their flows, but need to always remain synchronized to the beat. Some UK/Grime rappers have quite distinctive *flows* because they begin their raps on the off-beat. Ocean Wisdom is one of these who employs a distinctive off-beat style in many of his songs, which produces quite a different sounding rhythm<sup>13</sup>. This description of *flow* from a musical notation perspective is useful as it is possible to visually count syllables based on the length of musical notes. However, for the purposes of this thesis it is only included to provide another way of understanding *flow*. As I explain below, my data is *acapella freestyle* and has no defined tempo, it is near impossible to develop accurate musical notation. The description of flow so far may also suggest difficulty as the recordings in my data contain no beat. However, as we will see, there is no doubt that rappers attempt to produce *flow* even when rapping in acapella, so despite its variable nature it is still suitable for the goals of this study. Although there are many elements involved in characterizing rap flow, *rhythm* is the focus of this study. Techniques and theories have been developed to characterize and measure rhythm in language, but have not been applied to rap specifically. These will be detailed in Chapter 2.

#### 1.4 Rap arenas and their influence on rap style

The early MCs formed the initial beginnings of rap with more basic rhymes designed to be easy to sing along to, and to keep the energy up. However, as noted above, in the environment in which it developed it quickly became an outlet for many youths to escape the tribulations of poverty, street life, racial intolerance and personal strife. Here I will outline some of the different arenas in which rap occurs and some terms that characterize different forms of rap. This discussion requires taking somewhat of an epistemological position. However, I aim to discuss the state of the rap industry as accurately and as objectively as possible.

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<sup>13</sup> <http://www.huckmagazine.com/art-and-culture/music-2/brighton-rapper-ocean-wisdom-world-feet/>

### 1.4.1 Different rap forms

As mentioned earlier, in the beginning, rap began with MCs in a party or club setting and used more basic rhymes and rhyme schemes, often with *hooks*<sup>14</sup> that can be chanted. These laid the foundation for a simple line by line rhythm. In this setting, rappers tend to produce a rhythm similar to the beat, because in a party setting people are mainly reacting to the beat rather than the rapper: “*If it’s just like a party song, a club song, I’d say the flow [is more important], and how it makes you feel, because when you’re in the club you’re not really tripping off the subject matter of the song.... You’re kind of tripping off the beat and how the rapper flows to the beat*” – *Stressmatic, The Federation*, (Edwards, 2009, p. 20)

**Freestyling** means to rap off the top of the head and can be referred to as improvised rap. For obvious reasons this can be very difficult to do but it is also impressive if done well. The content in freestyling can vary wildly, of course, but freestyle raps often include **braggadocio content** (detailed in the battle rap section), and if there is a crowd present rappers often attempt to improvise raps about things in the immediate vicinity, or make local references that will get a reaction from the crowd. It is generally acceptable to have some ‘filler lines’ prepared or hooks that can be used to build off in a freestyle, but over-use of such techniques will reduce the rappers’ overall perceived skill. Some rappers make use of these to keep the *flow* going while they think up further lines, and some can switch between different *flows* while remaining synchronized with the beat. *Sway in the Morning* is a rap show hosted by Sway Calloway, who invites rappers from all over the US hip-hop community to come to the studio to discuss their raps, their lives, and usually to perform some form of rap. One of the most popular segments is known as the Five Fingers of Death, where the DJ lines up 5 different instrumental tracks (usually of varying tempos) in sequence, which he transitions without warning, and the guest rapper must adapt to these transitions and either freestyle, or deliver lyrics from memory matched to these beats. This is an excellent way for rappers to demonstrate their prowess. In the freestyle performed by guest rapper King Los<sup>15</sup>, Sway

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<sup>14</sup> In music terminology – a short phrase or riff used and usually repeated more than once in popular music, sometimes makes up or is similar to a chorus, in rap it is often shorter however

<sup>15</sup> King Los grew up in Baltimore, Maryland, and has released several mixtapes and online freestyles, and one studio album in 2015



throws some random and complex words at him during the freestyle, to which Los picks up and continues to freestyle with, and even concludes with a lengthy acapella segment<sup>16</sup>.

*Acapella* is traditionally associated with singers or singing groups (a cappella groups) who rely solely on their voice and harmony, with no instrumental accompaniment. *Acapella rap* is identical in concept, that is rapping with no instrumental track or beat to accompany. This can produce quite a different style of rap as opposed to rapping over a beat, as instrumental tracks are intended to maintain a consistent tempo for a rapper to synchronize with. I will discuss this in more detail later in this chapter. Without this accompaniment, it is much more difficult to maintain a consistent tempo, therefore the pace of the rhythm is almost certain to be more variable. Nevertheless, in producing raps and freestyles rappers aim to create patterns to produce rhythm, otherwise it would be no different than simply speaking quickly. An excellent example of acapella rap comes from ‘The Shady CXVPHER’<sup>17</sup>, that involves members of Shady Records, Eminem’s record label. A *cypher* is sometimes referred to as a freestyle battle, as it involves rappers taking turns rapping over the same beat. This is more collaborative however than battle rapping (outlined below), and usually involves members who frequently collaborate or represent the same team. In this case the rappers all represent Shady Records, but contrary to typical cyphers, in this one every rapper delivers their verse acapella. The rhythms displayed are incredibly varied, but showcase each rapper’s command of the art form. Although this form does not occur often in the category of produced and commercial rap, multiple rappers have produced songs containing a section where they will switch to acapella. In “*Growing Pains II*” by Logic<sup>18</sup> he raps over an instrumental track until the 3:40 mark, where the beat drops out and he raps in acapella for 14 ½ bars, or around 40 seconds, much longer than most rappers who use this technique – known as an ‘extended beat drop’ (Connor, 2016).

Freestyling often goes hand in hand with **battle rapping**, an entirely different situation that utilizes an MCs freestyle abilities to verbally attack their opponent, whilst boasting their own ability or prowess – this may be in reference rap ability, notoriety, or unrelated skills. This is known as ‘**braggadocio**’ content, and has been an integral part of rap music for a long time.

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<sup>16</sup> <https://www.youtube.com/watch?v=RbimBJiGUA>, Best Freestyle of the Year: King Los Kills the 5 Fingers of Death

<sup>17</sup> <https://genius.com/5140216>, Eminem, KXNG KROOKED, Joe Budden, Yelawolf, Joell Ortiz, Royce Da 5’9” - The Shady CXVPHER

<https://www.youtube.com/watch?v=ygzRDayKxTk>

<sup>18</sup> <https://youtu.be/Rt-RHLHC6l8?t=3m39s>, Logic – Growing Pains II

As it is a competitive domain, a rapper needs to be able to boast their own prowess in some manner that sets them aside from other rappers. This is captured in the essence of a battle rap, which is done in a live situation with an observing audience, sometimes with a DJ to control the music in the rounds or sometimes it is done in acapella. The winner is traditionally (but not always) gauged from the reaction of the crowd. Battle rapping is what rappers might call lyrical warfare, as it requires finding and attacking weaknesses in your opponent, whether it be in their appearance, personal lives, rhyming skill, or whatever they can find. Each rapper gets a fixed amount of time to say their rhymes, at which it alternates and the other rapper has the same amount of time to respond until the round limit is reached or a unanimous victory is decided. The best battle rappers are those who can respond to the rappers last verse immediately after with clever wordplay, and who make references to relevant events or objects that are familiar to the crowd. Some great examples come from the ‘Blackout’ rap battle league, hosted by King Of The Dot Entertainment<sup>19</sup>. The battle between Conceited (an African American rapper from Brooklyn) and Dumbfoundead (an American rapper of Korean descent) was the most talked about battle from the league in 2015, where both rappers produced some very clever wordplay, with the use of puns or double entendre, and displayed a great ability to turn what had been said previously against their opponent (King Of The Dot Entertainment, 2015):

*“You’re a D-list celebrity, I’d rather keep my integrity  
I’d make more money in my sleep while you sleep with the enemy  
I couldn’t have bought my **condo** with **Con** dough, I got **Dumb** money  
And that’s not a **pun** dummy, now I got young money for the artist fee” –  
Dumbfoundead<sup>20</sup>*

Note the bold sections where Dumbfoundead references both artists, whilst also boasting his own status.

*“I should let the snub light you right now  
You’ll let the pipe blaow? Nigga, pipe down!  
You ain’t got the **Magnum** for **protection** to pop **Con**  
**Dumb** (condom), it’s not in your lifestyle” – Conceited*

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<sup>19</sup> <https://kotdty.com/>, King Of The Dot Entertainment website

<sup>20</sup> <https://genius.com/King-of-the-dot-conceited-vs-dumbfoundead-lyrics>, Lyrics to the rap battle

Here Conceited amalgamates and references the names of both rappers into ‘condom’, and uses the word ‘magnum’ to reference the condom brand, as well as the weapon for ‘protection’. Listening to the entire battle shows a clearer idea of the progression of the battle, and the skill of the rappers to turn what has been previously said into a fresh attack against their opponent. The rhythmic elements of both rappers here is quite distinct. Because it is in acapella, the rappers do not need to adhere to any metrical structure, can take more time to construct punchlines, and vary the speed to create emphasis at certain points. The overall pace is much slower than in typical written or recorded rap songs, though Dumbfoundead seems to have faster periods than does Conceited. In the boldened words from Conceited’s verse, he slows down and exaggerates his production of them to emphasize the puns.

Another popular reference to battle rap is presented in 8 Mile, a film based around Eminem’s (known as Jimmy Smith Jr. and B. Rabbit then) life in Detroit and a prequel to his break into success (Hanson, 2002). In it he participates in battles—albeit unwillingly at first—at the local rap club known as The Shelter, where a DJ loops a beat for each round so it is even for both rappers. In the end, he wins the battles against members of the rival crew and makes his name known, as a prequel to his break into musical success. In these final battles, he uses the knowledge gained over the course of the film to attack his opponents, whilst referencing the previous verses that had been delivered<sup>21</sup>. The special features of the film also present some rap battles that were filmed to let some of the extras have some fun and ‘battle’ Eminem, who was reportedly conserving his voice for filming and therefore played along simply lip-syncing. However, the reactions from his opponents’ verses get to him and eventually he produces some impromptu freestyle verses;

*“Hold on, lemme turn this mic on  
Don’t think for a minute I’m a let you get away with that song  
Cause that shit was wack, you ain’t spittin’  
As a matter of fact, all of that shit was written” - Eminem*

Even though some of them are quite basic, he increases the impact of the punchlines simply through expert timing. Instrumentals in a battle rap often maintain a constant melody with strong drums, a steady accompaniment for the rappers but not overpowering the rap. In order to please the crowd, the ‘flow’ needs to be timed well along with clever content. Due to its

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<sup>21</sup><https://www.youtube.com/watch?v=yIkOAtifuJ0>, Compilation of the three final rap battles in 8 Mile  
<https://genius.com/Eminem-papa-doc-vs-eminem-8-mile-rap-battle-lyrics>, Lyrics to the final battle in 8 Mile

improvised nature, rap rhythm in battles is highly variable, but often slower overall in accordance with the beat—often using pauses for emphasis and effect. Many rappers who gained success in the US rap industry started out performing in rap battle contests to gain some notoriety before breaking out into the production scene.

The final arena involves studio production. This is where the majority of rap heard by the general population. Rappers can take their time to write their raps, think of exactly how they want to express themselves, and how to deliver their lyrics in their rap. This is where some listeners and critics consider the most innovative raps emerge, and debut albums are often credited as a rapper's best work as it comes from the most honest or authentic position, before the rapper truly breaks into success. There are mixed attitudes towards battle rapping and written rap however. Some members of the industry as well as listeners may consider battle rap as secondary to writing rhymes, whilst others feel it forms the best lyrical content as the aim is to impress the crowd (Edwards, 2009). Some tracks are even produced to directly attack another rapper or group – these are known as 'diss tracks'. As these are written and can be thought out, the attacks can gain much more complexity in battles, and can utilize the beat to further emphasize punchlines. Despite the aggression and personal subject matter thrown in battle situations, there is often a supportive feeling created even after a battle – such as in the cited KOTD battle. However, in hip-hop there have been rivalries that emerged into what are known as *feuds* or *beefs*. Many infamous 'diss tracks' have been produced and resulted in a back and forth repartee, that are often touted for the way they are constructed into incredible verbal assaults. However, some have also extended out of the studio and led to violence and in some cases murder, such as in the infamous shooting of 2Pac. In some cases, these feuds can occur within groups, such as that which caused the breaking up of popular rap group N.W.A. (Spirer, 2003).

