Rhyming Grammars and Celtic Phonology

by

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ABSTRACT

This dissertation broadens our understanding of a typology of poetic rhyme through the analysis of three rhyming traditions that show unconventional patterns in the contents, position, and size of rhyme domains. The rhyme domain (RD) is a string of segments that stand in correspondence with another string of segments in a poetic constituent.

In Early Irish poetry, strict identity of consonants in RDs is not required, but consonants instead correspond based on membership in defined classes. These classes correlate with sonority levels. Though analysis of VCC and bisyllabic rhymes, which match for sonority, but not featural identity, across the RD, I show that poetic rhyme can be sensitive to the sonority profile of a rhyme, and not just to similarity of segments. Statistical analysis of a rhyming corpus provides further evidence for this.

Old Norse skaldic rhyme shows an unusual position for RDs. Rather than occurring at the end of two lines in a couplet, both RDs appear in the middle of a single line. One of these RDs will occupy the penultimate syllable of a bisyllabic word, which means that the rhyme will begin and end word-internally. This gives evidence for rhyme being based not on a syllable rime, but on the interval: a metrical constituent that spans from one vowel to the following vowel including all intervening consonants.

The four types of Welsh cynghanedd I analyze present challenges in terms of the size, position, and contents of the RD. In all four types, the RDs occur with in a single line, like skaldic, but the position, size, and number of the RDs are less predictable. The RDs may span the entire line, or may contain only a single interval or consonant each. My analysis shows that all four types of cynghanedd can be analyzed as separate poetic grammars drawing on the same set of constraints in different rankings. A few constraints maintain a fixed ranking across all four cynghanedd grammars.

Analysis of these three apparent outliers contributes to the development of a typology of rhyme, showing that even extreme cases draw on familiar concepts to define their RDs.

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Chapter 1
Introduction

This dissertation aims to broaden our understanding of the typology of poetic rhyme and alliteration through analysis of two poetic traditions that have been mentioned as apparent exceptional cases in a theory of poetics. (e.g. Fabb 1999, 2002)

Poetic ornamentation, whether it is meter, rhyme, or alliteration, has been of interest to linguists because it draws on the poet's innate linguistic knowledge and can provide data about how speakers understand language. Poetic meter is related to the meter of natural language, in that it gives us information about metrical constituents, and avoids clashes and lapses, and ictus, like stress, is drawn to heavy syllables. (Golston & Riad 2000, Hanson & Kiparsky 1997, Hayes et al. 2012, Hayes 1989) Imperfect rhyme gives us insight into phonological similarity – two non-identical sounds that are rhymed together frequently are thought to be more similar than two sounds that do not rhyme together. (Katz 2015, Kawahara 2007, Steriade 2003) Alliteration shows us evidence about the splittability of consonant clusters. (Minkova 2003) Certain clusters will require a match between only the first consonant, while others will require that the entire cluster be repeated.

The purpose of poetic ornamentation has been argued (Fabb 1999, 2002) to be to communicate the existence of poetic constituents and to link related constituents together. The most basic of these constituents is the line, which is an integral part of poetic verse (Fabb 1999), however, there are other constituents that exist above and below the line which are introduced in chapter 2, and these are communicated through poetic ornamentation as well. The idea of marking constituents and their relation to each other also has analogues in non-poetic language. Katz (to appear) analyzes a particular type of lenition as applying throughout a phonological phrase to identify that constituent. Marking case and agreement are methods available to non-poetic language to show the syntactic relations between lexical items or constituents.

In many poetic traditions that have been analyzed by linguists, there is only one type of ornamentation that is used consistently throughout a poem. For many traditions, this is end-rhyme, or a combination of end-rhyme and meter without interaction between the two. However, in Welsh rhyme there are, in addition to end-rhyme, four types of internal rhyme which may appear in a line. This challenges the idea of a single poetic grammar being active in a particular poem and raises the question of how the poet decides which type of internal rhyme to use in a line, and what this means for a Welsh rhyming grammar.

Irish rhyme also brings up questions of what dimensions of similarity may be compared in rhyme. Although Irish rhyme includes many non-identical rhymes, many of them are considered to be in perfect adherence to the rules set out in the bardic grammars. Imperfect rhyme has been analyzed as related to a loss of perceptual cues in a particular context, which mean it is harder to distinguish between two particular strings. (Katz 2015, Kawahara 2007, Steriade 2003) However, in Irish rhyme, an immediately post-vocalic consonant in a cluster may be rhymed imperfectly, despite this being a position which should provide strong perceptual cues, compared to a consonant appearing between another consonant and the end of a word in a cluster. This raises questions about what dimension of similarity is being compared in Irish rhyme for it to pattern so differently from other rhyming grammars, and what kinds of imperfect or loose rhyming systems can exist.

Another question is what difference exists between rhyme and alliteration. The two have typically been described in terms of syllable structure: alliteration is repetition of onsets, and rhyme is repetition of rimes. However, alliteration rarely targets a full onset in every case, and rhymes that occur word-internally do not target a syllable rime. Ryan (2010) brings alliteration and rhyme in line by analyzing both as beginning at the perceptual center of a syllable nucleus and occupying a span that spreads either rightward or leftward from there.

Welsh rhyme includes a type of sound patterning that involves repetition of all consonants, whether onsets or codas, across an entire half-line. This would appear to challenge either definition of rhyme and alliteration. This dissertation explains some of the apparently exceptional and complicated systems of poetic ornamentation by referencing constraints used in the analysis of other rhyming traditions. This places even systems such as Welsh and Irish rhyme at one extreme end of a typology of rhyming grammars.

Chapter two introduces an approach to the linguistic analysis of poetic ornamentation. It discusses some ways in which different poetic traditions may differ. Chapter three analyzes the system of non-identical rhyme used in Old through Classical Modern Irish poetry, using an early Middle Irish poem as a corpus. Chapter four introduces a system of line-internal rhyme in skaldic which challenges the idea that rhyme must occur at a word edge and at a line edge. Chapter five looks at Welsh cynghanedd, a complex system of line-internal ornamentation that involves interval correspondence and consonant correspondence. Chapter six is a conclusion.

Chapter 2
Rhyming technology

This chapter introduces the terminology and methods involved in linguistic analysis of rhyme. Rhyme is one of several forms of ornamentation that is used in poetry to communicate the verse structure. Fabb (1999, 2002) explores the function of meter, alliteration, and rhyme in marking the constituents that make up a verse. Fabb (1999: 230) distinguishes between inherent form, such as feet, or NPs, and communicated form, such as the line or the stanza. Poetic ornamentation serves to link and demarcate the constituents that are a part of the communicated form of a poem.

End-rhyme in poetry marks the boundary of a line, and also links two adjacent (or alternating) lines as making up a couplet. For example, in the pair of couplets of the Early Irish poem *Saltair na Rann* in (1), end line, which is underlined in both the IPA on the left and the orthography in the center, links the first two lines together as a couplet, and does the same for the second two lines.

(1)

mə 'rʲi:sʲə 'rʲi: 'nʲiṽʲə 'na:ʲrʲ kʲen 'u:ᵊβur kʲen 'im:arβa:ʲɣʲ də 'ro:sat 'doṽun 'du:ᵊlax mə 'rʲi: 'bʲiθʲbʲ$_e$o: 'bʲiθʲbu:ᵊðax	Mo rí-se rí ṇime ṇáir cen ụab*ur*, cen ịmmarbáig, do-rósat ḍom*un* ḍúalach mo rí ḅithbeó ḅithbúadach	My king, the king of pure heaven without vainglory, without strife, created the ordained (?) world my king ever-living, ever-victorious

(Greene, 1981)(IPA mine)

Additionally, there is internal rhyme connecting lines two and three, marked with italics in the center orthographic representation of the poem, between *úabur* and *domun*. This joins the two couplets together as a quatrain. Alliteration is also marked in the orthographic representation of this poem, with a subscript dot. This is used to connect words within a single line, contributing to the unity of the line.

In this poetic tradition, these three forms of ornamentation: alliteration, end-rhyme, and internal-rhyme, each serve to mark and connect the various constituents that make up the poem. Lines are marked with alliteration, end-rhyme holds between two lines in a couplet, and internal-rhyme holds between two adjacent couplets in a quatrain.

Fabb (1999:226) also mentions strict meter, in addition to sound patterning, as a way to define and communicate verse structure. In the Irish, skaldic, and Welsh traditions discussed here, there is not said to be any periodic stressed-based meter that defines the line – only counting syllables. It could be that the lack of meter as a means of communicating line structure could have contributed to the development of these complicated patterns of rhyme and alliteration instead to communicate the poetic form.

2.1 Poetic grammar of Celtic

This section focuses on introducing the terminology and methods that will allow for the analysis of medieval Irish and Welsh rhyme.

2.1.1 Rhyming and rhythm

While many rhyming traditions will show interaction between the rhythm of the line and the rhyme by requiring a rhyme domain to contain a stressed vowel, Welsh and Irish verse show different patterns of influence between the rhythm and the rhyme.

In Welsh poetry, internal rhyme links the hemistichs of one line, defined by the position of two or more prominent stressed syllables. The rhyme occurs around these stresses.

In medieval Irish poetry, the location and size of the rhyme domain is determined by the position of the final stressed syllable of the line. However, here only the first rhyme domain in a pair may contain a stressed vowel.

2.1.2 Modules of poetic grammar

In this section, I briefly define a few terms that will be used in this dissertation.

2.1.2.1 Structure of the metrical line

In both the medieval Irish (§3) and medieval Welsh poetry (§5) analyzed in this dissertation, the line consists of seven syllables. There are six syllables in a line of skaldic poetry (§4).

2.1.2.1.1 Feet

For the purposes of this work, a foot is a binary grouping of syllables.

2.1.2.1.2 Metra

A metron is a grouping of two feet, for a total of four syllables.

2.1.2.1.3 Hemistich

The hemistich is an immediate sub-constituent of the line. For Welsh poetry, the line is divided into hemistichs based on the location of the most prominent stresses of the line. These may be traditional hemistichs, where the line is divided into two parts, or triolets, where the line is divided into three parts.

2.1.2.1.4 Interval

The interval is a phonological constituent that consists of a vowel and any following consonants up to the next vowel. It was introduced by Sturtevant (1922) for calculating syllable weight, and taken up by Farnetani and Kori (1986), Fant and Kruckenberg (1989), McCrary (2005) to define durational invariance. The interval was used by Steriade (2009, 2011a-c) to analyze poetic rhyme. For rhymes that end at the end of a word, this will not make different predictions than saying that a rhyme includes the rime of a syllable. For example, in the word-end rhymes in (2), both rhyme- and interval-based accounts will predict a rhyme domain that spans from the vowel to the end of the word:

(2) m[ast]
    l[ast]

However, for rhymes that end in the middle of a word, interval-based approaches make a different prediction about the size of the rhyming constituent than do syllable rime-based approaches. For example, in a type of Welsh cynghanedd, word-internal sequences of segments are rhymed. In the example in (3), a syllable-based account would predict that a poetic rhyme contains at least one syllable rime. For the first rhyme domain in the line, the rime is /ɔɪd/, which corresponds to the segments in the rhyme domain. However, in the second rhyme domain, the /d/ would be considered the onset of the next syllable, and not a part of the rime. However, an interval-based account correctly predicts the inclusion of the /d/ in the second rhyme domain as well as the first.

(3) /dɪgrɪnvlaɪn g[ɔɪd] am [ɔɪd]aɪ/ <Digrinflaen goed a'm oedai> (ap Gwilym 32:5)

Because the interval can better capture the segments which are included in rhymes, this analysis uses the interval as the constituent that rhymes are sensitive to.

2.1.2.2 Stanza structure

2.1.2.2.1 Rhyming and alliteration

Rhymes and alliteration both involve corresponding segments within a domain. In rhyme, typically, these begin with a vowel and include some following consonants. In alliteration, these segments generally begin at the beginning of a word, and continue up to a steep rise in sonority, whether a sonorant, or a vowel.

However, in Early English verse, alliteration begins before a stressed vowel, and not necessarily at the beginning of a word. (Minkova, 2003:55) In the examples in (4), from a selection of poems, an unstressed prefix, in italics, can appear before underlined consonants participating in alliteration.

(4) a. He will *for*giffe yow this gilt of his grace one
    b. I *vndire*take on my trouthe tire is þine awen
    c. Bi a stounde was non so stef þat hem *wiþ*stonde miȝt

Fabb (1999: 227) defines the two as follows, "Alliteration is repetition of a coherent sequence of segments which begins with an onset; rhyme is repetition of a coherent sequence of segments which begins with a nucleus."

2.1.2.2.2 End rhyme and internal rhyme

End rhyme refers to rhymes which occur at the end of the line, typically as the final interval of the line, or beginning with the final stressed interval of the line and continuing to the end.

Internal rhyme involves rhyme domains that are not aligned to the end of the line.

2.1.2.2.3 Stanzas branch into couplets

Stanzas are sequences of lines that are defined by the meter (e.g. regular stanzas of eight lines). Alternatively, in some Celtic poetry, they may instead be joined by a common theme much like a paragraph. These are made up of pairs of lines, called couplets.

2.1.2.2.4 Couplets

A couplet is a pair of lines. For both skaldic and Welsh rhyme, metrical units are right-branching, and so the second element in a pair is stronger. (See Hayes et al. 2012 for precedent.) This means that the second line of a couplet will be the stronger one, and will require stricter mapping between meter and linguistic rhythm, stricter identity between correspondent sequences.

2.1.3 The constraint RHYME!

The type of constraint that favors correspondence between metrical constituents in poetry is RHYME!. (Steriade 2011a-c) Any set of constituents that contain correspondent rhyme domains will satisfy these constraints. Constraints of this type can be defined in specific ways according to the rhyming grammar they are a part of. For example, the constraint may specify the kind of constituent, whether a line, hemistich, or foot, that contains a rhyme domain. The constraint may also specify the number of constituents that stand in correspondence with each other. For the Celtic and skaldic traditions discussed in this work, only pairs of constituents may stand in correspondence, but this is not universal. In other rhyming traditions the number of constituents standing in correspondence may vary, such as in Cornish (Bruch, 2009:73) which may use a single rhyme at the end of every line throughout a poem; the Early English alliteration from (4) where three sets of consonants are in correspondence; or examples from Zwicky (1976) where three or four lines may rhyme, such as the lyrics in (5) with the rhymes underlined.

(5) With all memory and f<u>ate</u>[1] (via Zwicky (1976:678))
        Driven deep beneath the w<u>aves</u>
    Let me forget about tod<u>ay</u>
        until tomorrow

1 Bob Dylan, "Tambourine Man".

The necessary variations in RHYME! constraints for this work are discussed in each section where the constraints are defined and used. For an example of a general version of the constraint which favors candidates with line-end rhyme, see the definition in (6).

(6) **RHYME!** = For any pair of designated lines L_1, L_2, there is a substring (=RD) in L_1 that has a correspondent in L_2.

When evaluating candidates made up of pairs of lines, this constraint will favor candidates where the lines contain rhyme domains which stand in correspondence. Additional constraints will determine what requirements must be met for a string to stand in correspondence in a rhyme domain.

2.2 Correspondence constraints above and below RHYME!

While RHYME! favors any set of constituents that stand in correspondence, other correspondence constraints will determine the size, location, and contents of the rhyme domain. If these constraints outrank RHYME!, they represent differences that are not tolerated in a rhyming pair. That is, if a candidate would violate a constraint ranked above RHYME! by standing in correspondence, the winning candidate would be a pair which does not stand in correspondence, and violates the lower-ranked RHYME! instead. Constraints ranked below RHYME! represent a difference that can be tolerated in a rhyming pair. This is demonstrated in the sections below.

2.2.1 Constraints on the size of the RD

Constraints on the minimum size of a rhyme domain reference the interval.

If a rhyme domain is defined as requiring an interval as a minimum, and this constraint ranks above RHYME!, then any pair in which two intervals stand in correspondence will win over a candidate where nothing stands in correspondence.

(7) **RD≥I** = A rhyme domain must contain an interval.

For the example in (8), in the winning candidate (8a), each RD contains an interval. (8b) violates this by including only the consonants, and (8c) does not stand in correspondence.

(8) Oh and just one kiss[2] With her tenderness	RD≥I	RHYME!
☞ a. Oh and just one 'k[iss] With her 'tendern[ess]		
b. Oh and just one 'ki[ss] With her 'tenderne[ss]	*!	
c. Oh and just one 'kiss With her 'tenderness		*!

However, rhyming grammars may specify that the rhyme domain must include a stressed interval, and not just any interval. This constraint and ranking would rule out the example from (8) because only one of the two rhyme domains contains a stressed interval, but would allow feminine rhyme, as in (9). The candidate in (9a) includes the stressed interval in both rhyme domains. The candidate in (9b) includes an interval, but not a stressed one, and the candidate in (9c) does not stand in correspondence.

(9) A woman's face with nature's own hand painted; A woman's gentle heart, but not acquainted[3]	RD≥Í	RHYME!
☞ a. A woman's face with nature's own hand 'p[ainted]; A woman's gentle heart, but not a'cq[uainted]		
b. A woman's face with nature's own hand 'paint[ed]; A woman's gentle heart, but not ac'quaint[ed]	*!	
c. A woman's face with nature's own hand 'painted; A woman's gentle heart, but not ac'quainted		*!

2.2.2 Constraints on the location of the RD

The position of the rhyme domain within the line can be determined through the use of ALIGN constraints. In the most familiar English language rhyme traditions, the rhyme domains will be aligned to the right edge of the line.

(10) **ALIGN$_{RD}$(RD-R, LINE-R)** = The right edge of a rhyme domain aligns to the right edge of a line.

If an ALIGN constraint outranks RHYME!, the RD will not be permitted to appear anywhere else in the line, but if it ranks below RHYME!, as in (11), the RD will be able to move to avoid violating other constraints.

2 Bruce Springsteen, "She's the one", via Zwicky, 1976:676
3 Shakespeare, Sonnet 20

(11)

Now, the roving gambler he was very bored[4] Trying to create a next world war	RHYME!	ALIGN$_{RD}$ (RD-R, LINE-R)
☞ a. Now, the roving gambler he was very b[ore]d Trying to create a next world w[ar]		*
b. Now, the roving gambler he was very bored Trying to create a next world war	*!	

Alternatively, this line could be analyzed as having a higher ranking for the Align constraint, and that the line in question instead violates a MAX(C) constraint, like in the tableau in (12).

(12)

Now, the roving gambler he was very bored Trying to create a next world war	ALIGN$_{RD}$ (RD-R, LINE-R)	RHYME!	MAX(C)
☞ a. Now, the roving gambler he was very b[ored] Trying to create a next world w[ar]			* (d)
b. Now, the roving gambler he was very b[ore]d Trying to create a next world w[ar]	*!		
b. Now, the roving gambler he was very bored Trying to create a next world war		*!	

A lower ranking of ALIGN constraints relative the edges of the line will also allow line-internal rhymes.

2.2.3 Constraints on the contents of the RD

There are also constraints on the kind of phonological similarity which is required to hold between correspondent rhyme domains. These are a series of IDENT(F) constraints which hold between rhyme domains. For example, to allow segments which are mismatched for place between rhyme domains, the constraint in (13) would be ranked below RHYME!.

(13) **IDENT(PLACE)$_{RD}$** = Two correspondent consonants in a rhyme domain must agree for place.

An example of this ranking can be seen in (14). In this rhyme, /v/ and /ð/ are allowed to stand in correspondence, so the pair may rhyme.

4 Bob Dylan, "Highway 61 Revisited", via Zwicky, 1976:680

(14)

Like dust in the wind you're gone forever, You're wind-blown leaves you're a change in the weather[5]	RHYME!	IDENT(PLACE)$_{RD}$
☞ a. for[ever] ... w[eather]		* (v~ð)
b. forever ... weather	*!	

If an IDENT constraint ranks above RHYME!, it represents a difference that is considered too great to stand in correspondence in a rhyme, and in this case, the non-rhyming candidate will be the winner. For example, the pair of words in (15) would not be able to rhyme under this grammar.

(15)

cat ~ pan	IDENT(NASAL)$_{RD}$	RHYME!
☞ a. cat .... pan		*
b. c[at] ... p[an]	*! (t~n)	

These constraints can also be restricted to favor stricter identity in stronger metrical positions. For example, in line-internal rhyme, a constraint requiring vowels to be identical in the second line of a couplet (if it is considered stronger) could outrank RHYME!, and a general constraint requiring vowels be identical could rank below it. This would mean that mismatched vowels would be permitted in odd-numbered lines, but not permitted in even-numbered ones.

2.3 Summary

Rhyme domains involve strings of segments being put into correspondence to communicate poetic form. They can vary in terms of where they occur, and whether they align to a line edge or a different constituent. Rhyme domains can also vary in size, and whether they must contain an interval at minimum, or a stressed interval. Lastly, they can vary in terms of what kind of imperfect matches will be tolerated in corresponding strings. To form a perfect rhyme, every segment in one rhyme domain must have an identical correspondent segment in the other rhyme domain. However, different poetic traditions and different poets will vary in terms of what kind of identity is required within the rhyme domain for the RDs to be able to stand in correspondence.

5 James Taylor, "Something's Wrong", via Zwicky, 1976:685

Chapter 3
Partial Identity in Rhymes: the case of Irish

The perceptual similarity of sonority contours has been explored previously as an explanation for the attested patterns of epenthesis versus assimilation in word-initial consonant clusters (Fleischhacker 2001, 2005; Flemming 2008; Steriade 2006). In this account, the perceptual distance between C_1C_2 and C_1VC_2 is smaller, thus making epenthesis a more likely repair for disallowed clusters, when there is a steep rise in sonority between C_1 and C_2 because that steep rise is more similar to the one between C_1 and an epenthetic vowel.

This fits the results observed by Fleischhacker (2001, 2005) whose research on the perceptual distance between original and epenthesized consonant clusters shows that C_1C_2 is more similar to C_1VC_2 in clusters to the left of the ranking in (21) (from Flemming 2008:8).

(16) TL > SL > SN > ST
(L = liquid, N = nasal, S = sibilant, T = stop)

Her results present a typology of epenthesis patterns (Fleischhacker 2001:10,33), and show that anaptyxis is more likely in clusters of rising sonority (TL→TəL), and prothesis is more likely in clusters of falling sonority (ST→əST). Languages differ in where they draw the line between anaptyxis and prothesis, but crucially, none show a reverse pattern of prothesis in clusters of rising sonority and anaptyxis in clusters of falling sonority.

Loanword adaptation has been a primary source of data revealing perceptual similarity because it is governed by a speaker's intrinsic knowledge of phonetic similarity rather than by the synchronic phonological rules and alternations of a language. Poetic half-rhyme, a rhyme where the segments in the rhyme are similar, but not identical, has been shown in several studies to be based on intrinsic knowledge of acoustic similarity rather than on featural similarity or knowledge of phonological alternations.

3.0.1 Arguments for perceptual similarity as the basis of rhyme

Steriade (2003) examines half-rhyme data from a corpus of the works of three Romanian poets, each of whom tolerated half-rhymes to some degree. This study found that the most frequently attested half-rhymes were better explained by perceptual similarity rather than by lexical knowledge or knowledge of productive phonological alternations. Looking at the available perceptual cues for mismatches in particular contexts, Steriade (2003) found that the least distinctive contrasts were also the most attested pairs in the half-rhyme evidence, for example, in rhymes of VC_1C_2, it is C_2 that is most likely to be unanswered, because there are fewer cues in that context than in a post-vocalic one.