#### **1.4.2 The mainstream vs. underground debate**

The popularisation of rap and subsequent transition of hip-hop into a mainstream industry has spurred both the genre's expansion, but also its deprecation (Speer, 2014). The discussion here requires taking an epistemological position, as I am certain there are multiple perspectives and opinions on this topic. As it is a passion of mine, I am certainly prone to bias towards certain rappers and against others, and I am still limited in my knowledge of rap music so cannot generalise too conclusively across the entire genre. However, as a critical

listener I do my best to remain as objective as possible when judging rap music in general, and I feel as a trained listener of rap, I can present a discussion with observations of the rap industry whilst remaining objective.

Although MTV and other popular entertainment media networks have helped to spread hip-hop and allowed it to be heard more widely, many rappers have discussed in their lyrics the influence exerted by record labels, and pressure to produce marketable music that simply makes money. This has subsequently popularised sexual content, vulgarity, and an emphasis on simpler lyrics that can be marketed to youths and the party/club demographic, whilst ignoring much of the more intellectual and conscious rap music being produced. There was a period in mainstream hip-hop—known as the *Golden Age of Hip-Hop*—that was characterized by the innovations in metaphorical storytelling, quality of rhymes and lyrics, and the general diversity of the music produced at the time<sup>22</sup>. More complex patterns and rhyming schemes were being used, and rappers at the time raised the bar for rhythmic capabilities. Although the exact years and specifics vary from different sources, it is generally agreed as being from the late 1980s to the mid to late 1990s. The cited article from LA Weekly lists 20 of the best hip-hop albums from this era—the period from around 1988 to 1993—and though it may not be entirely agreed upon, it gives a good idea of rap music during the era. Many of the albums and rappers at the time discussed ghetto and ‘hood’ life, which set the tone for much of the rap music produced in subsequent years as well. The general acceptance of the suggested ‘Golden Era’ gains some credibility from the fact of *sampling*, and that much of the rap today and since the millennium still use samples and references from these golden era albums. Many individual rappers have gained success and notoriety by breaking ground in the hip-hop. This could be considered as simply a romanticised view in hindsight, as rap certainly continues to evolve and produce groundbreaking new rappers up to the present day. However, when comparing the rap music produced in the Golden Age era, it is certainly distinctive as a turning point for the lyrical complexity achieved as well as the content discussed in rap music. Notable rappers from this era and subsequent years are continually raising the bar.

There is however a collective desire for avid listeners and members of the rap genre to identify who are ‘real’, i.e. rappers who are honest in their music and create a genuine image,

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<sup>22</sup> <http://www.laweekly.com/music/top-20-golden-age-hip-hop-albums-4484998>

against those who are ‘fronting’, i.e. put up a false image, act tougher than they are, or make unfounded claims about some aspect of their persona:

*“Nah it ain’t like that I just happen to be a nutty abundantly funny type of  
individual  
Like, as a guy  
So when I get up on the mic I ain’t finna just lie  
Real recognize real, right?” – Lil Dicky, Professional Rapper<sup>23</sup>*

The phrase ‘**real recognize real**’ is a hip-hop idiom that concisely summarises the recognition and mutual respect of those who are ‘real’ by others who are also ‘real’ – as described above. In Lil Dicky’s song, he draws allusion to his choice to abandon an academic path in pursuit of dreams of rap success, he references his Jewish heritage, and middle class upbringing that traditionally do not fit into the hip-hop demographic. In 2013, Kendrick Lamar recorded a verse as a feature on Big Sean’s song ‘Control’. In it he produces an incredibly aggressive verse, that addresses 11 rappers by name—some of whom he has collaborated with on prior tracks— and reflects his disapproval in the tone and anger found in his voice. He identifies himself as the ‘king of New York’ and ‘king of the coast’ (in terms of rap notoriety), and identifies the named rappers as competitors who he feels need to improve their game, and who he has his sights on. Lamar produced the verse as a challenge, causing a lot of controversy in the rap community, and multiple rappers wrote Control ‘response’ verses and ‘diss tracks’, to which Lamar also responded and highlighted those that received his approval<sup>24</sup>. There is a continuous debate over what is considered ‘mainstream rap’ that largely relies on methods like early MCs, more basic rhymes with hooks that can be sung along to in clubs and market to the masses. Modern iterations, especially since the millennium often use sexual or vulgar content in music videos and lyrical content to be edgy and appeal to youths. This contrasts with what is considered ‘underground rap’, where some analysts consider the most honest, ‘real’ and innovative rap occurs. Generally, underground rap describes independent rappers whose core principles lie in what hip hop is, or should be, and do not ‘sell-out’ to major record labels that can control and censor the content they

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<sup>23</sup> <https://genius.com/Lil-dicky-professional-rapper-lyrics>, Lil Dicky Feat. Snoop Dogg – Professional Rapper

<sup>24</sup> <https://www.youtube.com/watch?v=0UWhdGnf65I>, Lamar’s chosen best response verse, by King Los

produce. This distinction is clearer in the content of some rappers than others, and I try to remain as objective as possible when listening to any rap music.

### 1.4.3 A move towards blurring the lines

The term ‘conscious rap’ generally refers to rappers who discuss socially relevant topics such as politics (Nærland, 2014), but also encompasses those who discuss personal thoughts, conflicts, and social or philosophical ideas<sup>25</sup>. The use of labels such as ‘conscious rap’ however, are perceived by some listeners and analysts as damaging to the genre<sup>26</sup>, as it implies the other group as being unconscious, or vacant. However, this is where I feel the uppermost level distinction in terms of rap content needs to be made, between conscious and non-conscious rap. Although it originated as a party form, the fundamental idea of rap developed into a freedom to express whatever you want, in an artistic manner that truly harnesses the linguistic ability of a rapper. This is not to say that all rap music and lyrics must be sentimental or thought-provoking, but at the very least they need not be thoughtless, or solely for the sake of marketing or ‘edgy-ness’. In considering this conscious/non-conscious split however, developments in the industry, the way media is distributed, and the potential exposure available for rappers, means more and more rappers can achieve mainstream success, whilst remaining true to themselves and producing conscious music. Many rappers today that have achieved a high level in the rap industry, could be put in the ‘mainstream’ category simply as a measure of success<sup>27</sup>. However, while doing so many have brought their own roots and selves to their music, and told their stories from their own perspectives and experiences. With the diversity in rap music now it is possible for anyone to find some rap music that appeals to them, whether at a semantic, emotional, or purely euphonious level. There are many rappers now that blur the line between this perceived rap divide, and those who produce both conscious rap music as well as rap that appeals to the masses. As rap began and remains a predominantly black arena (in the US), Eminem’s rise to success was groundbreaking in the sense that until then white rappers were considered to have no place in the rap echelon. Eminem broke this stereotype with no warning of how successful he would go on to become. He also found it difficult bridging the gap between his upbringing as an underground

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<sup>25</sup> <http://www.hitthefloor.com/features/top-10-socially-conscious-rappers/>

<sup>26</sup> <http://www.hotnewhiphop.com/stop-saying-conscious-rap-news.19179.html>

<sup>27</sup> <http://hiphopdx.com/editorials/id.1021/title.get-your-mind-right-underground-vs-mainstream#>

MC, and his success as a mainstream pop artist: “... so it was like, when I first started lashing out at popstars it was because I was placed in that category, and coming from being an underground MC, I just didn’t wanna be grouped in with that bunch” (Eminem, 2004).

J. Cole is one of the more recent rappers who made a conscious shift to producing more honest and genuine music, as he found himself becoming more arrogant in the Hollywood scene<sup>28</sup>. He references this directly in the album following this transition, and continued to carry out this resolve in many of his later tracks – even producing a song addressing the criticism received regarding one of his earlier more commercially focused tracks from one his rap idols; Nas. Unfortunately, more innovative rap remains unheard by general music listeners, although developments in the internet and social media have helped make these more accessible. The reason for this background discussion is to detail a debate I have observed in the rap community, and that is not immediately clear to those unfamiliar with rap and hip-hop culture or history.

## 1.5 Rap regions, content and identity

A large part of what defines rap and provides much of its appeal to many youths is that it can be an outlet for self-expression in an artistic form. Some research suggests that rappers use it as a way of constructing or solidifying their social identity. This is exemplified in a major portion of rap music, as rappers often reference local landmarks, events, or people who are associated with a particular geographic region. Often this includes references to groups (or ‘crew, squad, team’) and other rappers whom they frequently collaborate with or who hail from the same region. They do this to associate themselves with the respective geographic community and the region which they identify with. For example, Logic & C Dot Castro from Maryland whose team is known as Rattpack<sup>29</sup>:

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<sup>28</sup> <https://genius.com/J-cole-gomd-lyrics>, J. Cole – G.O.M.D.

<sup>29</sup> <https://genius.com/Logic-ballin-lyrics>, Logic – Ballin’



*“Okay it’s Rattpack ‘till my pulse flat  
We keep it real no false rap” – Logic*

*“And I rep Maryland, home of the Terrapins  
Say you spit crack homie we spit that heroin” – C Dot Castro*

Rappers often attempt to express their loyalty or association with their group through clever wordplay in their lyrics. A similar example can be found in Eminem’s song Detroit vs. Everybody<sup>30</sup>, that features five other collaborating artists from Detroit who all discuss some aspect of Detroit life in their verses:

*“Range Rover, this ain’t the squash beef state  
You thinkin’ make-up, we thinkin’ Lark Voorhies face” – Royce Da 5’9”*

*“Welcome to Detroit where if you get that promotion  
Don’t worry man, them bullets will still at be your ass firin’” – Big Sean*

Through research and general listening of rap music, it is possible to identify rap styles associated with certain groups, and therefore geographic regions. Following rap’s inception and through the 80s and 90s, multiple rap groups emerged all over the US. Notable mentions are N.W.A (Niggaz Wit Attitude), from *Compton*, California; Run DMC from *Queens*, New York; and D12 (or the Dirty Dozen) from Detroit. Groups from different regions were and are often still accredited with employing certain styles, and some also discuss the fact in their songs. Rappers such as Tech N9ne, Twista, and Krizz Kaliko are known for employing a very fast ‘machine-gun’ or staccato-style delivery. This style of rap is credited as originating in the Midwest, and rappers from the Midwest who make claims to this style use the term ‘choppers’ (as an analogy to a helicopter rotor) and reference it in their songs (Iandoli, 2013). These rappers have made the term representative of the Midwest itself – note the introductory quote to “*Midwest Choppers II*”<sup>31</sup>:

*“We scoured the globe on a quest to find the most elite  
Most intricate tongues of all time  
California, New York, Denmark, Australia*

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<sup>30</sup> <https://genius.com/Eminem-detroit-vs-everybody-lyrics>, Eminem Feat. Royce Da 5’9”, Big Sean, Danny Brown, Trick Trick, DeJ Loaf – Detroit Vs. Everybody

<sup>31</sup> <https://genius.com/Tech-n9ne-midwest-choppers-ii-lyrics>, Tech N9ne (Feat. K-Dean & Krayzie Bone) – Midwest Choppers II

*Then a cold wind from the Midwest brought the hardest  
Fastest, most accurate tongues ever heard in our lifetime  
These are the Midwest Choppers”*

Of course, this is not to say that every rapper in the Midwest adheres to such an emphasis on speed, and individual rappers may still emerge with different styles.

At the opposite extreme, there is **G-funk**, a subgenre of hip-hop popular on the West Coast strongly influenced by George Clinton who led the band Parliament in the 1970s and produced funk music that incorporated heavy synthesized basslines and funky beats into the hip-hop genre. *G-funk* in general has a more laid-back vibe with a more mellow pace than the choppers described above. The subject matter is largely concerned with street life: crime, poverty, and the lingering racial tension towards Black Americans.

The **UK rap/grime** scene began its emergence in the early 2000s, in East London. The strong influence of Cockney English and slang associated with it developed UK rap into an incredibly distinctive style, and its own subgenre known as *grime*. It is derived from earlier electronic music styles popular in the UK such as 2-step/garage and jungle. “(*grime producers*) have developed a fierce, antic sound by distilling the polyrhythms of drum and bass or garage, (Frere-Jones, 2005). Rap styles in grime are generally quite aggressive, with strong *braggadocio* content and references to local objects and landmarks.