Kawahara (2006) uses a database of Japanese rap lyrics to show that Japanese speakers consider acoustic details when creating imperfect rhymes, and have knowledge of perceptual similarity. A corpus analysis found that segments with more shared feature values were also more highly attested in rhymes, however, some features had stronger predictive values than others, and he concludes that context is an important factor in judging the acceptability of half-rhymes, concluding that acoustic similarity plays a larger role than featural similarity.

Johnsen (2011) carried out an experiment to test the predictions of perceptual similarity versus featural similarity approaches to imperfect poetic rhyme. This experiment allowed him to avoid the problem of a lack of negative data in corpus studies, and working with English rhymes enabled him to use confusion matrices, which were not available in the languages analyzed by Kawahara (2006) and Steriade (2003). In the experiment, participants rated the acceptability of imperfect rhymes, and the results were compared to the predictions made by perceptual similarity, acoustic features, and articulatory features. Johnsen found perceptual similarity to be the best single predictor for the results.

Katz (2015) examines a database of hip-hop lyrics in African-American English for evidence about the basis of imperfect rhyme. Katz's study is a statistical analysis of consonants in correspondence in rhyme, which allows him to correct for the effects of frequency of particular segments in the lexicon. His analysis is a feature-based comparison of pairs of consonants in correspondence, which he found to vary in frequency depending on context. If half-rhymes were made on the basis of features, he points out, we would expect the frequency at which any particular feature is mismatched in a rhyme would remain constant, regardless of the context in which it occurs. Because this is not the case, but rather, mismatches are frequent where confusability is high, perception and contextual confusability must play a role in determining the suitability of half-rhymes.

3.0.2 Sonority contours in Irish rhyme

The rhyming system formerly used in Irish poetry can provide evidence for perceptual similarity based on sonority contours. I argue here based on evidence from Early (Old and Middle) Irish poetry, although Ó Cuív (1966) explores a proposal along similar lines for Classical Modern Irish rhyme, saying that it is because Irish rhyme compares the overall "prosody" across the vowels and consonant clusters that it allows segments to be skipped. In pre-Modern Irish poetry, rhymes were made not by a strict identity requirement on matching final consonants, but by pairing similar consonants according to defined classes, which correspond to different levels on the sonority hierarchy. Previous analyses of Irish rhyme based on featural similarity have generally not been able to account for all of the data of rhymes involving consonant clusters (see, e.g. Malone (1987), Grijzenhout & Holtman (1994), Jaskuła (2007)) and tend to concentrate on analyzing the prescribed rules rather than looking at how they are put into practice in a corpus (though Plaster (2008) is an exception to this).

Rhymes based on similarity in sonority are not unattested elsewhere: in skaldic rhyme, described in more detail in chapter 4, mismatch is allowed at the end of a rhyme as long as both rhyme domains include a final rise in sonority (Árnason, 2007:102). In such rhymes, as demonstrated in an example from Steriade (2011b), the glides [j, w] and [r], which was likely an approximant, may rhyme as part of a rising cluster:

(17) meina n[iðɹ̠] í m[iðj]an (Þórsdrápa 17:7)

In this chapter, I argue that what constitutes similarity in Early Irish rhyme is not the sonority level of the individual segments, but instead it is the sonority contour across any the vowel(s) and consonant(s) that make up the rhyme domain. Specifically, I introduce the concept of a sonority profile to measure the similarity of Early Irish rhymes. The sonority profile is a more precise comparison of the changes in sonority in the rhyme domain (RD), comparing the difference between the points of highest and lowest sonority, as well as the sonority levels of the lowest point(s). By assigning numerical values for the sonority level of vowels and each class of consonant, it is possible to calculate the change in sonority for each rise or fall in a RD. Using the mean of these differences, we can compare the overall sonority profile of a rhyme over multiple segments, allowing us to take into account the segments that appear between the beginning and end of a rhyme domain. This is necessary to analyze consonant cluster rhymes and bisyllabic rhymes, which need a more precise comparison than just the fall from the first vowel to the final consonant of the rhyme.

3.0.3 The Early Irish rhyme corpus of *Saltair na Rann*

This chapter presents an analysis of Early Irish rhyme representing the grammar governing the rhymes which appear in the corpus used in this chapter, the Early Middle Irish poem *Saltair na Rann* ("The Psalter of Quatrains") (accessed on-line from the CELT edition[6] and corrected where necessary to data in Jakob (2013) or David Greene's[7] edited version for word-division and hiatus). It consists of 7,788 lines in 150 cantos, and was written in the 10th century, at the beginning of the Middle Irish period. *Saltair na Rann* includes many rhymes which would be considered imperfect by the rhyming system dictated by the bardic tradition, but which point towards sonority as the relevant dimension of similarity. I show through statistical analysis that rhymes which are predicted to be more similar based on my analysis also occur at greater than chance frequency in this corpus.

Section 3.1 is a description of the rules of Early Irish rhyme and meter as laid out in the bardic grammars. Section 3.2 explores how sonority can explain these rules and proposes a grammar for the monosyllabic VC rhymes, which is compared to a statistical analysis of these rhymes in the corpus. Section 3.3 expands the analysis to rhymes involving consonant clusters, and looks at their distribution in the corpus. Section 3.4 shows the behavior of bisyllabic rhymes. Section 3.5 is a summary.

3.1 Early Irish rhyme in the bardic tradition

The earliest surviving rules for Irish rhyme were recorded in the *Irish Grammatical Tracts* (Bergin, 1916) for professional poets to learn. As described by the bardic manuals (see Knott 2005:5; Meyer 1909:7; Murphy 1961:32 for clearer interpretations of the *IGT* rules), for two words to rhyme in Early Irish, they must contain matching vowels within the rhyme domain, and each consonant must be in correspondence with a consonant from the same class,

6 http://www.ucc.ie/celt/published/G202001/
7 http://www.dias.ie/images/stories/celtics/pubs/saltairnarann/

though not necessarily a strictly identical consonant. The consonant classes are divided as below in (24):

From Murphy (1961:32):

(18) Class P: Voiceless stops: [p, t, k]
Class B: Voiced stops: [b, d, g]
Class F: Voiceless fricatives: [f, θ, x]
Class S: Sibilant: [s]
Class β: Voiced fricatives (β): [β, ð, ɣ]
+ singleton sonorants (N): [l, r, n, ṽ]
Class NN: Geminate sonorants: [l:, r:, n:, m, ŋ:]

Any pair of words could form a perfect (i.e. sufficient) Irish rhyme as long as both had matching vowels and ended in a consonant from the same class. That is, a word ending in /at/ could rhyme with either /ap/ or /ak/, but not with /ad/ or /et/. Looking at the division of consonants into these classes, we can conclude that place of articulation was not considered important for similarity, but that manner of articulation was.

The classes are defined along lines of sonority, with some exceptions. For comparison, a simplified version of the sonority hierarchy based on the universal hierarchy proposed by Parker (2002:240) appears in (24) where segments with higher sonority appear at the top of the list, and those with lower sonority appear at the bottom.

(19) Vowels (highest sonority)
Rhotics
Laterals
Nasals
Voiced fricatives
Voiceless fricatives
Voiced stops
Voiceless stops (lowest sonority)

In comparing the consonant classes in (24) to the levels on the sonority hierarchy in (24), we see that Class β is made up of the singleton sonorants and the voiced fricatives, despite the fact that voiced fricatives, nasals, laterals, and rhotics each have a distinct level on the universal sonority hierarchy. We can assume that this division means that for the purposes of Irish rhyme, the perceptual distance between the lowest sonority member of this group, the voiced fricatives, and the highest, the rhotics, is smaller than the perceptual distance between members of any other two groups, as shown in (20), where *β* represents any voiced fricative, *f* represents any voiceless fricative, *b* any voiced stop, and *p* any voiceless stop:

(20) $\Delta(\text{n:}\beta) < \Delta(\beta\text{:f}), \Delta(\text{f:b}), \Delta(\text{b:p})$

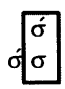
This, and the fact that vowels cannot mismatch on sonority, suggests that there was less sensitivity to differences in sonority at the higher end of the scale. The phonetic details which may have led to the distribution in (20) will be explored in §3.2.1.

3.1.1 Stress and the rhyme domain

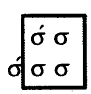
Two definitions of the rhyme domain that are commonly found in European poetry are that it begins at the last stressed vowel of the line, or at the last vowel, whether it bears stress or not. These correspondent vowels in the rhyme domain must typically match for stress value. The situation in Irish rhyme looks at first glance to be a mix of these two definitions, which also mismatches for stress value.

In the meter of *Saltair na Rann*, called *debide* (/ˈdʲeβʲɨðʲə/ or /ˈdʲeˈvʲiː/) each line consists of seven syllables, and the rhyme domain is defined in first line of a couplet as beginning at the last stressed vowel. In the second line of the couplet, however, the RD must begin after a stressed vowel, so that a stressed vowel in the first line must correspond with an immediately post-tonic vowel. Because stress in Old Irish falls on the first syllable of a word, this means that a monosyllabic word must rhyme with a word of two syllables, and a rhyme that begins on a bisyllabic word must be answered by a three-syllable word, as below in (21). Words of more than three syllables are uncommon in Early Irish[8], limiting the rhyme domain to a length of either one or two syllables. An illustration of possible line-final word length and rhyme domain in the *debide* meter is below. (21a) shows the pattern which gives a rhyme domain of one interval, and (21b) shows the pattern which gives a rhyme domain of two intervals.

(21) a.



b.



This pattern is also attested in at least one other poetic tradition[9]. A similar meter exists in the end-rhyme of Welsh, called *cywydd deuair (/ˈkʌ.ʊɪð ˈdeɪ.aɪr/),* though Meyer (1914:10) points out the difference is that "in Irish the shorter (monosyllabic or bisyllabic) rhyme-word must always stand in the first verse of the couplet, while in Welsh it may equally well stand in the second."

As a step towards an analysis, it would be possible to index constraints to the rhyme domains in odd versus even lines, similar to what is necessary for skaldic rhyme in §4, which alternates between requiring identity in the vowel or not in odd and even lines. That is, to the lines which are first in a couplet, or second in a couplet. For the RDs in odd lines, the size of the rhyme domain would be defined by a combination of the constraint in (22) and a highly-ranked ALIGN-R constraint to keep the rhyme domain at the end of the line.

8 Biblical names of more than 3 syllables are frequent in this corpus, but rhyming data suggests they bear a stress on the penultimate syllable, likely from the Welsh Latin pronunciation that introduced them. For more on these, see Knott (1952).
9 Sproule (1987:199) suggests that *debide* meter was based on a type of Latin rhyme which normally only occurred in unstressed final syllables, but might occasionally include a second, stressed syllable as well. He observes that the earliest Irish rhyming poetry follows this pattern from Latin, but later it became systematic to alternate the length of rhyming words.

(22) $\mathbf{RD}{\geq}\acute{\mathbf{I}}_{\mathrm{ODD}}$ = A rhyme domain in an odd-numbered line must contain at least the stressed interval.

Then, the rhyme domain of the second line in a couplet, would be defined as follows:

(23) $\mathbf{RD}{\geq}\mathbf{I}_{\mathrm{EVEN}}$ = A rhyme domain in an even-numbered line must contain at least an interval.

MAX(V) and DEP(V) constraints would ensure that both rhyme domains contain an equal number of intervals. However, in addition to the attested rhyme patterns in (21), where the RD in even-numbered lines begins immediately following the stressed interval, this analysis would allow a rhyme between a stressed monosyllable and the final interval of a three-syllable word. Such rhymes are attested, but uncommon.

(24) $\begin{array}{cc} & \\ \acute{\sigma} & \sigma \end{array}\boxed{\begin{array}{c}\acute{\sigma}\\ \sigma\end{array}}$

Such rhymes are attested, and are the most common type of rhyme domain size, outside of the prescribed rhyme domains of (21). There are 709 rhymes (18%) which fit the pattern in (24), as opposed to 234 pairs (6%) in which both rhyme domains include the stressed vowel.