Another electronic genre that spurred on party MCs in the UK was jungle/drum & bass. This is wildly different to other styles, with a much higher tempo than grime, usually of around 170-190bpm. MCs in the UK such as Skibadee, Harry Shotta, Grima, & MC Traumatik, have all made names for themselves in UK rave scene as drum & bass MCs. Recently, they are making names for themselves as high speed rappers, and are also moving towards studio production, and making their rap style more prominent all over the world

Hip-hop in **New Zealand** emerged in the early 2000s, where it began as an underground scene but swiftly broke out into popular music and entered radio charts. Rappers like Scribe, King Kapisi, Mareko, and Tom Scott and the Home Brew Crew, are innovators of NZ hip-hop who have showcased their lyrical ability whilst retaining a strong sense of local identity. Scribe was born and raised in Christchurch, New Zealand, and was one of the first NZ rappers to achieve huge mainstream success in 2003 with his debut album, *The Crusader*, which went platinum within days. His local success was further reflected when he garnered 8

awards at the 2004 NZ Music Awards<sup>32</sup>. Scribe's lyrics displayed the aforementioned sense of local identity, discussing life in NZ and the local hip-hop scene, as well as a sense of collaboration between NZ hip-hop groups:

*"I'm like Nesian **Mystik**, you dissed it and now you love it  
New Zealand hip hop, there's not many things I hold above it  
Now this is the time to focus, call up the **Footsouljahs**  
**Deeptikonz**, **Hamofied**, yeah we taking over"* – Scribe, 'Stand Up'<sup>33</sup>

Tom Scott and his band the Home Brew Crew released their self-titled debut album in 2012, which hit number #1 on NZ album charts. Prior to this however they had developed a significant underground following, with mixtapes released as digital downloads. Home Brew set a laid-back pace and tone in their rap style, similar to West Coast G-funk. Their best defining aspect however, was in their conscious discussion of introspective and personal ideas, with no sign of the ego usually found in rap, and often accompanied by amusing descriptions of the NZ youth and counter-culture (Jenkin, 2012). Additionally, there is a high retention of the Kiwi accent and much use of local slang, which helped cultivate a fan base with a strong sense of local pride.

Some research however has found shifts in the pronunciation of NZ singers and rappers to adopt more American features, perhaps in an attempt to appeal to more of a global demographic (Gibson, 2005). A later study investigated potential vowel shifts in the freestyle raps of Christchurch rappers in addition to a questionnaire designed to measure each rappers' attitude and engagement to NZ hip-hop culture (Dorreen, 2015). Each rapper was given a Rap Engagement Score (RES), and Kernel Density Estimate Plots (KDEP) were produced that display the spread and concentration of vowels within the vowel space. He concluded that while shifts towards the American are becoming quite prevalent, his results show that for the rappers in his dataset, the amount of 'Americanization' present in their accents was wholly dependent upon their attitudes towards NZ hip-hop culture.

The rappers who provided data for Dorreen's study, and the current research, also provided some insights into the hip-hop scene in 2015 through the interviews Dorreen conducted (Dorreen, 2015). One of the rappers in my research, Arthur<sup>34</sup>, describes what he considers to

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<sup>32</sup> [http://m.nzherald.co.nz/nz/news/article.cfm?c\\_id=1&objectid=3593730](http://m.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=3593730), Article from the NZ Herald

<sup>33</sup> <https://genius.com/428725>, Scribe – Stand Up

<sup>34</sup> All rappers in my data are referred to with anonymous names.

be rule number one in hip-hop; “*Don’t be boxed in*”. Each person comes in with their own subjective experience and each rapper will rap about different things, so people need to be open to that. Oliver entered through the battle rap arenas (detailed in Section 1.4) in New Zealand. He noted that in Auckland there is a supportive spirit even between competing MCs, and the scene is more accepting of different styles of rap. In Christchurch, the scene he describes is far more ego-driven and aggressive, rivalries tend to breakout, and rappers or groups who represent different subgenres do not tend to collaborate with each other. He cites the Home Brew Crew and strongly credits their continued use and retention of the Kiwi accent whilst continuing to make conscious but successful rap music.

These are examples of how certain rap styles can become associated with a geographical region, and even spur the development of subgenres – for many people including myself this is purely for the sake of categorisation, as most rappers do not claim to hold ties to any specific ‘genre’, nor do I feel should fans aim to restrict rappers to any one genre. However, there is no doubt these styles can be identified and categorised, which is quite useful for investigative purposes. From here rappers add their personal vocal aspects to create their own unique vocal style. Just as certain styles along with certain rap rhythms can become associated with geographic regions, so too can certain rappers be identified by their rap rhythm, or what is known in hip hop as their ‘*flow*’.

## 1.6 Rhymes and rhyme schemes

Rhymes and rhyming form an integral part of poetry and certainly song-writing across many cultures. Rhyme has been present in the English verse since the 18<sup>th</sup> century (Mckie, 1997), though its origin is not of great concern to modern scholars. Its use in poetry is where it is most relevant to rap rhythm, as its primary use was as a repeating pattern that is pleasing to the ear. William Shakespeare (1564-1616) is well known for his use of *blank verse*<sup>35</sup> in his works, a technique present in much of English poetry. Rap however is primarily concerned

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<sup>35</sup> Or ‘iambic pentameter’ – a set of five stressed syllables (feet or iambs) followed by five unstressed syllables, if is ‘unrhymed’ then none of the words need be rhymed

with rhyme and rhyme schemes. Verses from early MCs utilized more simple rhyme schemes and techniques, such as rhyming couplets with rhymes that fall only at the end of the line, and was still quite minimalist in the range and complexity of words used:

*“I got a lot of raps but I’ll be **real**  
I never need a horse I like to **chill**” – Big Bank Hank<sup>36</sup>*

This is an example of an end-rhyme, where the rhymes simply fall at the end of the verse. The rhymes themselves in this case are examples of half-rhymes, where the sounds are similar but not identical; real [ɹɪəl], chill [tʃɪl]. In the song however, the rapper tweaks the second word making it match, [tʃɪəl]. In rap, the use of half-rhymes is very common, and almost necessary to expand the range of possible rhymes. The fact that it is spoken means rappers can alter the production of such words when recording.

When rappers began writing and producing thought out songs in studios, the rhymes naturally became more intricate and complex. A common technique involves the use of rhyming pairs:

*“Go ahead and **grip Glock**s  
I’ll snap your trigger finger **in six spots**  
You’ll have to **lip lock** with hypodermic needles to **lick shots**” – Diabolical,  
Diabolic<sup>37</sup>*

Nas made his breakthrough in 1994 with his debut album “Illmatic”, since then it has been credited as a landmark album in the development of East Coast hip hop. The lead single ‘The World is Yours’ was an iconic track encompassing the feeling of life in New York and the East Coast hip-hop communities<sup>38</sup>, this was tied together with incredible wordplay, and included shout-outs<sup>39</sup> to all the NY boroughs:

*“**Dwelling** in the Rotten Apple, you get tackled  
Or caught by the **devil’s** lasso, shit is a hassle”*

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<sup>36</sup> <https://genius.com/Sugarhill-gang-apache-jump-on-it-lyrics>, The Sugarhill Gang - Apache (Jump on It)

<sup>37</sup> <https://genius.com/Immortal-technique-diabolical-lyrics>, Immortal Technique Feat. Diabolic – Diabolical

<sup>38</sup> <https://genius.com/4142> – Nas – The World is Yours

<sup>39</sup> See glossary

*“The **thief’s theme**; play me at night, they won’t act right  
The **fiend** of hip-hop has got me stuck like a crack pipe” – The World is  
Yours, by Nas*

The example by Nas above shows the use of multiple rhyming segments, with the earlier words in each line rhyming with each other, and the later words in each line rhyming with each other.

## 1.7 Summary & prospect

So far, we have determined that *flow* is highly integral to the success of a rapper, and the perceived quality of his raps. Rappers also use *stress*, alongside rhyming schemes in order to time their rhymes to fit a musical bar. I first conducted an auditory analysis to produce my own descriptions of *flow* based on perceptions. I also attempted to extract clips based on my own perceptions, separating periods of regularity or distinctive patterning.

As rhythm is certainly an integral factor to the definition of *flow*, the main analysis of this thesis will attempt to measure various aspects of rhythm using the Pairwise Variability Index (PVI). The data used in this study are acapella freestyle recordings, originally obtained in a prior study by Kieran Dorreen at the University of Canterbury. The participating rappers were asked to improvise (in rapping terms; freestyle) lyrics on the spot, with no accompanying drum beat. The questions considered during this auditory analysis are:

- How is the rapper’s *pace*, and *fluidity*?
- Does the rapper use few or many *stressed* sounds?
- How often does the rapper produce an error, pause, or fumble?
- Does the consistency reach a level where it is patternable for a reasonable period?

The questions above I feel are central to providing a cohesive description of rap rhythm and many aspects of ‘flow’. The final question however is more of a discussion point, as it is incredibly difficult for a rapper to maintain a consistent underlying tempo when rapping in acapella, or to synchronize to a tempo that is not there—even more so when freestyling. My aim was to identify periods with distinctive patterning, where the rapper used stress to

separate lines in their rap, or where distinctive phrase patterns emerged. Following this auditory analysis, I used the PVI rhythm metric developed by Grabe & Low (2002), to produce general rhythmic measures of each of the rappers' recordings. I elaborate on the methodology of this study chapter 3, but first in the next chapter I discuss linguistic studies of rhythm and introduce Dorreen's (2015) work on which this thesis builds.

## Chapter II: Literature Review

### 2.1 Rhythm & isochrony, outdated but not Outcast

In 1940, Arthur Lloyd James postulated a metaphorical description for the prosodic differences found in some languages. He described the first group as having a ‘machine-gun rhythm’, and the second group as having a ‘morse code rhythm’ (James, 1940). Kenneth L. Pike cited James and proposed the typological classification of languages as either *stress-timed*, or *syllable-timed* (Pike, 1945). He postulated this alongside the notion of *isochrony*, which refers to the way language divides time into portions, based on certain units. For syllable-timed languages, each *syllable* is postulated to be of equal length. In mora-timed languages, each *mora* is of equal length, and in stress-timed languages the *intervals* between stressed sounds is equal. This was met supported by multiple subsequent studies (Hockett, 1958; Abercrombie, 1965; Ladefoged, 1975; Catford, 1977). The idea describes linguistic rhythm as categorised by the recurrence of a given element at regular intervals. In some languages, this element is stressed vowels—such as English where *accentuated feet* may have greater or lesser durations, and intervals between stresses are said to be close to equal (stress-timed). In others, this element is the length of the syllable limited by the language, and it is the successive syllables that are of equal length. Pike refers to Spanish as the prototypical example of a syllable-timed language. Abercrombie presented this distinction based on the physiology of speech production. He described *chest pulses* as the puff of air to produce a syllable, *stress pulses* were described as a reinforced chest pulse, and the *foot* is the unit of a stress pulse and following chest pulses (Abercrombie, 1967). In stress-timed languages stress-pulses are equally spaced, while chest pulses are not – while in syllable-timed languages the opposite is true. Another way of describing this is in terms of time. In syllable-timed languages, each syllable is the same duration (da-da-da-da-da), therefore each syllable added increases the duration of the entire utterance. In stress-timed languages however the feet may vary in duration (da-daa-da-da, daa-da-da-daa-da, etc).

This idea for classifying languages led to a general agreement of Spanish, French as the prototypes for syllable-timed languages; and English, Russian and Arabic among the stress-



timed languages. Later, a third type- mora-timing was proposed and exemplified by Japanese speech (Bloch, 1950; Ladefoged, 1975). Subsequent studies in the 1970s and 1980s debated some of the initial classifications, for example whether French indeed fell into the syllable-timed category. Wenck & Wioland investigated this very claim, and highlighted the incompatibility between ideas of syllabic isochrony and the longer stressed syllables present in French. Their results support their hypothesis and show stressed syllables to have a much longer duration than unstressed ones (Wenk & Wioland, 1982). A similar story occurs with Spanish, though Pike initially cited it as the prototype of a syllable-timed language – data from acoustic experiments by Navaro Tomás do not support this (conducted from 1916-1922, even earlier than Pike’s book), showing that the duration of syllables in Spanish does vary, however accentuated feet remain the same (Bertran, 1999).

One of the most convincing arguments for the validity of rhythm classes came from an infant study that examined their understanding of rhythm roles (Nazzi, Bertocini, & Mehler, 1998). The participants were all French infants, and were tested within five days of birth. Four female native speakers of each language were recorded (N=91, with 51 excluded for various reasons) resulting in 40 infants who completed the test, and the stimuli consisted of 40 English and 40 Japanese sentences. The second experiment also recorded 40 infants who completed the test (N=92, with 52 excluded for various reasons), and this group was presented with 40 English sentences and 40 Dutch sentences. The response of the infants was measured by sucking rate, for which a baseline measure was taken for spontaneous sucking rate, followed by a familiarization period, and then the experimental stimuli was presented. Results showed that using filtered speech exclusively, French new-borns can discriminate between English and Japanese, because they belong to different rhythmic classes – however they are unable to discriminate English and Dutch, because they belong to the same rhythmic class.

## 2.2 Subsequent theories for characterizing rhythm

Despite the studies discussed so far and multiple others that have supported the typological classifications of world languages, no clear empirical evidence has been presented to confirm

a categorical distinction between stress-timed and syllable-timed rhythms, and the initial ideas of near-equal length of stress or syllables are unsupported or found to be more variable than suggested in experimental settings (Dauer, 1987). Although it holds that there is a clear prosodic distinction between the syllable-timed and stress-timed classes, no language is entirely stress-timed or syllable-timed. Subsequent studies interpreted the measures as reflecting rhythmic differences as opposed to classes, and placed languages on a continuum of more or less stress-timed or syllable-timed. Although some languages may hold to a dominant rhythm, many will utilize both timings (Mitchell, 1969; Frota & Vigário, 2001). Nevertheless, these typological terms are useful for providing descriptive comparisons of any kind of speech rhythm, or in my case; rap rhythm.

Subsequent theories posited various models of rhythm, Dauer (1983) proposed a uni-dimensional model of rhythm with the typical descriptions for stress-timed and syllable-timed languages occurring at either end of a continuum. Dauer discussed certain components present in language rhythm, and suggested that if a language displays more properties typical of a stress-timed language, then it is stress-timed – and if it displays the opposite then it is syllable-timed (Dauer, 1987).

More recent theories reconceptualised rhythm with attention to phonotactics and the metrical properties of language. Ramus presented a thorough discussion of the research on rhythm and speech rate in 2002. He identified some of the issues that arise when investigating speech rate, and the theories on what level of unit needs to be measured when investigating it (Ramus, 2002). Attention is drawn to the fact that syllable rate is often the unit of focus when examining speech rate, but other factors that also contribute to speech rate go largely ignored. In the research for this thesis I intend to take syllables into account alongside the PVI measures.

### 2.3 The Pairwise Variability Index

The Pairwise Variability Index (PVI) was developed as another approach following the debate on typological classifications of language rhythm. The PVI is an equation that produces rhythm metrics by considering durational variability in successive acoustic phonetic

intervals. It was proposed by Esther Grabe and Ee Ling Low, and calculates the difference in duration between each successive interval, divides it by the mean duration between each pair, then averages all the differences (Grabe & Low, 2002). This effectively catches variation in diphthongs against monophthongs, and long vs. short consonant clusters.

$$PVI = 100 \times \left[ \sum_{k=1}^{m-1} \left| \frac{d_k - d_{k+1}}{(d_k + d_{k+1}) / 2} \right| / (m - 1) \right]$$

*Figure 3 - the nPVI formula*

Grabe & Low point out that in prior studies, speech rhythm was related to phonological units such as interstress intervals or syllable duration rather than durational variability. So, they decided to develop their method of rhythm analysis and tested it by comparing traditionally classified stress-timed, syllable-timed and mora-timed languages, with languages so far unclassified. As discussed earlier, no significant empirical evidence of isochrony in speech has yet been found, leaving the idea in dispute. The researchers therefore decided to avoid the search for isochrony, and investigated the relationship between speech timing and rhythmic classification of languages (Grabe & Low, 2002). They used the PVI to investigate the acoustic-phonetic basis of speech rhythm, with the theory that languages are either stress-timed; where intervals between stresses are near-equal, or syllable-timed (and later mora-timed); where, as noted above, -successive syllables are of equal length. They used the raw PVI (rPVI)(C) to calculate consonantal intervals, while the normalised PVI (nPVI)(V) is used for vocalic intervals, as it is normalised for speech rate (Grabe, Post, & Watson, 1999).

Their predictions were that stress-timed languages would exhibit high vocalic nPVI and high intervocalic rPVI values, while syllable-timed languages would show low vocalic nPVI and low intervocalic rPVI values. A prior study applied the nPVI to vowel durations and found that stress-timed languages exhibit more vocalic variability syllable-timed languages, therefore languages that do not employ features such as vowel reduction, have lower vocalic variability – and lower nPVI (Grabe, Post, & Watson, 1999). Other languages with a more mixed syllable structure such as Polish were predicted to show a low vocalic nPVI value than stress-timed languages but high intervocalic rPVI, while Catalan would exhibit the opposite. Their results, presented in Figure 4, showed that their PVI profiles provide acoustic evidence

for rhythmic differences between British English, Dutch and German (stress-timed), and Spanish and French (syllable-timed),

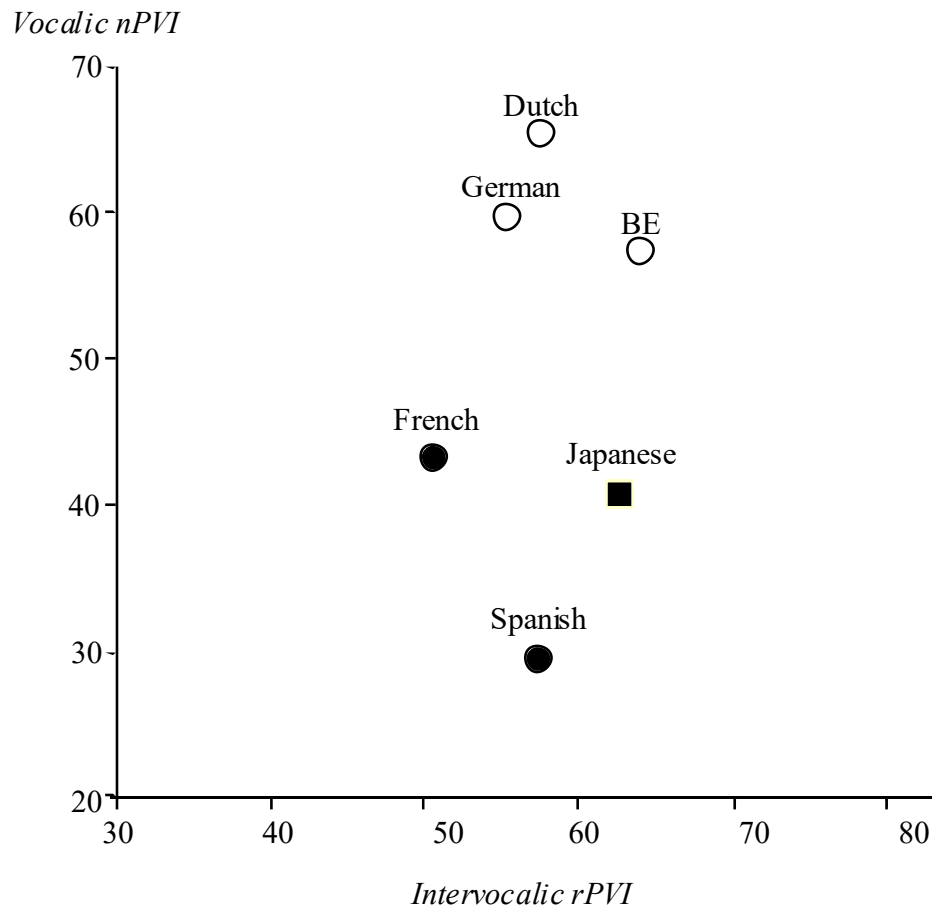


Figure 4 – Spread of nPVI and rPVI scores for six world languages (Grabe & Low, 2002, p. 21)

The results for Japanese also support the authors’ prediction, Japanese is mora-timed – which in terms of speech timing is more like syllable-timing than stress-timing. A **mora** can determine stress or timing depending on the language. In Japanese, each mora occupies one rhythmic unit, and each one is produced with equal duration and loudness, in contrast to English for example where stressed syllables are often produced louder or in a higher pitch. The values for Japanese and French support this prediction, with neither language having vowel reduction (nPVI). The rPVI value of Japanese is closer to those of other stress-timed languages.

Research into the PVI algorithm and measures from other languages yielded useful insights to methodologies when investigating rhythm. One study compared the rhythm of English and Estonian speakers and discussed some problems found in PVI research thus far. They explored an innovative technique of examining PVI at the level of the *foot* – as well as the *syllable* (Asu & Nolan, 2006). They describe the PVI as a scalar ‘prominence gradient’

between successive units. Prior research indicated that Estonian is classified as a syllable-timed language, but is also characterized by foot isochrony, with main stress upon the first fixed syllable. Asu & Nolan's results indicated that both languages have a goal for foot-isochrony, but as English contains the feature of vowel reduction, this increases its syllable PVI. They concluded that examining PVI with a 2-dimensional characterisation, at the level of the foot, as well as the syllable, provides a wider picture for the investigation of rhythm.

I will use the PVI measures to investigate rap rhythm in terms of speed and length of vocalic and intervocalic durations over time.

## 2.4 Dorreen's research, hip-hop studies and methodologies

Dorreen's research produced much of the data used in my thesis, and investigated socio-phonetic aspects of rap and hip-hop culture (Dorreen, 2015). He looked at the maintenance of a local identity expressed through hip-hop, and his experiment involved recording local Christchurch rappers to compare their accents and attitudes to the 'American performance accent'. This is described as the 'American standard', and developed through the incredible amount of music production and media promotion that occurs in the US. International artists are therefore prone to shifts in linguistic features to adhere to this standard and gain more popularity. Dorreen conducted interviews with each of his participants to discuss their attitudes towards maintaining a local New Zealand identity, to determine whether they are conscious of it, and if they prefer to retain it or are happy to shift toward the 'American standard'. Dorreen measured the attitudes of his participants using a Rap Engagement Score (RES), that scored them on answers given in the interviews, one dimension was 'Awareness' – i.e. how aware is the MC of his/her accent while rapping, and how important is it to them to maintain their New Zealand accent? This contributed to the overall RES score alongside the dimensions of **Experience**; how long they have been involved in rap production, **Involvement**; how involved the rapper is in the local hip hop community, and **Influences**; how much local rap does each MC consume compared to international rap? The RES score allowed Dorreen to gauge each MC's attitude towards identity and how they feel about associating themselves with New Zealand. He combined this with an analysis of

vowels, and presented Kernel Density Estimate Plots (KDEP), that are not unlike topographical maps, and show the concentration and spread of the vowels within the vowel space. He then compared the typical NZE vowel shifts that occur with the vowel shifts that occur in the American standard, for example the increased F1 and F2 formants in the production of the BATH vowel; that is typically realised as /a:/ in NZE similar to RP, but in the American standard it is more raised to /æ/.

His results showed that while the MCs do ‘americanize’ their accent, the extent of this is almost entirely dependent on their personal attitude towards their linguistic identity and NZ hip hop culture.

In 1992, Victoria B. Anderson developed rules pertaining to stress based on shifts in the interests of eurhythmics, and conducted a case study on Young M.C.<sup>40</sup>, to investigate the constraints of metrical structure and prosodic hierarchy (Anderson, 1992). She identifies that in rhythmic speech, eurhythmic constraints are stronger as some adherence to metrical structure is required. However, there is also greater freedom from the typical stress assignments in natural speech prosody. She considers the rhythmic target in rap music to be the *quatrain*, a pattern referred to as “fully unmarked meter” (Attridge, 1995), with alternating stresses based on powers of two.

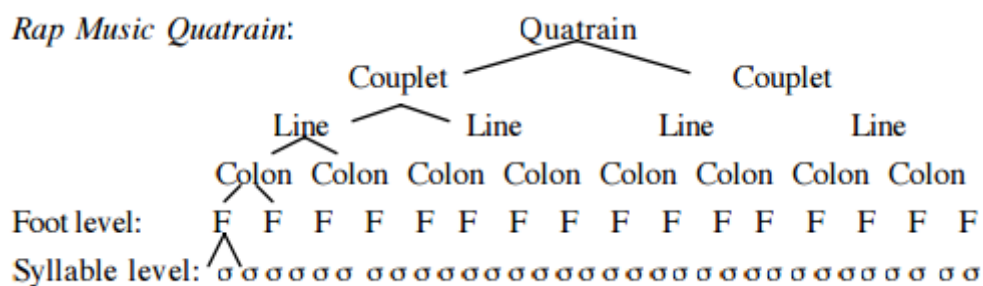


Figure 5

Anderson’s research presents some excellent insights into the investigation of stress within rap music, and the distinction between syllable, foot, and higher level prosodic unit structure.