I leave further analysis of this meter open for future work, and take the rhyme domain as a given for my analysis of the sonority-driven system of Irish rhyme. My attempts to analyze this as a requirement for near-similarity in vowel-energy between corresponding vowels (cf. Giavazzi, 2010) or correspondence between separate correlates of stress (e.g. length and pitch) in a Welsh-like stress/pitch accent system (cf. Williams, 1989) were largely unsuccessful, leading me to interpret the mismatched stress in Irish rhyme as more a requirement of the metrical structure of the line rather than an aspect of phonological similarity in the rhyme domain itself. Nigel Fabb (p.c.) suggests interpreting this meter as the result of a conflict between a requirement of the rhyme to contain a stressed vowel and a requirement that the meter have five syllables between the two prominent stresses of the couplet. These five syllables could also be interpreted as a constituent minimally larger than one metron (§2.1.2.1.2), to avoid positing a phonology that could count as high as five without building up to it in binary constituents.

3.2 Evidence for sonority in Irish rhyme in *Saltair na Rann*

Comparing the prescriptive system described in §3.1 to the practices of a poet in an actual rhyming corpus gives evidence for a sonority profile-based account of these rhymes. The imperfect rhymes in this corpus show that even when the poet deviated from the stricter grammar described above, he strove to maintain similarity in sonority in his rhymes.

The first quatrain of *Saltair na Rann* appears in (25) as an example, where the rhymes largely follow the system described earlier. The poem appears on the left in broad phonemic

IPA; in the center, in normalized Irish orthography (where accents mark a long vowel, not stress); and on the right is a translation from Greene (1981). The line-final rhyme domain appears in underline in both the IPA and orthography versions. There is also line-internal rhyme, which appears in the center sample in italics, but because its use is optional and unpredictable in this poem, it is not taken into account in this analysis, although it is subject to the same system of matching consonants as final rhyme.

Underline: final rhyme
Italics: internal rhyme

(25)	mə 'rʲi:sʲə 'rʲi: 'nʲiṽʲə 'na:ʲrʲ	Mo rí-se rí nime náir	My king, the king of pure heaven
	kʲen 'u:ᵊβur kʲen 'im:arβa:ʲɣʲ	cen úab*ur*, cen immarbáig,	without vainglory, without strife,
	də 'ro:sat 'doṽun 'du:ᵊlax	do-rósat dom*un* dúalach	created the ordained (?) world
	mə 'rʲi: 'bʲiθʲbʲₑo: 'bʲiθʲbu:ᵊðax	mo rí bithbeó bithbúadach	my king ever-living, ever-victorious

(Greene, 1981)(IPA mine)

The above sample demonstrates that rhyme domains can either be one syllable long (as in the *a* and *b* lines) or two syllables long (as in the *c* and *d*), as is expected for the *debide* meter. It also demonstrates the rhyming system explained above, wherein vowels in the rhyme domain must match exactly, but the consonants may mismatch. Here, /rʲ/ and /ɣʲ/ are considered a perfect match by the standards of Irish rhyme, as are /ð/ and /l/ in the second couplet. However, consonants were not required to avoid perfect identity, despite the freedom to do so, as we can see by the final /x/ in the second couplet.

As mentioned in section 3.1, Irish rhyme depends on matching consonants by class, rather than by complete identity. These classes, as defined in (18), are repeated below in (26).

(26) Class P: Voiceless stops: [p, t, k]
Class B: Voiced stops: [b, d, g]
Class F: Voiceless fricatives: [f, θ, x]
Class S: Sibilant: [s]
Class β: Voiced fricatives (β): [β, ð, ɣ] + singleton sonorants (N): [l, r, n, ṽ]
Class NN: Geminate sonorants: [l:, r:, n:, m:, ŋ:]

This means that any VC~VC rhyming pair where both consonants are members of the same class will be said to form a perfect Irish rhyme, despite not showing strict identity in every segment in the rhyme. However, in addition to rhymes which follow the class-based system described previously, the *Saltair na Rann* poet also used many rhymes which would be considered imperfect by the description above. To give an example, the pair in (27a) rhyme perfectly, but (27b) is an imperfect, but commonly attested, rhyme:

(27) a. nd[ath] ~ beoth[ach]	/aθ/ ~ /ax/	*SnR:* 27-28
b. m[eth] ~ rich[ed]	/eθ/ ~ /eð/	*SnR:* 345-346
c. gr[éin] ~ aicg[éin]	/e:ʲnʲ/ ~ /e:ʲnʲ/	*SnR*: 5-6

The division of consonants into these particular classes shows that manner of articulation was a more important dimension of similarity than place of articulation. Despite this freedom in choosing a rhyming pair, there are many rhymes attested which do not adhere to these defined classes. The pair in (27b) is an example of this type of imperfect rhyme, which I call 'cross-class rhymes' to differentiate them from perfect Irish rhymes, which follow the above system; and identical rhymes, where each segment in a rhyme domain corresponds with an identical segment (as in (27c)).

Evidence from cross-class rhymes points towards sonority as the relevant dimension of similarity in this system. If the above classes are laid out in order based on their position on the sonority hierarchy and compared to attested cross-class rhymes, we see that cross-class rhymes can occur between neighbors on that scale, as demonstrated below in (28):

(28)	[Class P]	↔	[Class B]	↮	[Class F]	↔	[Class β]	↔	[Class N]
	[voiceless stops]		[voiced stops]		[voiceless fricatives]		[voiced fricatives]		[nasals | laterals | /r/]
	(low sonority)								(high sonority)

The exception to the above generalization is that no cross-class rhymes are attested between stops and fricatives, suggesting that the gap in sonority between these two groups is larger than is between any others, creating a perceptual distance that is too great to be tolerated in even an imperfect rhyming pair. Evidence from these imperfect cross-class rhymes also leads me to divide Class β, which is defined as including both voiced fricatives and singleton sonorants, into two separate classes. The voiced fricatives frequently form imperfect rhymes with voiceless fricatives, but the singleton sonorants rarely do. Similarly, singleton sonorants may rhyme with geminate sonorants, but voiced fricatives do not often.

Not every aspect of early Irish rhyme is dependent on sonority, however. Other factors of similarity are considered as well. For example, the division of singleton and geminate sonorants[10] into separate classes is not based on sonority, but rather a difference in length. While they are divided into two classes in the traditional grammars, I treat them as a single class from a sonority-based approach. Rhymes between singleton and geminates are imperfect due to a violation of an IDENT(LONG)$_{RD}$ constraint, and not due to a violation of the constraints on similarity in sonority that I argue are the most crucial dimension of similarity to Irish rhyme.

Additionally, /s/ has its own class, although there is no reason to assume that /s/ has a level of sonority that is any different from that of the other voiceless fricatives. This, I argue, is because /s/ is a sibilant and has a higher frequency of strident energy, which sets it apart from the other fricatives. This may not be unexpected due to the special treatment of /s/ in a variety of phenomena, including forming onset clusters, another sonority-driven phenomenon. There is no /z/ or other strident in early Irish, but there is a palatalized /s^j/ which may rhyme (albeit imperfectly) with /s/.

There is generally a preference for the palatalized series of consonants to rhyme only

10 There is some disagreement over the actual pronunciation of the orthographic geminate sonorants in Early Irish. I interpret them as phonologically geminate because they are historically derived from geminates (or assimilated nasal+stop clusters) and the contrast is neutralized after long vowels (Thurneysen 1949:38, Greene 1952:218). In the modern Gaelic languages, the contrast is described as 'tense/lax' and is realized mainly in a preceding vowel (Archangeli et al., 2010). By the Middle Irish period, the contrast may not have been purely one of length.

with other palatalized consonants, and non-palatalized with non-palatalized. This is also not the result of a difference in sonority between the two series. Instead, I consider it a result of the requirement that vowels in the rhyme domain match. Thus, a vowel which includes a glide onto a following palatalized consonant may only rhyme with another vowel + glide combination. For example, in the first couplet in (25), the glide onto the palatalized /rʲ/, repeated in (29a), matches the one appearing before the palatalized /ɣʲ/ in the next line, shown in (29b). However, the lack of this glide in (29c) prevents it from rhyming with (29a), despite being a match for sonority.

(29) a. na:ⁱrʲ
b. im:arβa:ⁱɣʲ
c. im:arβa:ɣ

3.2.1 Assigning sonority values

In order to pursue an analysis of Irish rhyme based on sonority, it is necessary to assign numerical values to each relevant point on the sonority hierarchy. Parker (2002:78) suggests that levels on a phonological sonority hierarchy are always evenly spaced, but my data requires unevenly spaced levels, as some previous work on sonority has done (see Parker (2002:76-8) for discussion). From the division of the classes, with voiced fricatives and sonorants paired together, we can assume that the two had fairly close values for sonority. Imperfect rhyme data shows us that there must have been a large gap in sonority between the stops and the voiceless fricatives.

At first glance, the necessity of this gap poses some complications for a sonority-based account. The relative sonority levels of voiced stops and voiceless fricatives have been debated on phonological grounds (see Smith (2012) for a proposed explanation for this parameter). In some processes said to be based on sonority, there is evidence for voiced stops being less sonorous than voiceless fricatives, such as in syllabification in Imdlawn Tashlhiyt Berber. In this language, any segment may form the nucleus of a syllable, but the choice of a nucleus comes down to sonority levels with a preference for the most sonorous. In the example in (30a), the input, shown between slashes, is syllabified with the voiceless fricative /χ/ as the nucleus rather than the equally possible /b/. (30b) demonstrates that voiced stops, here /g/, are able to serve as nuclei when there is no more sonorous segment available.

(30) a. /t–bχl=akkʷ/ ⟶ tbχ̩.lakkʷ (Dell & Elmedlaoui 1985, via Smith 2012)
'she even behaved as a miser'

b. /ma=ra–t–g–t/ ⟶ ma.ra.tg̩t
'what will happen of you?'

On the other hand, there is also evidence from Pirahã showing that voiced stops can be treated as more sonorous than voiceless fricatives. In this example, from Smith (2012) citing Everett & Everett (1984), main stress is drawn to heavy syllables, and in the case of a tie, lower sonority onsets are preferred. In the example in (31b-d), /s/ or /h/ is preferred (as lower sonority) over /b/.

(31) a. káa.gai 'word'	/k/ is less sonorous than /g/
b. pa.hái.bii (proper name)	/h/ is less sonorous than /b/
c. bii.sái 'red'	/s/ is less sonorous than /b/
d. ʔi.bao.sái 'her cloth'	/s/ is less sonorous than /b/

If we interpret these processes as indeed based on sonority, and take them as evidence that there is cross-linguistic variation between these two levels on an otherwise fixed sonority hierarchy, which suggests they are very close in sonority, then why should Early Irish have such a large gap here?

In his dissertation quantifying sonority, Parker (2002) found that the phonological property of sonority correlates closely with the phonetic property of intensity, and develops a method of calculating sonority on phonetic grounds. He comes to the conclusion that voiced stops and voiceless fricatives are phonetically equally sonorous, and that languages may choose to treat one or the other as more sonorous for phonological processes.

My solution is to take this gap in sonority as evidence that the voicing distinction in early Irish stops was one of aspiration (even word-finally and intervocalically) rather than true voicing. This is also the case in all of the modern languages which descended from Old Irish (Modern Irish (Ní Chasaide, 1999), Scottish Gaelic – with pre-aspiration (Silverman, 2003), and Manx (Thomson, 1992)). With this change, the "voiced" (voiceless unaspirated) stops will have a lower sonority level than the voiceless (voiceless aspirated) ones because the noise associated with the burst of aspiration increases the sonority. However, because the two groups rhyme only with each other, this reversal does not have any undesired effects in terms of how they might be expected to rhyme imperfectly with other classes. In fact, in the only VC rhyme I am aware of that involves a stop rhyming with a fricative, it is a voiceless stop and a voiceless fricative, shown in (32), from the *Infancy Gospel of Thomas*:

(32) t[uə^{i}θ^{j}]	<tuaith>	(Carney, 1958)
[uə^{i}t^{hj}]	<uait>	

The second assumption I make about Early Irish pronunciation was that the voiced fricatives were realized as approximants, as in Spanish. This will give them a higher sonority than true fricatives, explaining why they are said to rhyme as a group with the sonorants. It also suggests they were already on their way to becoming the glides that they tend to become in the modern languages.