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<sup>40</sup> <http://www.rollingstone.com/music/news/bust-a-move-20-years-later-young-mc-reflects-on-the-hit-that-changed-hip-hop-20090325>, Martin Young, an English-born American singer, rapper and actor, who had his biggest hit with “Bust A Move” in 1989

A quick internet search yields much preliminary information about the factors people are concerned with when comparing rappers and their rhythms or *flows*. Many videos on YouTube feature a compilation of a rapper's 'top-ten' verses, or fastest sections. One channel does some more critical breakdown of a rappers' music, in particular they assess rappers' syllables per second (CDTV Productions, 2016). The use of multi-syllable words often adds to the perceived speed of a section, as they usually only contain one stressed segment, meaning three syllable or higher words usually lead to an overall faster pace. One video discusses the raps of Brandon Perry, who goes by the alias K.A.A.N<sup>41</sup>. (Knowledge Above All Nonsense). Perry is an underground rapper from Maryland, with a decent catalogue of music available on YouTube. He employs an incredibly fast rap speed (like the Midwest Choppers), and does an excellent job at maintaining his enunciation which the video reviewer (Chris) remarks upon. In the video, Chris states that Perry's slowest verse, of 8.4 syllables/second, is faster than most of the other rappers he has analysed. His fastest verse is one of the fastest he has found, reaching an incredible 10.1 syllables/second. Although Perry does not have the highest recorded syllables/second in a verse, his uniqueness lies in his consistency. Maintaining even a pace near 8.0 syllables/second is impressive, however in most cases rappers will do this only for a section of a song, while Perry tends to maintain a consistently high pace throughout his songs. He maintains that the analyses in this category are chosen or recommended by the community due to their distinctively fast-paced rhythms, so the rappers he compares would serve as suitable markers of high speed rap. Articles similar to the YouTube videos discussed above can be found that compare rappers in terms of speed based on words per minute. Although they provide quite a suitable comparison between some of the fastest rappers in the industry, they only consider a single (section of a) song per artist – so it only provides an absolute measure of the fastest 10 second period (Chalabi, 2014).

Some online blogs carried out by individuals have also discussed methods of examining rhythm through simple musical notation. Martin Connor hosts his own website known as Rapanalysis.com where he posts reviews of artists as well as in depth analyses of single songs (Connor, 2015). In the cited article, Connor provides some excellent descriptions of how beats are arranged in the typical time signature of a rap song, and provides transposed

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<sup>41</sup> I refer to Perry by his name rather than alias for simplicity's sake when referencing him in text

examples of sections, and even entire songs, in musical notation<sup>42</sup>. This is typically 4/4 for most rap music, which means there are four *beats* to every *bar*<sup>43</sup>. However, in terms of syllables rappers are generally able to fit more syllables than there are beats to a bar. Connor also discusses some of the ideas surrounding rhyme schemes, and how rappers decide or alter where the rhymes fall in a bar. Although the techniques are not directly recognized from an academic standpoint, the descriptive analyses found in Connor's blog utilize his knowledge of musical theory, and highlight the relationships between timing and rap rhythm and rhyme. He presents some excellent insights into the styles displayed by some rappers and form a good basis for further comparison to other artists.

## 2.5 Rhythm research on New Zealand English

NZE is reported as being quite syllable-timed, partly due to the influence from Maori English and its shift towards a syllable-timed rhythm (Warren, 1999). One study obtained and compared measures from New Zealand speakers, Singapore English speakers, and British English speakers. They found NZE had lower nPVI scores than British English overall, and Singapore English had an even lower nPVI score still, indicating the most syllable-timed rhythm.

Nokes & Hay conducted a large-scale diachronic investigation on the rhythm of New Zealand English in 2012 (Nokes & Hay, 2012). Their study was the first to be carried out on such a scale using automated techniques. They examined the speech of over 500 NZE speakers born between 1851 and 1988, using data from the Origins of New Zealand English (ONZE) corpus (Gordon, Maclagan, & Hay, 2007). Results showed a reduction in normalised nPVI values over time, lending support to the notion that NZE speakers show less differentiation in duration between stressed and unstressed vowels in comparison to older speakers of NZE. Although they discuss the notions of examining PVI at the level of either the syllable or foot, the reliance on manual segmentation limits the range of speakers that can be included. Other

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<sup>42</sup> Martin was kind enough to allow me to use some of his transposed pdf data in this thesis, a huge help!

<sup>43</sup> See glossary for definitions



consonantal factors such as manner of articulation are cited as likely as speech rate to affect duration. However, controlling for these factors introduces more complexity than was viable. In their discussion, Gordon, Maclagan & Hay cite changes in the realisation of certain vowels in NZE as causing a “*flow-on*” effect on its rhythm. The short front vowel shift – raising the TRAP and DRESS vowels – as well as the mid-centralisation of the KIT vowel, have led to a smaller differentiation in duration between stressed and unstressed vowels, as vowel reduction often results in centralized schwa-like realisations (Nokes & Hay, 2012).

A study conducted in 2012 investigated the rhythms of Māori speakers, which has shifted from a mora-timed rhythm, to a syllable-timed rhythm in modern Māori English speakers (Vowell, 2012). Results indicated that a syllable-timed shift had indeed occurred in modern speakers, and the use of it is correlated to the degree of Māori identity felt by the speaker. These results are not unlike that of Dorreen, indicating that New Zealand speakers display their sense of national pride through not only their phonetic features, but also rhythmic features.

## 2.6 The PVI in singing and musical rhythm research

The PVI has more recently been applied to the analysis musical rhythm. One study in 2011 investigated how well the nPVI modelled various dimensions of musical rhythmic complexity (Toussaint, 2012). Results showed that the nPVI correlated mildly with performance complexity, and can discriminate between the 12 families of rhythms tested, which span genres and cultures, it met shortcomings in terms of modelling metric complexity and rhythm complexity. However, as the data used in my study consists of only speech, this is not a concerning factor in the case of my data. In his conclusion, Toussaint suggests a modification of the nPVI that takes metrical structure into account. He also cites a prior study by Asu & Nolan (2009) in which they concluded that ‘*duration cannot be assumed to be either the exclusive correlate of perceived rhythm nor to act independently of other cues in perception*’. This means the duration of units – whether syllables or feet, cannot be the sole dimension examined when producing a cohesive description of rhythm, and in the case of my study, *flow*.

## Chapter III: Methods

### 3.1 Acapella data & Praat

As noted above, the data used in this thesis was recorded in a prior study by Kieran Dorreen, at the University of Canterbury (Dorreen, 2015). He approached local Christchurch rappers—mainly looking for professionals or those with experience performing rap live—and invited them to record acapella freestyles—that means improvised rap with no accompanying beat. Dorreen obtained recordings from eight rappers, three or more freestyle recordings, and a short interview with each of them to obtain conversational speech data. A time-aligned corpus of this data was created, using the **LaBB-CAT** client (Language Brain and Behaviour Corpus Annotation Tool), a linguistic database for storing and performing linguistic analyses on audio recordings, transcripts and other annotation information (Fromont & Hay, 2012). Dorreen transcribed the data using Praat, then via LaBB-CAT, applied the Hidden Markov Model Toolkit (or HTK) recognition software to autosegment the data. Alignment errors were manually corrected. An example of alignment is provided in Figure 6.

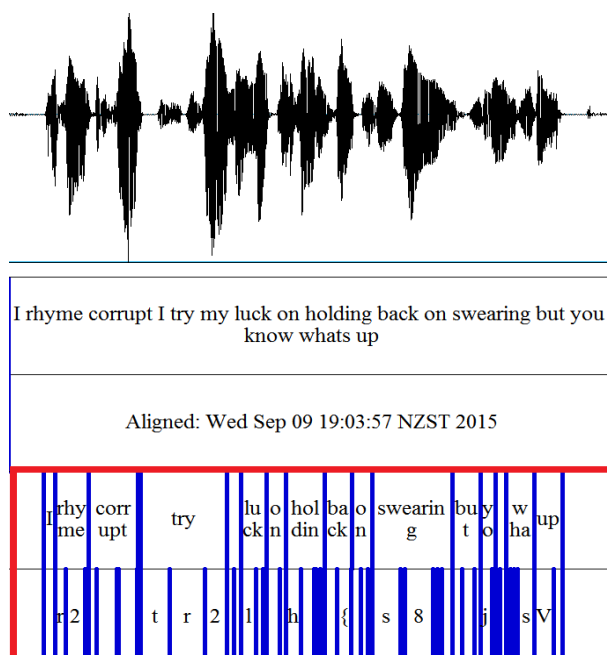


Figure 6 - Praat window displaying time-aligned annotation data

This is crucial to my research as it relies on having time-aligned segments at the level of a certain linguistic unit. Prior discussions on examining PVI at the level of the syllable or foot were considered. However, given that the data had already been force-aligned at the phoneme level, proceeding using these segments seemed viable.

Initially I had planned on using extracts from this data, to create clips and conduct a perceptual test online, which would be open to the public and shared on social media. The planned target demographic would be a mixture of some people with a general interest in music, and some with an interest in rap or hip-hop culture—as this was not part of the original application to the University of Canterbury’s Human Ethics Committee for which Dorreen (2015) received approval, it was necessary to try to make contact with the rappers in Dorreen’s corpus, to ask for their permission for the data to be used in this way. (They had already given permission for their data to be held in a corpus and use by other researchers, but not explicitly for their data to be used to create a publicly available perceptual test). Unfortunately, only three of the original data providers responded when requesting for consent to use their data in this follow up study. This was deemed an insufficient number, and because of constraints in time and ethics approval, I opted to instead conduct a further analysis myself, but not carry out a perceptual test with six artists from the original data set. I performed an initial auditory analysis of the rap recordings to produce my own descriptions of each of the rappers’ *flows*, then produced PVI measures in the acoustic analysis to test my and provide comparison against prior research and other known rappers. This will provide enough information to assess the effectiveness of the PVI for rap analysis, and some interesting discussion points for comparison with prior PVI research, in NZE and in rhythm research.

### 3.2 Auditory analysis

The first phase of the research involved an auditory analysis, where comparisons were drawn to traditional classifications of language rhythm, and the descriptions of rap *flow* as posited by Paul Edwards were considered. The questions presented at the end of Chapter 1 were considered during this analysis, namely:

- How is the rapper's *pace*, and *fluidity*?
- Does the rapper use few or many *stressed* sounds?
- How often does the rapper produce an error, pause, or fumble?
- Does the consistency reach a level where it is patternable for a reasonable period?

*Pace* and *fluidity* were judged by the speed and *connectedness* of the rap. Speed is fairly self-explanatory and is described first for the recording overall, then narrowing down to specific sections where necessary. Distinctive gaps between words, or unintentional pauses that break the pattern reduce the perceived level of *fluidity*.

The question of *Stress* required some thought given its variable use in freestyle acapella rap. Stress is an important factor to consider when examining rap rhythm. The use of stress in a verse can lend much to the overall perceived pace of the rhythm. Effective use of stress can provide impact from a semantic context. As these are acapella recordings, there could be much variation in the stress used, so any kind of patterning in stress would be a notable point. For this section, I attempted to provide descriptions of the ways each rapper used stress, whether it was patterned at all (on end rhymes for example), and to what extent it was used overall.

*Errors, slip-ups, or 'chokes'* - as they are known in hip-hop, were judged as when the rapper lost their train of thought requiring a pause or stop (unless for a breath), or when he to enunciate the intended words correctly; e.g. "*Rhyme nice so believe this, it's my type of a..st-my type of steez*". In a case like this it is quite noticeable, as he needs to repeat the previously said line, but in other cases errors can be more difficult to judge. Any kind of error like this – unless recovered quickly – is likely to break the rhythm and perceived fluidity of the verse.

The final question I attempt to address in the auditory analysis is more concerned with the phrase-level of the rap. The focus is to observe periods of regularity or patterning that are typical in raps with an accompanying beat, to see if the rappers maintain any adherence to an internal tempo. Rhymes and rhyme schemes typically result in phrase-level patterning, so I am hoping this will be observed in the freestyle data. The discussion will also consider synchronization, and the description presented earlier of 'flow' as a drum beat to accompany an instrumental track (a beat, usually with a consistent tempo).

### 3.3 Stress counts & syllable measures

#### 3.3.1 Stress counts

To investigate stress counts, stressed sounds were identified manually. To provide a baseline for comparison for all the rappers, I defined a value of 0.25s as the maximum duration for an unstressed syllable. Any syllable with a longer duration was added to the stress count, and the number of force-aligned segments it contained was also recorded. This provided a standardised baseline to compare the shortest syllables of each rapper. The length of segments was identified simply by listening and identifying sounds that stood out, and then verifying them with the spectrograms. Examining the spectrograms after conducting a purely auditory search helped to confirm the tokens that were not quite clear. This helped in the rare cases where the forced-alignment failed to place segment boundaries accurate to the utterance, or where my auditory perception did not register a sound as stressed. In addition, occasionally the segments did not align with the utterance, as the force-alignment did not take this into account, only the phonetic annotations – care had to be taken therefore in cases where tokens appeared longer because the segment began before the utterance. Figure 7 shows an example of this in the word ‘canterbury’, where for both the plosive sounds, /k/ and /b/, the force-aligned segment begins earlier than the utterance in the waveform. The selected section is highlighted in pink, and in the top-centre of the pink area you can see the duration of the selected period is 0.369s (3sf).