Numerical values for the relevant levels of sonority can be assigned with reference to data from Parker (2008), which calculated sonority levels of segments in English, Spanish, and Quechua. To calculate sonority, he measures the intensity levels of segments relative to the vowel /a/, to which he assigns a level of zero. Different languages will vary in the exact level of phonetic intensity for each class of segments, but the relative order of segments on the phonological hierarchy will remain constant. The data in (33) shows what early Irish might have looked like, with data pieced together from different languages in the results of Parker (2008). We see very little difference between voiced fricatives and sonorants, and a larger gap between voiceless fricatives and stops.

(33)

Class	Sonority	Source language
V [a(:), i(:), u(:), e(:), o(:)]	0	--
N [l, r, n, ṽ], [l:, r:, n:, m, ŋ:]	-5 ~ -10	Spanish
β [β, ð, ɣ]	-13	Spanish
F [f, θ, x], [s]	-21	English
P [pʰ, tʰ, kʰ] (voiceless asp.)	-35	Quechua
B [p, t, k] (voiceless unasp.)	-52	Quechua

A possible shortcoming of these numbers is that their intensity values were measured in pre-vocalic positions. None of the languages in the study had word-final aspirated stops to compare, and because pre-pausal sonority levels were often lower than pre-vocalic ones, I chose to use pre-vocalic values across the board. Similarly, the three languages measured in Parker showed variation in sonority levels in different tokens of the same segments in the same environments. The actual pronunciation of Early Irish was likely somewhat different from these numbers, but this will give us approximate values for this analysis.

Using this data, I assigned positive numbers to the Irish consonant classes, starting with a value of 1 for the voiceless unaspirated stops, and maintaining the distances between the values from Parker. These appear in (34) along with the number obtained by subtracting that consonant's value from the value of a vowel. This is what we will be comparing in rhymes: the change (fall) in sonority from a vowel to the final consonant of a word. This approach, comparing the fall in sonority from the vowel to the final consonant, rather than comparing the sonority levels of individual consonants, allows us to use the same analysis of rhymes involving consonant clusters as we use with singleton consonants in VC rhymes. Consonant clusters are discussed further in §3.3.

(34)

Class	Value	Fall
V [a(:), i(:), u(:), e(:), o(:)]	53	0
N [l, r, n, ṽ], [l:, r:, n:, m, ŋ:]	43	10
β [β, ð, ɣ]	40	13
F [f, θ, x], [s]	32	21
P [p, t, k]	18	35
B [b, d, g]	1	52

I use the low end of the range of sonority values for sonorants because there is evidence suggesting that sonorants in Early Irish would lenite in certain environments, and that certain types of lenition target low sonority segments (Katz, to appear). The only orthographic evidence of this comes from the alternation between an unlenited /m/ (orthographic <mm> or <mb>, often) and lenited /ṽ/ (orthographic <ṁ> or <mh>, often). Many Old Irish scholars take this to mean that all sonorants could lenite[11] (see, for example, Quinn (1975), Thurneysen (1961: 74), or Hickey (1996: 160-4)).

Using these numbers, it is possible to calculate the perceptual distance between two falls in sonority with a method similar to the one used in Flemming (2008).

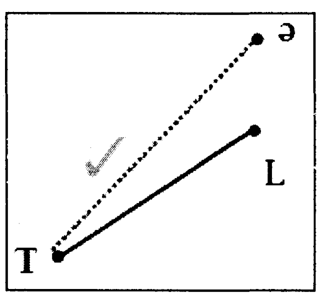
3.2.2 Measuring the Sonority Profile

In order to compare the similarity in sonority rises between original and epenthesized onset clusters, Flemming (2008:10) assigns numbers to each level of the sonority scale that is relevant in his case. The rise between C_1 and C_2 in a cluster is calculated by subtracting the numerical value of C_1 from that of C_2. In the same way, the rise between C_1 and an epenthetic vowel is measured by subtracting the value of C_1 from the number assigned to vowels.

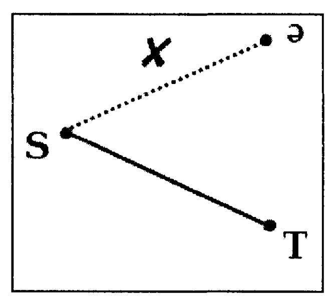
For example, for an onset /tl/, the value of C_1, /t/, is 1 and the value of C_2, /l/, is 4, so the rise between them is 3. The value of a vowel in this system is 6, so the initial rise in C_1VC_2, (/təl/) in this case, is 5. To measure the distance between this pair, Flemming creates a ratio between the two: 3/5 for this example. Because an identical pair would create a ratio of 1, he subtracts this ratio from 1 to create a scale on which an exact match results in a distance of zero. The example pair of tl~təl would have a distance of 0.4.

The two slopes /tl/ and /təl/ are compared in the graphic in (35a). For an /st/ onset cluster, the value of an /s/ is 2, and /t/ is 1, so the initial change in sonority is -1. Compared to this, an epenthesized /sət/ has a rise of 4, giving us a ratio of -1/4. Subtracting this from 1 gives us 1.25 for (35b), a much greater distance than the 0.4 obtained for (35a), explaining why epenthesis is much less common in clusters of this type.

(35) a.



b.



My approach for comparing rhyme is similar. I use the numerical values I assigned to each relevant level of sonority on the hierarchy from (34). We can calculate the distance of a sonority fall by subtracting the value of the final consonant from 53, the value of a vowel. A ratio between two falls can be calculated by dividing the smaller number by the larger and the

11 Quin (1975:4-5) writes, "when written double (*rr ll nn*) these represent a strongly pronounced vibrant, lateral and nasal respectively, perhaps also somewhat longer in duration than the normal sounds in modern European languages. This was also the pronunciation in initial position. Further in consonantal groups before *tdslrn* and after *slrn*. When written singly between vowels and finally after vowels and also when lenited in initial position these letters represent less energetic and probably shorter sounds."

perceptual distance between them can be found by subtracting that ratio from 1. Rhymes between consonants from the same class will have a ratio of 1, and therefore a distance of 0.

To give an example of how the ratios work, consider the imperfect rhyme pair [eð] and [eθ]. The vowel in both cases is assigned a value of 53. ð = 40, and θ = 32. Because there is a greater fall in [eθ], it will have a steeper slope than [eð]. The ratio of these can be calculated as in (36):

(36) 1 - ((53-40) ÷ (53-32)) = 0.38

The distances between VC rhymes with consonants from other classes are in the table in Figure 1. The classes in the rows represent the final segment from one line of a couplet, and the columns show the final segment from the other line. The diagonal represents perfect Irish rhyme between two members of the same class, so the distance in sonority profile here is zero.

	V	N	β	F	P	B
V	0	1	1	1	1	1
N		0	.23	.52	.71	.81
β			0	.38	.63	.75
F				0	.4	.6
P					0	.33
B						0

Figure 1: Sonority distance values in VC pairs.

Empty, dark grey boxes are redundant values (because the distance between two classes would be the same no matter which order the two lines of the couplet were in) and light grey boxes are distances that early Irish poets seem to judge to be too dissimilar to rhyme. The values in the white boxes include both perfect Irish rhymes with a distance of zero and cross-category rhymes that are considered close enough to be acceptable. Using these numbers, we want a constraint ranking that will allow any pair whose sonority falls differ by less than 0.4 to rhyme.

We can compare these distances to the attested numbers for each type of rhyme in the corpus in Figure 2. The 3,141 monosyllabic rhymes of the shape V or VC are attested with the following frequencies:

	V	N	β	F	P	B
V	423	0	0	0	0	0
N		1158[12]	423[13]	44[14]	0	0
β			345	271	0	0
F				424[15]	0	0
P					2[16]	10
B						49

Figure 2: Attested numbers of VC pairs in SnR.

The sonority distance calculations using the sonority values from Parker (2008) seem a good fit for the attested rhymes in this set of the data. The perfect Irish rhymes across the diagonal are well attested, with less frequent rhymes away from that diagonal. Greater frequencies of words in the lexicon ending in particular consonants will have an effect on the distribution of the data, which is further explored in a statistical analysis of the corpus in §3.2.4. However, we see a pattern we might have expected based on the sonority distances in Figure 1. The cut-off point of 0.4 can explain which types of rhymes are attested in the corpus, with the exception of the 44 F~N rhyming pairs (1.4% of the V(C) rhymes). However, §3.3 shows that rhymes between segments belonging to the [F] and [N] classes are much more frequently attested when they are a part of a cluster, followed by a stop.

A challenge for this analysis is why there are no rhymes between [P] and [F] with a distance of 0.4, but 44 rhymes between [F] and [N], with a greater distance, or why there are so many rhymes between [F] and [β], when that distance is only 0.02 smaller than that between [P] and [F]. There are a few factors which may contribute to this distribution. First is the availability of words ending consonants of these classes in the lexicon. Words ending in a singleton stop are not well attested in this corpus, and it is possible that more data might turn up more examples of stops rhyming with fricatives, like the one from (32). Second, it could be that additional perceptual factors prevent [P] and [F] from being as good a match. Similarly to how stridents form their own class and cannot rhyme with other voiceless fricatives, despite sharing identical sonority levels, it may be that the noisy burst associated with a voiceless aspirated stop is not sufficiently similar to a fricative in word-final position. Additionally, the sonority values measured by Parker (2002, 2008) for stops are the result of averaging the noise of the burst and of the stop closure, so these numbers do not take into account the fact that

12 This number includes any pair in which both rhyming words end in a sonorant – either geminate or singleton. Of these pairs 792 are both singletons, 202 are both geminates, and 164 are a geminate rhyming with a singleton.
13 Of these, 29 are β~NN, and 394 are β~N.
14 This number includes 41 F~N, and 3 F~NN.
15 This includes 189 pairs which are of class [F] (/f, x, θ/) as well as 235 [S] class rhymes.
16 Due to the inconsistent orthography of Early Irish stops, these numbers are not likely to be perfectly accurate.

stops are contour segments. Fricatives, approximants and sonorants have in common that they all lack the silence created during a stop closure. This makes them more perceptually similar, and therefore, more rhymeable with each other than with stops.

3.2.3 Faithfulness Constraints on Rhyme

This chapter follows Steriade (2011a-c) in its approach to an Optimality Theory analysis of rhyme, introduced in §2.3. In this approach, the grammars of poetic rhyming systems are determined by the ranking of faithfulness constraints relative to a constraint (37) requiring two corresponding lines of poetry to contain a rhyme domain; that is, for them to rhyme.

(37) **RHYME!** = For any pair of designated lines L_1, L_2, there is a substring (=RD) in L_1 that has a correspondent in L_2.

This constraint forces two lines of poetry to stand in correspondence. A pair would violate this constraint by not containing a rhyme domain. Violation of any constraint ranked above RHYME! will mean that the winning pair is one that does not rhyme, while violations of any constraints ranked below RHYME! are tolerated in a rhyming pair.

Due to the complexities in the *debide* meter described above and the fact that there is no interaction between the constraints on the contents of the rhyme domain and the constraints on its size or alignment at the end of the line, the present analysis takes the position and size of the RD as given, and focuses rather on the constraints which determine what degree of similarity is allowed inside the RD. These constraints do not interact with the constraints governing the positioning of the RD, which is left open for future work. The series of constraints which determine the RD are ones which require that the rhyme domain be aligned to the right edge of the line, that it begin at a stressed vowel in the first line, and at an immediately post-tonic vowel in the second line.

The constraints proposed in the following sections will determine what is and is not allowed to correspond within the RD. Constraints ranked above RHYME! represent differences which are considered to great to stand in correspondence, while those below RHYME! are considered similar enough to rhyme. Faithfulness constraints will determine what degree of mismatch will be tolerated within two strings standing in correspondence in a couplet.

3.2.3.1 Sonority Profile Correspondence

In order to capture the requirement that a rhyming pair have a perceptual distance of less than 0.4 in sonority profile, I follow Flemming (2008), who uses similar IDENT constraints for his work on epenthesis. These will necessarily be ranked in a stringency hierarchy such that a constraint against a larger distance will outrank any constraint against a smaller distance.

(38) **IDENT(SONORITYPROFILE)$_{RD}$≤*n*** = Two strings in correspondence in a rhyme domain must have a sonority profile distance that does not exceed *n*.

For the purposes of Irish rhyme, the crucial ranking of these appears in (39). That is, that a constraint penalizing a match of 0.4 or greater will outrank RHYME!, and a constraint penalizing a match of 0.3 or greater will rank below it. This ranking also applies to the rhymes involving more than two segments, introduced in §3.3 and §3.4.

(39) IDENT(SONORITYPROFILE)$_{RD}$≤0.4 » RHYME! » IDENT(SONORITYPROFILE)$_{RD}$≤0.3

An example showing a variety of rhyming pairs with cross-class rhymes appears in the table in (40) with their violations.

(40)

	IDENT(SONPROF)$_{RD}$ ≤0.4	RHYME!	IDENT(SONPROF)$_{RD}$ ≤0.3	IDENT(SONPROF)$_{RD}$ ≤0.1
a. gr[ax] ~ eŋ:[ax][17]				(0.0)
b. l[e^{i}θ^{j}] ~ na^{i}k^{j}s^{j}[e^{i}ð^{j}]				*(0.19)
c. r[aθ] ~ aθ[ar]	*(0.52)		*	*
d. tr[ik^{hj}] ~ fix[it^{j}]			*(0.33)	*

By comparing how a selection of rhyming couplets are evaluated by these constraints in (40), we can see how they work to rule out certain types of rhymes. The forms in this table, however, are not in competition with each other, so there is no optimal candidate. (40a) has a perfect identity rhyme, and does not violate any version of the IDENT(SONPROF)$_{RD}$ series of constraints. (40b) has a voiced approximant and voiceless fricative in correspondence, which equals a sonority profile distance of 0.19, violating the lowest-ranked version of this constraint that has been included in the table. For (40c), which is one of the 44 rhymes involving a voiceless fricative rhyming with a sonorant, the distance of 0.52 is just barely too large to be considered rhymeable by my analysis (though it may have been considered a very marginally acceptable rhyme by the poet), and the solution for this pair would be to have the two lines not stand in correspondence, thus violating the lower-ranked RHYME! rather than the higher-ranked IDENT(SONPROF)$_{RD}$≤0.5 constraint. (40d) is a pair rhyming a voiceless aspirated stop with an unaspirated one, giving a sonority profile distance of 0.33, which violates the IDENT(SONPROF)$_{RD}$ constraints ranked below RHYME!.

3.2.3.2 Other dimensions of similarity in the rhyme domain

In addition to the sonority profile, which I argue is the most important dimension of similarity for early Irish rhyme, there are other relevant factors of similarity. Perhaps most important of these is the highly-ranked constraint which prevents strident consonants from rhyming with anything else, due to the marked nature of the high frequency noise that defines a strident:

17 (a) SnR:71-72; (b) SnR:329-330; (c) SnR:603-604; (d) SnR:5325-5326

(41) **IDENT(STRIDENT)$_{RD}$** = A strident segment in a rhyme domain must correspond with another strident.

This constraint is undominated and never violated in the corpus. An /s/ in a rhyme domain may not correspond with anything but another /s/. This is shown in the tableau in (42).

(42)

	IDENT (STRIDENT)$_{RD}$	IDENT(SONPROF)$_{RD}$ ≤0.4	RHYME!	IDENT(SONPROF)$_{RD}$ ≤0.3
☞ a. br[as] ~ aðṽ[as][18]				
b. br[as] ~ aðṽ[aθ]	*!			
c. bras ~ aðṽaθ			*!	

The winning candidate in (42a) is the attested pair in the poem. It contains a perfect identity rhyme. The hypothetical pair in (42b) is not able to rhyme, and is completely unattested, despite having a perfect match for sonority, as both /s/ and /θ/ are voiceless fricatives. In candidate (42c), the words from (42b) simply do not stand in correspondence, which would be a better candidate than (b).

There is also a constraint requiring vowels match (though line-final words with mismatched vowels can still form consonance, another poetic ornamentation which follows the same rules for matching consonant classes). In addition to ruling out rhymes with mismatched vowels, this will also prevent palatalized segments from rhyming with non-palatalized ones, by penalizing any pair where the presence or absence of a glide is not matched.

(43) **IDENT(VOWEL)$_{RD}$** = Correspondent vowels in a RD must be identical.

The IDENT(STRIDENT)$_{RD}$ and IDENT(VOWEL)$_{RD}$ constraints must outrank RHYME!, as these are differences which are not tolerated in early Irish rhyme[19]. There are also some constraints on similarity in rhyme which rank below RHYME!. Matching rhyme domains on these dimensions can make an acceptable rhyme into a more beautiful rhyme, but they are not required. Statistical analyses on the corpus show a preference for rhymes to match in more ways than sonority, however. These constraints are defined below in (44) and (46):

(44) **IDENT(PLACE)$_{RD}$** = Two consonants in correspondence in a rhyme domain must match for place of articulation.
IDENT(PLACE)$_{RD}$ will be violated by any pair with consonants with different places of

18 SnR:29-30
19 There are 478 (12.5%) examples of rhymes where the vowels are mismatched along some dimension. These tend to mismatch for height, rather than backness (similar to loanword adaptation of English words in Cantonese (Kenstowicz, to appear)), and do not appear to mismatch in order to maintain similar sonority levels. However, there are no examples of a mismatched strident segment, suggesting this constraint is very highly ranked.

articulation, whether or not they are members of the same class or have equal levels of sonority. Although this constraint is ranked below Rhyme! and does not play a role in distinguishing acceptable rhymes from unacceptable ones, the statistical analysis of the corpus in §3.2.4 shows that the poet did make an effort to match correspondent consonants for place at greater than expected frequencies, if he were completely ignoring this dimension of similarity. In the table in (45), I show the violations accrued by several attested rhymes from my corpus which match perfectly for sonority.

(45)

	IDENT(SONPROf)RD ≤0.4	RHYME!	IDENT(SONPROf)RD ≤0.3	IDENT(PLACE)RD
a. gr[ax] ~ eŋg[ax][20]				
b. [oɣ] ~ ilx[or]			*	*
c. n[uᵊɣ] ~ iṽl[uᵊð]				*

In (45), candidate (45a) shows a perfect identity rhyme, (45b) mismatches for place and class, with a sonority profile distance of 0.38, but is still close enough to rhyme, and (45c) mismatches for place but maintains an identical sonority profile.

Another constraint which is frequently violated in some of the imperfect (even by Irish standards) rhymes in *Saltair na Rann* is mismatching between so-called geminate and singleton sonorants. It is unclear precisely what phonetic distinction would have differentiated the two in the early Middle Irish period when the poem was composed, but see footnotes 11 and 12 above for information on what this geminate sonorant distinction might represent.

(46) **IDENT(LONGC)RD** = Two consonants in correspondence in a rhyme domain must match for length.

IDENT(LONGC)RD will be violated by any rhyming pair which rhymes a geminate sonorant with anything but another geminate sonorant. As in (45), I show a few examples of how these rhymes are evaluated in the table in (47).

20 (a) SnR: 71-72, (b) SnR: 165-6, (c) SnR 267-8

(47)

	IDENT (SONPROF)$_{RD}$≤0.4	RHYME!	IDENT (SONPROF)$_{RD}$≤0.3	IDENT (LONGC)$_{RD}$	IDENT (PLACE)$_{RD}$
a. b[an:] ~ xaθb[ar:][21]					(*)[22]
b. gr[eiṽ] ~ carm[eil:]				*	*
c. x[i:ᵊl:] ~ nanr[i:ᵊð]			*	*	*

Here, (47a) mismatches for place, but is a perfect match in sonority and sonorant length, (47b) mismatches for length and place, and (47c) mismatches for length, place, and sonority profile.

3.2.3.3 Review of constraint rankings

Because it is not possible to tell which attested pair forms a better rhyme than another pair, the most detailed ranking possible will be to say that a constraint ranks either below or above RHYME!, depending on whether it is tolerated. The exception to this is, of course, the IDENT(SONPROF) constraints, which are ranked relative to each other depending on how large a distance they tolerate. The rankings and constraints so far appear in (48).

(48)	IDENT(SONORITYPROFILE)$_{RD}$≤0.4 »	RHYME! »	IDENT(SONORITYPROFILE)$_{RD}$≤0.3
	IDENT(STRIDENT)$_{RD}$		IDENT(PLACE)$_{RD}$
	IDENT(VOWEL)$_{RD}$		IDENT(LONGC)$_{RD}$

Violations of any constraints ranked above RHYME! will not be tolerated in a rhyme domain, but satisfying more of the lower-ranked constraints allows a poet to make a better rhyme than one that merely meets the basic requirements for a pair to stand in correspondence. Statistical analysis of the corpus allows us to see what kinds of rhyme were more common than expected. Analysis of more complicated types of rhyme, including rhymes of consonant clusters and bisyllabic rhyme domains continue in §3.3 and §3.4.

3.2.4 Statistical frequency of VC pairs

The relative freedom of the system of consonant-class-based rhyme outlined above has prompted scholars to raise the question of whether perfect identity rhyme was avoided on aesthetic grounds in early Irish rhyme (e.g. Tristam (1995:454), Sproule (1987:195), Plaster (2008)). There is theoretical reason to be interested in this question as well: rhymes that prefer dissimilarity would be cross-linguistically unique. However, a statistical analysis of my corpus shows that there is a marked preference for segments to rhyme with themselves (forming a perfect identity rhyme) rather than rhyming with another segment in the same class, forming a merely adequate rhyme.

21 (a) SnR: 5863-4, (b) SnR: 6267-8, (c) SnR 6231-2

22 Depending on what you assume about the pronunciation of this rhotic in Early Irish.

This chapter adopts the technique used in Ryan (2010) to test the statistical significance of the distribution of rhymes in this corpus. The attested rhymes are compared to a "fake" corpus generated by randomly pairing line-final words with an eligible match. Depending on what the particular trial intends to demonstrate, the pool of eligible matches may contain all words in the corpus which end in a singleton consonant of the same class, or it may include all words ending in a consonant of any of several classes which my sonority-based analysis expects to be allowed to rhyme. The mean of the results of 100,000 trials of these random pairings make up the expected values to which the observed frequencies can be compared. To do this, I use Fisher's exact test two-tailed to generate a *p* value based on a 2 x 2 contingency table of observed versus expected results

The observed results below are counted from all attested VC rhyme pairs where both consonants are from the same class. The expected results are randomly matched from a set of every line-final word in the corpus ending in the consonants of that particular class.