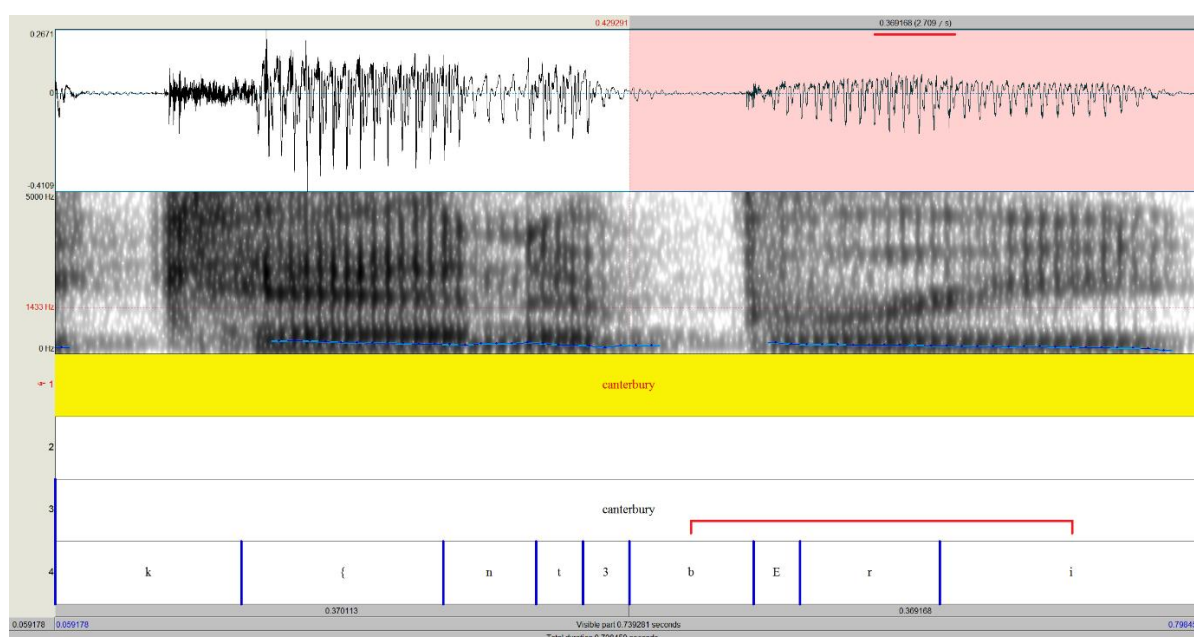


Figure 7 – Praat window showing duration for the word ‘canterbury’

The highlighted section, connected by the red line in Figure 7 represent a single syllable in the second part of ‘canter**bury**’ – this is because the rapper has realised the last part of the word, as the /u/ vowel has been reduced resulting in; /kæntəbri/. Note that the pink area contains four segments. Praat provides a number for the total segment count in each recording, so in addition to simply counting the stressed syllables, I took counts of the number of segments each syllable consisted of, allowing me to produce a percentage or decimal value for comparison between the rappers. In Figure 7, the single letter codes on the bottom row denote a certain linguistic unit, so for the few cases where manual entry was required, I only needed to add the *number* of segments to the count. Vowel length was also taken into consideration, as long vowels are inherently longer in duration than short vowels. However, this is not the case for rap. In order to make rhymes and rhythms fit, vowel sounds become highly malleable, also rappers employ multiple phonetic techniques such as vowel reduction, elision, flapping/tapping, even the complete omission of unnecessary sounds that may disrupt the desired rhythm. For this reason, and for the sake of simplicity in terms of comparison and analysis, the baseline value established for syllables was considered applicable regardless of vowel type. Words that included two vowel sounds, with primary and secondary stress that exceeded the baseline value, were marked twice. More stressed sounds generally lead to a reduction in the perceived pace of a rap, while less stressed sounds will generally lead to an increased perceived pace, however this still is restricted by the rapper’s overall tempo. Therefore, a baseline must be established for each rapper individually in order to judge which sounds are considered stressed. The value from the syllable count does not consider pauses between or within words, or gaps in between utterances, that both also have an impact on the rap rhythm and ultimately ‘flow’, so this value will be discussed alongside the PVI measures.

### 3.3.2 Syllables per second

As mentioned in Chapter 2, some YouTube analysis videos have used syllables per second (SPS) as a measurement to investigate and compare the highest ‘speed’ of rappers in their songs<sup>44</sup>. Given the variability in the rhythm of rap within a song, or even a verse; using

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<sup>44</sup> Syllables per minute (spm) is a more common syllable measure of general speech rhythm however

average values or simply the values from the fastest sections will vary depending on the research focus. In addition to the stress counts, I calculated SPS measures for each rapper in my data, following similar methodology to those found in rap comparison videos online (CDTV Productions, 2016). I counted the number of syllables within a defined measurement timeframe, then divided that by the length of the measured period, i.e.  $N_{\text{syllables}}/\text{duration}$ . For my data, I chose to calculate periods of 7.5 seconds and 30 seconds. As speed can be so variable, even in raps with a beat, it is only possible to compare certain periods as an average score, the greater the period, the more variability in speed. I attempted to identify the fastest sections within each of the recordings to perform the syllable counts, as my acoustic and auditory analysis are concerned with the overall description of the recording. Having the lengthier timeframe (30s) may show some more appropriate results, whilst the shorter timeframe (7.5s) will provide some comparison.

### 3.4 Acoustic analysis & PVI scripts

The PVI scripts used in my analysis were developed by Jacqui Nokes (formerly a member of the Linguistics Department at UC), and were used in several studies of New Zealand English using the Origins of New Zealand English, or ONZE corpus (Gordon, Maclagan, & Hay, 2007)—that included speech data from New Zealand speakers from the years 1851 to 1987. The script produces  $n\text{PVI}(V)$  and  $r\text{PVI}(C)$  values based on the inputted data. In my case I executed the script within Praat, and included the autosegmented textgrids as input. The script then outputs the information, that can be read into Microsoft Excel as a delimited text-file. I can then examine and produce further statistics from the measures.

First I produced the overall PVI measures for each rapper. As most of the rappers made three or four recordings, I took general measures from the first three recordings of each rapper. My hope here is to find a relationship between my intuitions of speed and rhythm, and the PVI measures based on the prior discussions of singing and language rhythm, and the traditional syllable-timed/stress-timed descriptions. Based on these, stress-timed rhythms correlate to higher normalised  $n\text{PVI}(V)$  values. The intervocalic  $r\text{PVI}(C)$  is not normalised for speech rate, meaning its usefulness in characterising speech rhythm is quite reduced. However, some

research suggests that rPVI(C) may indicate a higher or lower variability in the potential consonantal structure of a language, as intervocalic intervals can consist of several segmental units, which can vary the speech rate. Grabe & Lows' results supported their prediction that languages with more options for syllable-structure will yield a higher intervocalic rPVI(C) value. They note that French has a relatively simple structure and hence, has a lower rPVI(C) than English, Dutch and German (Grabe & Low, 2002). Nokes & Hay obtained PVI measures from 506 NZE speakers, their nPVI(V) values fell within the range of 51 and 70 with autocorrected segments (Nokes & Hay, 2012). From these results, I would expect the nPVI scores in my data to fall within the 50-70 range, as I would expect interval durations if anything to increase when performing acapella freestyle.

I will present scores for each recording analysed, and the average scores for each rapper from those recordings. My hope is to find that some of the predictions and thoughts posited in the auditory analysis will be reflected in the PVI measures obtained in the acoustic analysis.

### 3.5 Patterning clips

In addition to the overall PVI analysis for each rapper, I also separated each recording into 'patterning clips' based on where I perceived periods of regularity, or noted distinctive rhythms. These were created to isolate periods from the recordings, that can then be measured individually. Separating the clips was achieved by listening to the recording whilst observing the spectrograms and the force-aligned segment data. These sections were highlighted in Praat, and extracted along with the relevant annotations then saved as an individual clip.

Figure 8 shows an example of a Praat window viewing a brief period, to give an idea of the overall visual aspects of the Praat interface.



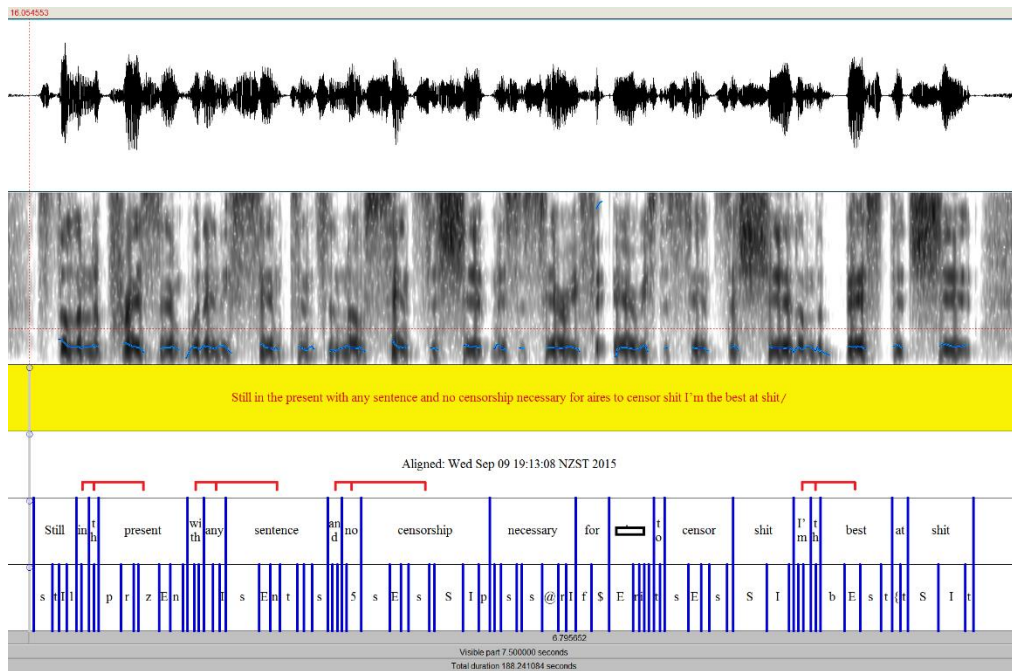


Figure 8 – Praat window showing some repeated patterns

At the bottom of the figure, the display shows that the visible portion at the current frame is 7.5seconds (though the image is slightly cropped at the edges, therefore showing 6.79s in total), the red lines highlight the repeated patterns identified in this period. The spectrograms and force-aligned segments are great for displaying the length of words and phonemes. In relation to the final question of the auditory analysis, the example shows a repeated pattern of two unstressed syllables in quick succession followed by a multi-syllable word or phrase with the stress placed on the first syllable: **present**, **sentence**, **censorship**, **best-at-shit**. These patterns can be quite ambiguous and often unpredictable in an acapella setting, thus they form more of a qualitative discussion point than particularly valid measures. However, they may display some connection to the auditory descriptions as well as the overall PVI measures.

# Chapter IV: Results

## 4.1 Auditory analysis & *flow* descriptions

In this section I will present the auditory analyses for each rapper and describe any distinctive aspects observed.

### 4.1.1 Arthur

Arthur produces a very steady freestyle without any clear faults or slip-ups. He also stresses many sounds. His overall pace is slower in comparison to other rappers in general, with the fastest pace showing in the very last few lines. Relative to the others this would lead me to expect his nPVI(V) to be higher than most of the other rappers.



Figure 9

Figure 9 displays a section of Arthur's rap, the lines in red show where I have inserted the potential separations of bars. Though the cuts are not necessarily all spaced evenly, I have inserted them based on the rhythmic aspects of the rap, the stress used, and knowledge of musical structure. Unfortunately, the duration marked in yellow is missing the relevant force-

aligned annotations, though this can be manually annotated. This is uncommon in the overall data and is most likely a result of the script failing to annotate correctly—perhaps due to outliers or some other problem in the Textgrid. Note that in the highlighted section (or the first three bars), each bar ends on the same two rhyming vowels; **start it** /sta:t it/, **market** /ma:kit/, **asking** /askɪn/. He then changes the rhyming vowel, and continues the alliterative pattern; **axeing** /æksɪn/, **accident** /æksɪdənt/, **accent** /æksənt/.

*“I know it’s a good place to start it  
I got no target audience or market,  
Its A\*\*\*s if you asking  
Axe-in’ I’m throwin’ them on ac-cident  
No accent necessary but the ac-cent will slice ‘em to pieces”*

The use of alliteration is quite common in rap as well as poetry; alongside an overall level of consonance they serve as good techniques for making speech, especially fast paced speech, euphonious.

This means he holds some semblance of musical tempo when freestyling. The rhymes he uses include multiple within-word rhymes, e.g. **music** -> **fluid**, as well as multi-vowel rhymes across different words.