Segment	Total Attested (in VC rhyme)	Rhymes with self:		O / E	Fisher's *p*
		Observed	Expected		
/p/	0	0	0%	Ø	1.00
/t/	0	0	17%	0	1.00
/k/	2	2 (100%)	82%	1.2	1.00
/b/	1	0 (0%)	1%	0	1.00
/d/	40	29 (73%)	74%	0.9	0.83
/g/	8	4 (50%)	25%	2.0	0.21
/f/	1	0 (0%)	2%	0	1.00
/θ/	125	55 (44%)	63%	0.7	0.005
/x/	63	53 (84%)	34%	2.5	<0.0001
/β/	56	43 (77%)	31%	2.5	<0.0001
/ð/	89	66 (74%)	39%	1.9	<0.0001
/ɣ/	200	81 (41%)	29%	1.4	0.07
/r/	192	84 (44%)	25%	1.8	0.02
/l/	209	108 (52%)	29%	1.8	0.0002
/n/	391	233 (60%)	45%	1.3	0.013
/ṽ/	0	0	0%	Ø	1.00
/r:/	0	0	0%	Ø	1.00
/l:/	21	2 (10%)	8%	1.3	0.69
/n:/	125	79 (63%)	37%	1.7	0.0002
/m/	24	21 (88%)	48%	1.8	0.0005
/ŋ/	24	2 (8%)	5%	1.6	0.62

Figure 3: O/E results for VC segments

The high observed / expected values in Figure 3 suggest that the poet did not consider all consonants within the same class to form equally good rhymes, but instead strove for perfect identity (except in the case of /θ/, and to a lesser extent /d/, which shows a preference not to rhyme with itself). In addition to showing that the poet strove for a perfect match, this method allows us to compare the distribution of cross-class rhymes while correcting for the effects of lexical frequency. This gives a more detailed picture of the distribution of consonants in VC rhymes than the table above in Figure 2 did.

3.2.4.2 Similarity at the class level

A statistical analysis can also give us insight into the reality of the defined consonant classes in the practices of the poet. By comparing the O/E ratio of how often VC pairs from a particular class are rhymed within-class versus with how often they rhyme into neighboring classes on the sonority hierarchy, we can get an idea of which cross-class rhymes the poet considered a better match. We expect that the pairs with a lower perceptual distance by my analysis will also have a higher O/E number. Greater distances, then, should be significantly less attested than expected.

The expected numbers in Figure 4 were gathered as above, using the mean of 100,000 random trials, with statistical significance calculated using a χ^2 test on the contingency table. For each of the groups of classes defined in the grey rows marked with a Roman numeral, members of those classes are attested as rhyming pairs. The observed frequencies count how many VC rhymes are attested between consonants of the same class (e.g. P – P, for a VC rhyme pairs where C is a voiceless aspirated stop in both words) or between consonants of adjacent classes (e.g. P – B, where C is a voiceless aspirated stop in one half of the pair, and voiceless unaspirated in the other).

The results show that rhymes within classes are generally attested at higher than expected results, and rhymes across classes, where there is a difference in sonority and possibly in consonant length, rhymes are attested at less than expected numbers. Additional discussion follows the figure below.

Classes involved	Observed	Expected	O/E	Distance	χ^2 test p
I. P, B {p,t,k,b,d,g}					0.09
P - P	2 (3%)	0%	Ø	0.0	
B - B	49 (80%)	85%	0.94	0.0	
P - B	10 (16%)	15%	1.01	0.33	
II. F, β {f,θ,x,β,ð,ɣ}					<0.0001
F - F	189 (23%)	10%	2.3	0.0	
β - β	345 (43%)	47%	0.91	0.0	
F - β	271 (34%)	43%	0.79	0.38	
III. β, N {β,ð,ɣ,n,l,r,ṽ}					<0.0001
β - β	345 (23%)	17%	1.35	0.0	
N - N	792 (52%)	34%	1.53	0.0	
β - N	394 (25%)	49%	0.51	0.23	

IV. β, N: {β,ð,ɣ,n:,l:,r:,m,ŋ}					<0.0001
β - β	345 (61%)	52%	1.17	0.0	
N: – N:	194 (34%)	8%	4.25	0.0	
β – N:	29 (5%)	40%	0.13	0.23[23]	
V. N, N: {n,l,r,ṽ,n:,l:,r:,m,ŋ}					<0.0001
N - N	792 (69%)	61%	1.13	0.0	
N: - N:	194 (17%)	5%	3.4	0.0	
N - N:	164 (14%)	34%	0.41	0.0	
VI. F, N {f,θ,x,n,l,r,ṽ}					<0.0001
F - F	189 (18%)	6%	3.0	0.0	
N - N	792 (77%)	57%	1.35	0.0	
F - N	41 (4%)	37%	0.11	0.52	
VII. F, N: {f,θ,x,n:,l:,r:,m,ŋ}					<0.0001
F - F	189 (49%)	29%	1.69	0.0	
N: - N:	194 (50%)	21%	2.38	0.0	
F – N:	3 (1%)	50%	0.02	0.52	
VIII. F, β, N, N: {f,θ,x,β,ð,ɣ,n,l,r,ṽ,n:,l:,r:,m,ŋ}					<0.0001
F - F	189 (8%)	2%	4.0	0.0	
β - β	345 (14%)	10%	1.4	0.0	
N - N	792 (33%)	18%	1.83	0.0	
N: - N:	194 (8%)	1%	8.0	0.0	
F - β	271 (11%)	9%	1.22	0.38	
β - N	394 (16%)	27%	0.59	0.23	
F - N	41 (2%)	12%	0.17	0.52	
F – N:	3 (0%)	3%	0.0	0.52	
β – N:	29 (1%)	7%	0.14	0.23	
N: - N	164 (7%)	10%	0.7	0.0	

Figure 4: O/E results for VC classes

23 In addition to the sonority difference, there is also a violation of IDENT(LONGC) in these rhymes.

While the stops are not attested at high enough numbers to show statistical significance in their distribution, the results for the fricatives and sonorants show that although the poet was willing to rhyme across classes frequently, he did not do so at rates that resemble chance. This is easiest to see in the numbers in Figure 4: VIII, showing the results of all fricatives and sonorants. Here, every type of within-class rhyme is attested at greater than chance frequency. The cross-class rhymes which are closer in sonority profile distance and which match for consonant length, show higher O/E results than those which would be less perceptually similar.

An exception to this, however, is that words belonging to class [β] appear to rhyme better than expected with those of class [F], and less well than expected with class [N], despite the fact that the Irish grammarians describe the voiced fricatives and the singleton sonorants as making up a single class for the purposes of rhyme. It could be that the segments in class [β] are still voiced fricatives at this stage in the language, and rhyme as such. Perhaps the grammarians' description holds more true for later Middle Irish and Classical Irish verse, when the voiced fricatives would have been farther along on their path to becoming the glides that they are in Modern Irish.

Another possibility is that the voiced/voiceless fricative alternations in some early Irish paradigms may have conditioned speakers to consider them a closer match than the phonetics alone would suggest, although Steriade (2003) found this effect not to hold for Romanian. For Early Irish, in consonant-stem nouns, there will be alternation between /x/ and /ɣʲ/ or between /θ/ and /ð(ʲ)/. An example of this is in (49) from Thurneysen (1961:202, 205).

(49)		/aⁱrʲə/ *aire* 'noble' (nm.)	/tʲɛŋgə/ *tengae* 'language' (nm/f.)
	Acc.	/aⁱrʲɨɣ̱ʲ/ *airig* (sg.)	/tʲɛŋkθ̱ə/ *tengtha* (pl.)
	Gen.	/aⁱrʲəx̱/ *airech* (sg.)	/tʲɛŋgəð̱/ *tengad* (pl.)

Perhaps adding support to the idea of paradigm-conditioned similarity is the observation that Plaster (2008) makes in his own statistical corpus study of Old and Middle Irish rhyme. He found that rhymes which occur outside the consonant classes tend to match in place of articulation, creating pairs that resemble those in (49). This suggests to me that the poets would try to improve a rhyme which was a less close match on sonority by putting more effort into making the consonants match on place of articulation. However, in my analysis of my own corpus, I found no such preference. While there is a preference for consonants to match in place of articulation in perfect (i.e. within-class) rhymes, there is no such preference in cross-class rhyming, suggesting that once the poet had failed to match the sonority of the consonants, there was no drive to improve it by matching the consonants in other ways.

Although these statistical results are promising for my analysis, the above data and statistical analysis alone do not justify analyzing the rhymes as comparing the sonority profile of the rhyme rather than simply considering the sonority level or the features, of the individual consonants. To show the necessity of the sonority profile, I now examine rhymes containing consonant clusters, for which there are no explicit instructions in the medieval poets' guidebooks.

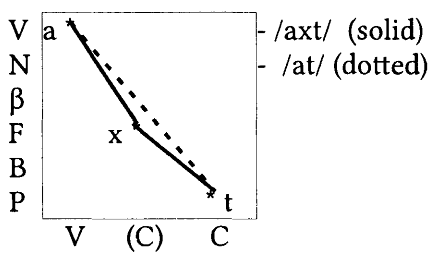
3.3 Consonant cluster rhyme

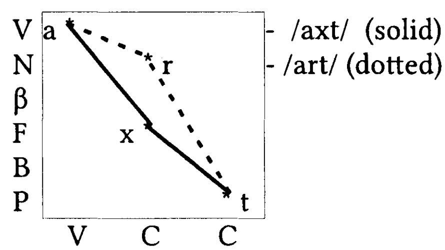
The evidence from imperfect rhymes over consonant clusters provides some strong evidence that Early Irish rhyme was looking at the sonority profile of a rhyme domain and not simply matching individual consonants for sonority level. When rhyming a word which ended in a consonant cluster, there are three options attested for forming a rhyme. A poet could form a perfect rhyme as in (50a), skip an intervening consonant as in (50b), or mismatch the intervening consonant as in (50c):

(50)	a. cl[echt] ~ imth[echt]	/ɛxt/ ~ /ɛxt/	(*SnR*:93-94)
	b. c[acht] ~ nám[at]	/axt/ ~ /at/	(4035-4036)
	c. tl[acht] ~ comn[art]	/axt/ ~ /art/	(15-16)

Rhyme domains which allow skipping segments are only sparsely attested in poetry, and in rock lyrics Zwicky (1976:683) notes that what he terms *internal subsequence* rhyme (which involve skipping an internal segment, such as in "proud ~ ground") only make up 3.1% of the examples of subsequence in his corpus – the far more common type being rhymes where the skipped segment falls outside the rhyme domain, as in "pass ~ fast". In addition to the poor perceptual cues in this environment, skipping an outside consonant may be helped by the option of not releasing these consonants, especially in English rock lyrics, where performance or dialectal variation may facilitate dropping the final consonant in a cluster. Modern Irish final consonants, however, tend to be released, and I take this to be the case for early Irish as well. Imperfect rhyme with external subsequence is well-attested in other poetry as well as in rock lyrics, though there is only one example of this in the nearly 8,000 lines of *Saltair na Rann*.

The possibility of skipping a segment in a rhyme domain makes sense if we consider the sonority profile the most relevant dimension of similarity. This can be sketched as in the charts below in (51) where the falls in sonority across segments of two rhyming pairs are compared. In (51a) (=50b), the sonority fall of a consonant cluster is compared to a simple VC rhyme. (51b) (=50c) shows two cluster rhymes with mismatched middle consonants.

(51)a.


b.


Because Early Irish phonotactics do not violate the Sonority Sequencing Principle, the only segments that are available to be skipped will have a sonority level at some point midway between a vowel and the final consonant in the cluster, so the sonority contour from a vowel to a stop, for example, will not look too different from the contour from a vowel to a liquid to a stop.

3.3.1 Measuring VCC sonority profiles

Because every consonant cluster rhyme in (50) involves a fall in sonority from a vowel to a voiceless stop, one might expect the sonority distance to be 0.0 for every pair. However, the three options are not equally frequent in the corpus, and there is evidence from bisyllabic rhyme (described in §3.4) suggesting that the entire sonority profile must be compared, not just the beginning and end points.