#### 4.1.2 Oliver

Oliver’s rhythm is quite similar to Arthur’s, though he has more fast sections with a lower proportion of stressed sounds. He uses some good multi-syllable rhymes with a consistent and connected rhythm when he gets going, but unfortunately in some areas has trouble continuing the rhymes and ends up taking some noticeable pauses. He does quite well at recovering by addressing his own failure:

*“Ahh I’m choking,  
I don’t care I’m a come back quick,  
like a rubber band that snapped quick,  
holy shit I could stretch a rhyme like elastic  
call me mister fantastic’.*

This is an example of an attempt to address the error whilst recovering or continuing the rhyme and rhythm. Some of the earlier sections contain a high number of stressed sounds,

usually on the rhyming vowels. Towards the end however he picks up his speed and falls into a more connected rhythm. Also similar to Arthur, in the final clip Oliver shows the fastest pace with less stressed sounds. I would expect Oliver to have a similar nPVI score to Arthur as their rhythms were quite similar in terms of pace and the number of stressed vowels.

### 4.1.3 Max

Max maintains quite a steady rhythm, with a faster pace than Arthur and Oliver overall. In some sections, he uses pauses or stressed sounds to define boundaries between lines, and forms some rhyming patterns. His use of stress is quite inconsistent however, which sometimes breaks from a patterning sequence.

*“Says fire **alarm**,  
I try to be the one—don’t be **alarmed** or **scared** cause I’m right **here**,  
It’s like a **nightmare** the way that I might **shear** off a couple seconds on my  
**best** record  
Could be a personal **best** I’m preferring to sit here at this **desk**”*

In the section above, he stresses the vowel in the second ‘right **here**’. He matches this stress in the second part of the next rhyming word, ‘**nightmare**’ but then moves the stress onto the first vowel in the third rhyming phrase ‘**might** shear’. There is some patterning shown in the example above and repeated sequences in the rest of the recording as well. However, Max does not constrain his rhymes to such a clear internal tempo, lines are often quite long or continuous, meaning the initial pattern that emerges is not maintained for long. Max also re-uses some words to begin a new rhyme phrase (**alarm** in the example above), but does well using this to keep the freestyle going, and changes between within-phrase and end of phrase rhymes. However, this leads to inconsistencies in the rhythm, meaning it would be difficult to synchronize when attempting to fit to kind of regular beat or time signature. In another section Max holds quite a distinctive pattern for a short time DA da-DA da-DA-da, where unstressed syllables are quickly followed by a stressed sound. Max often uses stress in the words or syllables he intends to rhyme, but follows more of a syllable-timed rhythm otherwise. Given the similarities in his rhythm to syllable-timed descriptions, I would expect his nPVI values to be lower than Arthur and Oliver’s.

#### 4.1.4 David

David has an incredibly well-connected rhythm. His rap contains no perceived errors, with only short pauses for breaths, that are timed well in between the end of a phrase. He appears to use a smaller percentage of stressed vowels compared to the other rappers discussed so far, and maintains the pace well throughout. He often uses many unstressed sounds in the middle of a phrase, then ends on either a two-syllable word, or on a single stressed sound, as highlighted in bold below:

*“...harassing thugs on the **mic**,  
They wanna be kic-kin’ my **ass**,  
So what the **verse** is too **fast**,  
I’m braining **nerds** in the **class**”.*

In multiple sections David shows some distinctive rhyme schemes and patterns. The example above shows some basic end rhymes that occur at the end of phrases, and then mid rhymes that occur in the middle of the phrase on multiple lines (‘verse’ and ‘nerds’).

David’s final clip (clip 4) contains no stressed vowels, and none of the syllables exceed 0.2s except for the final word. I would expect clip 4 to show the lowest nPVI(V) value, and for David’s overall nPVI(V) to also be the lowest overall.

#### 4.1.5 Eddie

Eddie has quite a distinctive style. He often uses pairs of rhymes and applies secondary stress to the second syllable, and primary stress to the first. Occasionally these switch positions. He also produces some well-structured verses and clear rhyming patterns:

*“My **format** is **all map**  
Like the **All Blacks** on a good year,  
I want **all that**  
plus some **more** of that **that**  
and some **more stacks** for my hood here”*

The example above is a layered rhyming phrase, the vowels in the bold words are rhymed throughout the Clip, and then two different vowels (underlined) end the second and fourth bars. This rhyming scheme fits perfectly into a musical layout, where the syllable containing

/æ/ ends each bar, and when looking at the spectrogram Eddie's timing is near-perfect as well, showing good maintenance of tempo and rhythm. His overall pace is quite quick, but also inconsistent in fluidity. Eddie frequently switches between faster connected sections and slower sections with stress on the rhyming vowel. Eddie's recording only contained one error where he paused for around 4 seconds.

#### **4.1.6 Joshua**

Joshua begins at quite a slow pace, and stresses a lot of words as he develops his thoughts for the freestyle. He follows a similar structure for stress as Eddie, and continues some tri-syllabic rhymes for a period. Overall, he comes up with some interesting and varied word choices there are a lot of slowdowns which lead to a slower overall pace, which leads to more stressed sounds used than the other rappers.

*“There’s too much homophobia now  
I’m **slowin’ it down**  
**Blowin’ em out**  
The **dopest of sounds**  
And the **aroma around...**”*

Joshua displays several different rhythms at over his freestyle. In the example above he delays his entry after the first line and produces the rest with the same rhythm, (da)-da-da-da-DA. There are a few periods where he slows down and stresses his words a bit more while thinking of his next lines.

#### **4.1.7 Summary Assessment of the rappers flow**

The six rappers in my data showed a good variety of rhythmic styles. Overall, Max and David seemed to have the highest overall pace, David goes almost non-stop during his entire piece, with very few breath pauses so I would consider him to have the best fluidity.

Arthur, Oliver, and Joshua have less connected rhythms overall, but all show some good examples of patterning in subsequent bars/lines. Oliver has some quite steady sections when he gets into a zone (he mentions his background in battle rap), but also has the most breaks

and fumbles which leads to pauses and exclamations. Eddie, Max, and David have the most consistent rhythms, with higher connectedness between sounds.

David was the only rapper with no distinctive errors, and Oliver had the highest number of errors (N=7), this was followed by Max (N=5). Despite Max and Oliver having the most errors, they also had longer freestyles and therefore more segments.

In terms of the syllable-timed/stress-timed dichotomy, when placing them on a continuum I would predict Eddie, Max, and David's are more syllable-timed as they show less variation in their vocalic intervals, with more short sounds and less overall stress. Arthur, Oliver, and Joshua appear to be more stress-timed, which produces clearer verse separations, but also a slower sounding rhythm overall.

## 4.2 Overall PVI measures

Here I will present the summary tables with the overall PVI measures. The PVI scores for the overall recordings of each rapper provide a general idea of their rhythm based on nPVI and rPVI scores. The table below displays the PVI scores for each of the artists' recordings. The highest and lowest scores are highlighted in the yellow cells. rPVI scores remained quite stable for most of the rappers, with a couple of distinctive outliers (highlighted in light blue) that will be discussed later.

Rapper	nPVI(V)	rPVI(C)	nPVI(V) Mean	rPVI(C) Mean
<b>Arthur</b>	68.98	5.501		
	67.246	4.728	67.596	4.94067
	66.562	4.593		
<b>David</b>	64.282	4.208		
	65.836	4.673	70.1176	4.5872
	68.881	4.276		

<b>Eddie</b>	63.071	4.748	66.4343	4.293
	71.795	3.825		
	64.437	4.306		
<b>Josh</b>	74.821	5.173	71.4843	5.198
	69.918	5.272		
	70.614	5.149		
<b>Max</b>	61.186	4.351	64.493	4.24367
	64.891	4.223		
	67.402	4.157		
<b>Oliver</b>	68.67	5.223	73.2124	6.58975
	71.921	6.618		
	77.367	6.647		

Table 1

As highlighted in Table 1, Oliver showed the highest overall nPVI value, as well as the highest mean nPVI, while Max showed the lowest values for both. The summary predictions suggested Oliver, Arthur, and Joshua as more stress-timed, and Eddie, Max, and David as more syllable-timed. These are reflected in the results, finding the median (Median nPVI(V)=68.03) shows a near accurate separation, only one of Eddie’s measures (nPVI=71.795) and one of David’s measures (nPVI=68.881) exceeds this. Similarly, Oliver and Joshua’s nPVI scores do not go below the overall median, as predicted. Arthur’s nPVI scores however did not fit into the expected nPVI range, falling closer to David’s nPVI scores.

### 4.3 PVI measures for patterning clips

Table 2 displays the PVI measures for each of the clips produced in the auditory analysis. Although it looks quite daunting, I have highlighted cells containing the highest scores for each rapper in green, and then cells containing the lowest scores for each rapper in yellow.



Rapper	nPVI(V)	rPVI(C)
Arthur	69.267	5.845
	64.523	4.5
	82.798	5.491
	63.857	5.842
David	66.152	4.654
	60.747	4.185
	67.777	4.226
	61.978	3.189
	53.726	4.55
Eddie	54.993	4.701
	73.013	3.932
	64.69	6.16
	64.195	3.991
Joshua	72.011	4.442
	74.163	4.688
	77.116	4.755
	75.369	4.224
	67.384	6.124
	60.683	5.441
	94.42	7.449
Max	57.861	4.968
	56.557	4.881

	60.692	4.593
	47.459	3.867
	58.879	3.623
	57.68	3.793
	63.29	4.67
	65.937	4.132
Oliver	73.165	4.273
	64.97	4.778
	72.392	6.619
	72.687	4.552
	62.778	4.801
	65.874	4.582

Table 2

The predictions for the extracted clips were also reflected in many of the nPVI scores, shown in Table 2. Arthur's final clip showed the lowest nPVI score, where the fastest pace was perceived. Oliver's lowest nPVI score was in Clip 5 followed by Clip 2, though I had predicted Clip 6 as the lowest. His highest scores were also only half-correct, with Clips 1 and 4 having the highest nPVI, followed by Clip 3. Joshua had the highest nPVI score overall (nPVI=94.42), and one of the lowest scores (nPVI=60.68).

#### 4.4 Stress counts

Rapper	Stressed Tokens	Total Number of Segments	Stress Percentage
<b>Arthur</b>	146	529	27.60%
<b>David</b>	53	542	9.78%
<b>Eddie</b>	165	605	27.27%
<b>Joshua</b>	323	1184	27.28%
<b>Max</b>	333	1726	19.29%
<b>Oliver</b>	223	1060	21.04%

Table 3

Table 3 displays the stressed tokens for each rapper based on the criteria specified in Chapter 3. The stress tokens display the stressed segment (these are the force aligned phonemes) count, and the percentages show the proportion of syllables that fall outside the 0.25s duration, and are marked as stressed. Arthur, Eddie, and Joshua share quite a close percentage of stressed tokens, in the ~27% range. These values show some correlation with the percept of the stress-timed/syllable-timed continuum, which would suggest that fewer stressed syllables indicates a more syllable-timed rhythm, David and Max both have the lowest stress percentages, and low (and in Max’s case, the lowest) nPVI scores. Oliver’s stress percentage is lower than expected relative to the rappers that have higher stress. This may be due to his much higher segment count.

#### 4.5 Syllable counts

Timeframe	Arthur	David	Eddie	Joshua	Max	Oliver
<b>7.5 seconds</b>	4.80	6.53	4.80	5.73	5.87	5.30
<b>30 seconds</b>	4.23	5.90	3.97	4.73	5.47	4.47

Table 4

The SPS scores displayed in Table 4 showed David to have the fastest SPS score (SPS=6.53) in both the 7.5s, and 30s timeframes. Eddie had the lowest score in both timeframes, though he is tied with Arthur in the 7.5s category.

## Chapter V: Discussion

### 5.1 Introduction

In this thesis, the focus has been to explore the aspects that surround *flow*, and to see if the PVI serves as a suitable approach for measuring *rhythm* in rap; one of the key factors involved in the description and characterization of *flow*. Although some independent music writers and online bloggers have laid foundations for studying rap, only Paul Edwards has published an academically recognized description of rap, flow, and other aspects such as content and delivery involved in the art of rapping. This thesis builds upon the descriptions laid forth by Edwards, taking rhythm as the focus (with rhyme as a discussion component), and attempting to measure it using the PVI algorithm and notions of durational variability discussed by Grabe and Low in 2002. As mentioned previously, comparisons between my data – and rap data in general – can be drawn to the rhythm-class hypothesis. Many notable rappers employ a style that can be likened to descriptions of syllable-timed rhythm. For example, earlier I discussed the fast-paced style of the Midwest Choppers. Their rap style exemplifies the descriptions of syllable-timed speech; the goal for them in terms of rap is to deliver as many syllables as possible, whilst maintaining a high speed and clear enunciation. Tech N9ne regularly emphasizes this in his lyrics, and even uses the analogy of a ‘machine-gun rhythm’ to characterize the chopper style. Some other rappers such as Twista, K.A.A.N., Krayzie Bone, Busta Rhymes, and Krizz Kaliko, are also credited with employing a more (though not entirely) syllable-timed rhythm. When it comes to stress-timed rhythm however, the distinctions are far less binary. Even in the case of the Midwest Choppers, inevitably not every sound and syllable can be devoid of stress, this could be due partly to the nature of writing lyrics to a beat, or *synchronization*. One description of rap is: “*rap lyrics are written to be performed to an accompaniment that emphasizes the metrical structure of the verse*” (Attridge, 1995). In his book, Derek Attridge states that rappers use stress to assist with fitting words within the bar. With the non-binary distinction of styles in rap, the notion of viewing the stress-timed/syllable-timed dichotomy as a continuum – or ‘more-like’ one timing or the other – makes more sense, especially in the case of the data in this thesis as

acapella freestyles are highly variable, and are therefore unlikely to be entirely one or the other.

## 5.2 A discussion of *flow*, and relevant elements of rhythm

Throughout this thesis, I have highlighted various aspects of *rhythm* that are pertinent to a description of *flow*. I will now summarise these rhythmic aspects, and address the research questions presented in the introduction.

### 5.2.1 Rhythmic elements involved in flow

Regarding **RQ1**, there are many aspects of *rhythm* contribute to the description of *flow*, with others also described by Edwards that fall outside the category of *rhythm* (Edwards, 2009). **Stress** is one of the major factors contributing to the characterisation of *flow*. As Attridge states, rappers use stress to fit words and rhymes within a metrical structure (Attridge, 1995). With more complex rhyme schemes therefore, even more unique methods and structures for *stress* will be used. This is reflected by observations from choppers who aim to adhere to a ‘machine gun’ style flow, but inevitably need to use stress on some words. In reference to **RQ2**, my auditory analysis showed some connection between the stress perceived, and the stress counts obtained. Eddie and Joshua were both identified with a high proportion of stressed sounds ( $S\%=27.27$ , and  $S\%=27.28$ , respectively), this was reflected in their stress percentages which only differed by .01%. At the other end of the scale, David and Max were described with the lowest amount of stress. David’s rhythm was very fluid, with barely any pauses for breaths. Max’s rhythm was also well-connected, but was a lot more unpredictable in terms of patterning and distinctive phrases. David’s stress percentage was far lower than all the other rappers ( $S\%=9.78$ ), followed by Max ( $S\%=19.29$ ). Although the method used in producing the stress measures provided a fair idea of the overall percentage of stress used, it ignored the positioning of bordering phonemes or intervocalic consonants, and categorised them into one or the other based on the annotations. The baseline accept/reject point for stressed sounds was centred upon the average duration of short sounds, and then kept

constant for all rappers at 0.25 seconds. Some research into similar methods returned a study that had used a comparable method to define a base unit for their algorithm (McDonough, Danko, & Zentz, 2007). More development in this methodology, such as using a constant with a computed ‘stress coefficient’ for different individuals, may yield more valuable results in future rap research.

In terms of my data there was no underlying metrical structure to adhere to as the freestyles were in acapella, meaning judgments had to be made as to observed periods of patterning and where the rapper intended their verses to begin and end. Concerning **RQ1** once more, the presence or use of patterns and rhyme schemes is another area that is pertinent to rhythm characterisation. Variations in the ways rappers fit their *flow* to a metrical structure sets a *flow* aside, but the investigation of this is limited by the use of *acapella* freestyle data. In terms of analysis it is quite useful, as it can be easily fed through and annotated in Praat without having to isolate the vocal track from the instrumental. However, the fact that there is no beat for the rapper to synchronize with initially means that the rhythm becomes highly variable. With regard to **RQ2**, periods of patterning and repeated sections can certainly be found in the acapella recordings. However, these are quite difficult to isolate because they often change too quickly, or do not continue for a long enough duration. Additionally, this means that performing any kind of measurable analysis is quite tricky, without producing some theoretical metrical structure. However, it also relies on acquiring a high level of consistency in the rap data. This problem is inherent in acapella data, as the lack of a beat also limits some techniques used in rap that rely on a consistent instrumental track.

*Syncopation* for example refers to a technique where rappers offset their *flow*, so that they begin their phrase on the off-beat, which can be earlier or later than the first beat of the bar. Many acapella recordings of known rappers are available that may yield some better insights into the description of *flow*. However, the manual labour required to annotate such data would be quite considerable. Testing the use of the HTK toolkit to force-align such segments could prove interesting, not only to judge its accuracy but also to see if visible patterns would appear in the segments.

The SPS measurement is a relatively simple method of assessing the fastest verses or sections of a rappers’ catalogue. However, it can provide some contribution to **RQ1** as a factor involved in *flow*. Investigating rap data that has been extracted from its instrumental track may allow for average values to be more suitable, as the speech still adheres to a consistent metrical structure. The SPS values provide a frame of reference and comparison against the

existing research available. The rappers in my data had relatively low SPS scores, however David's highest score for the 7.5 second timeframe (SPS=6.53) is comparable to that of some known rappers. Reviews of other notable artists have also been carried out, such as Logic, Tech N9ne, Futuristic, and Eminem – who hit the fastest speed found in a single section overall, of 11.4 syllables/second, in one of his infamous hits '*Rap God*'<sup>45</sup>. Although speed is certainly a defining factor in *flow*, the inherent variability present in rap music makes it quite tricky to measure and quantify, without using averages that limit accuracy.

### 5.2.2 RQ3 – PVI Measures and their validity

The results from the overall PVI measures appeared to show some parallels to descriptions of the syllable-timed/stress-timed dichotomy, and even connections to the auditory descriptions. As mentioned in Section 2.3, intervocalic rPVI scores are not normalised, and therefore unsuitable for rhythmic measurement. However, rPVI scores are suggested to be indicative of the potential variation in syllable structure – Grabe & Low correctly predicted that Polish, which has a complex syllable structure and no vowel reduction, would exhibit low nPVI and high rPVI measures (Grabe & Low, 2002). A low nPVI score is indicative of a more syllable-timed rhythm, or less vocalic variability.

A comparison to general NZE measures provides some values for comparison. Warren's study produced some average baseline values for male and female NZE speakers, male nPVI=54.9, female nPVI=63.5 (Warren, 1999). As mentioned above, Nokes & Hay also developed some nPVI measures from NZE speakers that fell within the range of 51-70 (Nokes & Hay, 2012). Comparing my PVI measures to these existing findings appear promising, although the nPVI values in my data are all higher, with most of them falling in the 60-70 range in their overall scores. This is still within the expected nPVI range based on NZE speaker data, however the highest score in my data (nPVI=77.367) is quite extreme. Given the circumstances of the recordings – an acapella freestyle in quite a bare recording booth – I did expect the values of the rappers to fall above the average for general speech, which in terms of NZE can be quite rapid. The outlying scores however leave much to be determined, especially those in the extracted patterning clips, the highest of which was found

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<sup>45</sup> <https://genius.com/Eminem-rap-god-lyrics>, Eminem – Rap God



in Joshua's final clip (nPVI=94.42). In the clip, although the words are quite connected, the duration of each one is extended considerably as he appears to be running out of rhymes.

## Chapter VI: Conclusion

### 6.1 Possibilities for future research

This study ended up containing more descriptive content than was initially intended. Some initial constraints, such as lack of response or consent from the original data providers, restricted the use of the data for some additional experimental purposes. Initially I had hoped to conduct a perceptual survey. This would include a self-assessment section to determine the participants' prior rap knowledge, and an auditory section where I would present them with my clips, and ask participants to judge certain aspects of rhythm. This could help identify a range of public perceptions on the rhythms in my data, and examine their correlations to the PVI measures. This could have been more insightful as it could identify and compare scores from general music listeners, as well as more avid rap listeners, and analyse whether similarities are due to perceptual accuracy, or if they are more different due to subjective influence.

Continuing from here, one path could be to examine the rhythms of known rappers. Looking at the vocal data isolated from the instrumental track (in acapella) could yield more information as to how rappers use stress to fit their words into a metrical structure, and about the patterning used in different *flows*. By investigating rappers with distinctively observable rhythms, hypotheses could be generated about them from a measurable perspective – such as in terms of PVI – although further research to confirm the validity of PVI measures in rap measurement is needed to test these hypotheses.

Research on *flow* can perhaps fruitfully be linked to the semantic content of rap music, such as the verbal structures used in rap lyrics. With more data on both aspects, it may be possible to conduct evaluations of the combined effectiveness of such aspects in rap performances.

## 6.2 Summary & final thoughts

This thesis presents the only known auditory and acoustic analysis of rhythm in rap music. The *flow* discussion provides a social dimension for investigation, as well as highlights the potential for linguistic research that may be gained from its study. This study only analysed rhythm as it is arguably one of the main aspects of *flow*, and theories and methods have been developed for its characterization and analysis. **RQ1** focused on outlining relevant rhythmic aspects, namely – stress, fluidity, pace, and patterning of lines/verse. These aspects were all considered during the auditory analysis, addressed by **RQ2**. Many of the measures displayed some connections to the descriptions produced in the auditory analysis, showing some promise in its accuracy. Further studies on PVI and its suitability and reliability in the research of rap rhythm is required however to form any conclusive declarations. There are also other aspects, mentioned in Edwards’ book, that also play a role in the description of *flow*. These also require investigation to form a cohesive definition of *flow*, namely these are vocal aspects that come under the concept of *delivery*, such as pitch and tone (Edwards, 2009).

The connections between the auditory and acoustic analysis show some viability for the PVI as a measurement tool for rap rhythm. I have attempted to address the research questions presented at the beginning of this thesis and highlight the aspects of rhythm that seem most pertinent to characterising *flow*, some of which show measurable relationships to each other. Development of these methodologies could lead to a cohesive formula for examining the rhythms of other rappers, and even individual instances of speech in general. For example, an article on prosodic studies suggest the usefulness of rhythmic research in the field of forensic linguistics. By making comparisons to corpus data, the studies found that measures of prosodic cues such as pitch, intensity, and segment duration, were enough to show distinctions between English, Spanish, and Portuguese – the three languages investigated. Researchers involved in the studies were able to identify differences between bilingual and monolingual prosodic systems, and discriminate partial distinctions from vowel duration measurements (Harris, Gries, & Miglio, 2014).

The combination of the acoustic and auditory analyses leave much room for expansion in terms of methodology and data. Certainly, the social aspects of rap and hip-hop culture are of interest to the social sciences, but my hope is that this will generate more interest in other

linguistic fields of research. To this end, the multiple linguistic arenas and perspectives covered by rap make it a potential source of linguistic knowledge for researchers of prosody, semantics, socio-phonetics, morphology, and syntax.

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## Glossary

**Acapella** – singing or rapping performed with no accompanying beat or instrumental track

**Bar** – in musical notation, a bar typically contains four beats, and rap verses are typically made up of 16 bars

**Beat** – a term used to refer to the instrumental track, which provides a musical accompaniment for the rapper to synchronize with, for the most part the beat needs to maintain a consistent tempo, although it can change in certain sections of a song

**Beef** – or feud, a term used by rappers to indicate a dispute or disagreement

**Bpm** – beats per minute, musical measurement of tempo

**Chopper** – a term most commonly associated with rappers from the Midwest Choppers, but also used to describe any rapper with a ‘machine-gun’ or staccato style rhythm

**Crotchet** – a musical term representing a quarter note

**Finna** – slang term for ‘gonna’ or ‘going to’

**Flow** – term in hip-hop that describes aspects of a rap

**Fronting** – to ‘front’ in hip-hop means to put up a false image, or make claims that are untrue to your own experiences

**G-funk** – a subgenre of hip-hop popular on the West Coast which emerged from ‘gangsta rap’. Characterised by melodic soul and funk grooves and often the presence of a secondary female singer. The content usually discusses street life, sex, drugs, and loyalty to the city

**Isochrony** – the postulated division of rhythm into equal time portions depending on the base rhythmic unit of the language – e.g. syllable, foot, mora

**Quaver** – a musical term representing an eighth note

**Rap battle** – a rap form where two rappers take turns to deliver rhymes designed to attack and exploit their opponent’s weaknesses, whilst boasting their own prowess in anything they like

**Semi-quaver** – a musical term representing a sixteenth note

**Shout-out** – Public expression of gratitude

**Synchronize** – to occur at the same time or rate, a rapper needs to be skilled at this to stay on time with the beat

**Syncopation** – described as a disturbance in the regular flow of rhythm, rappers are able to use this to vary their flows while remaining synchronized to the beat

**Tempo** – musical term for the speed of a section or entire instrumental

**Urban decay** – the degradation of a city or part of it, which can be due to a variety of reasons

**White flight** – a term originating in the US that describes the migration of people of European ancestry from mixed urban regions to more homogenous suburban areas.