My solution to this problem is to measure the difference in sonority fall at a midway point and to average the two. This is most easily demonstrated with a pair of mismatched clusters without skipping, as was in (50c):

(52)								
	value	53	43	18	53	32	1	$(1 - (10/21)) + (1 - (25/31)) \div 2 = \underline{0.36}$
	class	V	N	P	V	F	B	
	fall	10	25		21	31		

In the example pair in (52), the rhyming word on the left of the divide falls from a level of 53 to 43 to 18, and the one on the right falls from 53 to 32 to 1. (The voicing contrast in stops is neutralized after voiceles fricatives, and I assume that the unaspirated stop is closer to what is realized in this environment.) To calculate the distance between these two, we must compare the distances between the two parts of the fall. For the first part, the equation is distance = (1 – (10/21)), or 0.52. For the second part, distance = (1 – (25/31)), or 0.19. When we calculate the mean of these, the distance in the overall sonority profile of this pair comes out to 0.36, making this pair similar enough to rhyme using the 0.4 cut-off point from §3.2.3.1.

To use this approach to compare a rhyme that involves skipping a segment, we use the same method, but add a dummy middle point to the non-cluster rhyme in order to allow us to compare the sonority fall in two parts. An example of this is worked out below.

(53)								
	value	53	35.5	18	53	43	18	$(1 - (10/17.5)) + (1 - (17.5/25)) \div 2 = \underline{0.37}$
	class	V	*	P	V	N	P	
	fall	17.5	17.5		10	25		

In (53), the distance in the first half is (1 – (10/17.5)), which is 0.43. For the second half, distance = (1 – (17.5/25)), which is 0.3. The mean of these comes out as 0.37, which makes it an acceptable rhyme, with a similar distance to the pair in (34). However, VCC rhymes with a skipped consonant will also incur a violation of a low-ranked MAX(C)$_{RD}$ constraint that prevents examples like the one in (53) from being considered as good a rhyme as a pair where each segment corresponds to another segment, ideally of the same consonant class.

3.3.2 Extending the OT analysis to consonant cluster rhymes

The constraints from §3.2.3.3 can, with the addition of the previously mentioned MAX(C)$_{RD}$ constraint, be used to analyze potential consonant cluster rhyme pairs as well. Because the sonority profile constraints do the majority of the work in determining the acceptability of a rhyming pair, there is very little that changes in the OT account, once the method of calculating and averaging the sonority profile has been done. The definition of the constraint against 'skipping' consonants appears in (54):

(54) **MAX(C)$_{RD}$** = A consonant which appears in a rhyme domain in one line of a couplet must be in a one-to-one correspondence with a consonant in the other line.

We can see this in an example in the table in (55) with the three types of consonant cluster rhyme from (50) evaluated with their constraint violations.

(55)

	IDENT(SONPROF)$_{RD}$ ≤0.4	RHYME!	MAX(C)$_{RD}$	IDENT(SONPROF)$_{RD}$ ≤0.3	IDENT(PLACE)$_{RD}$
a. /ɛxt ~ ɛxt/					
b. /axt ~ at/			* (x,Ø)	* (0.37)	
c. /axt ~ art/				* (0.36)	* (x,r)

In (55), (55b-c) have nearly identical values for distance in their sonority profiles, but (55b) also has a MAX(C)$_{RD}$ violation for skipping the /x/. (55c) has some difference in sonority profile at 0.36, but not too great to prevent it from rhyming, and because each consonant stands in correspondence with another consonant, MAX(C)$_{RD}$ is satisfied. There is, however, a violation of IDENT(PLACE)$_{RD}$ violation for /x/ and /r/.

3.3.3 Corpus analysis of cluster rhyme types

To analyze the distribution of VCC rhymes in the corpus, I extracted every attested word-final VCC string from line-final words. I consolidated these into eight VCC types based on the consonant classes that each consonant in the cluster was a member of, such that the rhyme /axt ~ art/ from (50c) would be categorized as [FP]~[NP]. These were exhaustively paired with each other and with each of the VC classes, to test for possible skipping rhymes. The sonority profile distance for each possible pairing was calculated, and the pairs were sorted according to whether or not they were attested in the corpus and whether or not the sonority profile analysis predicted them to be acceptable rhymes (i.e. distance ≤0.4). This gave 105 unique pairings, which had the distribution in (56). Of these, the pairings which need to be explained are in the 'Attested; Not Expected' and the 'Not attested; Expected' categories.

(56)

	Expected	Not Expected
Attested	21	5
Not Attested	24	56

The five rhyme types in the 'Attested; Not Expected' cell include the 44 [F]~[N] rhymes mentioned in the previous section where a word ending in a voiceless fricative is paired with one ending in a sonorant, for a distance of 0.52. There are also 10 rhymes pairing a sonorant with a cluster of two sonorants. However, these all proved to be matching a geminate sonorant with a sonorant cluster, such as in (57), and this looks like exactly the kind of cluster rhyme we would expect to see in a system that matches sonority profile.

(57) ndr[enn] ~ Iff[ern] /ɛn:/ ~ /ɛrn/ (*SnR*: 871-2)

The remaining examples in this category are one rhyme pairing [B] with [NB] (for a distance of 0.5), two pairing [NB] and [Nβ] (dist. = 0.46), and one pairing [NB] with [ββ] (dist. = 0.62), all of which are very sparsely attested word endings in the corpus, which likely contributed to their being difficult to rhyme well.

Of the 24 rhymes in the 'Not attested; Expected' category, 16 include an unanswered /s/ and can be ruled out by the constraint against this which was defined above in (41), although they are close enough in terms of sonority distance alone. Of the remaining eight, two pairs, [F] rhyming with either [FB] or [NP] can be ruled out because the stop closures in the [(N)P] and [(F)B] would find no counterpart in the [F]. This difference, which prevents stops and fricatives from rhyming in VC rhymes also applies in rhymes involving consonant clusters. The last six examples in this category all contained very poorly attested word types, such as [Nβ], [ββ], and [NN] either rhyming with themselves for a perfect rhyme, or with each other for an imperfect, but acceptable, rhyme. I expect that this gap is due to chance, and that such pairs would occur, given a larger corpus.

The distribution of rhymes involving a consonant cluster appearing in this corpus appears below in Figure 5. The rhymes are labeled by the classes of the final C or CC, and appear in columns under their distance, cut off to the tenth decimal place. The numbers following each rhyme type are number of attested pairs, with the total number of rhyme pairs attested at each level of sonority profile distance appearing at the bottom.

Distance:	0.0	0.1	0.2	0.3	0.4	0.5	0.6+
Type, # attested	FB~FB, 71 NP~NP, 17 NB~NB, 27 SB~SB, 11 S~NS, 3 (N:~NN, 10)	B~FB, 44	NB~NP, 5	FB~NP, 82 B~NP, 37 P~NP, 2 P~FB, 1	NB~Nβ, 2	S~SB, 1 B~NB, 1	NB~ββ, 1
Total:	139	44	5	122	2	2	1

Figure 5: Attested consonant cluster rhymes in Saltair na Rann

The sonority profile analysis allows the majority of the attested cluster rhymes, and predicts very few unattested rhymes. The next section explores a statistical analysis of the corpus through comparison with randomized "fake" corpora to show the significance of these findings.

3.3.3.1 Statistical analysis of VCC rhymes

To test the predictive power of the sonority profile approach and the degree to which the poet had similarity along this dimension in mind while rhyming words ending in consonant clusters, I made a randomized corpus to test the attested corpus against, as I did for the VC rhymes in §3.2.4. Creating this randomized corpus involved a random pairing with 100,000 trials among all VCC and VC rhymes predicted to be possible under the sonority profile analysis. In determining what rhymes are possible, I included a requirement that any /s/ in one word be answered in its matched pair, so that rhymes such as /ast ~ axt/ were excluded, despite being a perfect match for sonority. The unattested, but predicted by sonority, rhymes matching a fricative and a stop, such as /art ~ af/ were included as a possible rhyme in the randomized corpus however.

I then compared the numbers of attested rhymes to the randomized corpus to obtain O/E numbers for each possible consonant cluster pair. The significance of these were tested in a two-tailed chi squared test on a contingency table. For many possible pairs, the attested numbers were below five, which means that the p values derived by this method are not necessarily accurate and I have excluded such results. For the consonant cluster rhymes that are attested at great enough frequency to be accurate, all p values were below 0.0001.

The first of the three cluster rhymes to meet these criteria is rhymes involving words ending in [NP]. Words ending in clusters of consonants in these classes are predicted to be able to rhyme with words ending in [NP] for a perfect rhyme, or with [NB], [FP], [P], [B], or [F]. The results of this appear in the plot in Figure 6 with O/E values on the y-axis and the calculated distance between the pair on the x-axis.

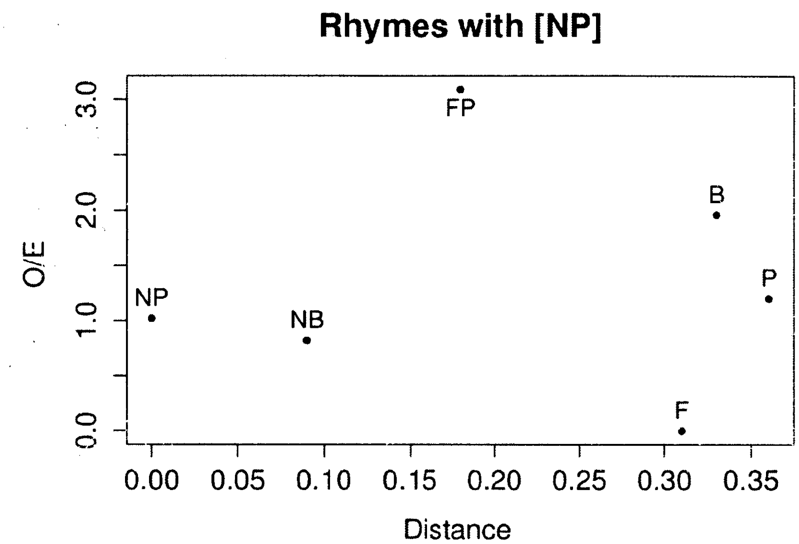


Figure 6: Rhymes with [NP]

The identical rhyme of [NP] with [NP] has an O/E of just over 1.0 and a distance of 0. It appears that O/E rates do not correlate with distance, but this data does not include the other factors that determine the similarity of a rhyming pair. For the rhymes between [NP] and [B], [P], or [F], there would also be a MAX(C)$_{RD}$ violation, and rhymes with [F] are ruled out because of the dissimilarity arising from the stop burst of [P] not finding a counterpart in [F]. These results also do not take into account the possibility of creating better rhymes by matching for place, or any additional difficulties in finding rhyming pairs due to the potential lexical effects of matching vowels in these clusters.

For rhymes with [NB], identical rhymes are attested at much greater frequencies than a random distribution would predict, and the O/E results drop off very sharply for any type of imperfect rhyme. The exception to this is the two types of rhymes which are not expected to occur at all by the sonority profile distance, [B] and [ββ], which occur once and twice in the corpus, respectively.

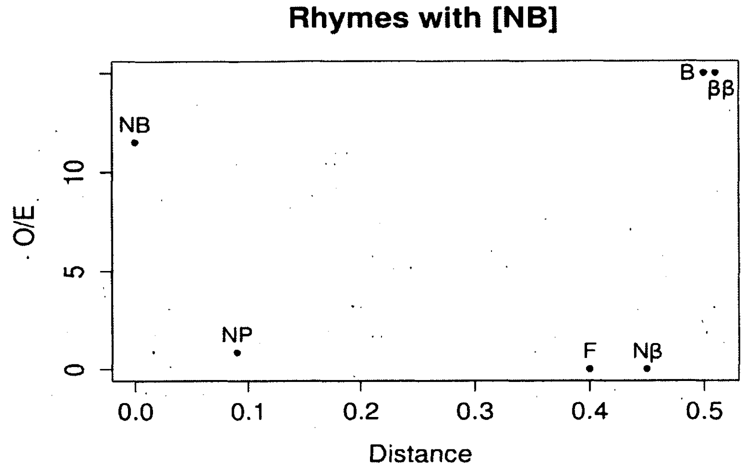


Figure 7: Rhymes with [NB]

Words ending in clusters of consonants of [FP] classes (which is actually [FB], due to voicing neutralization) are able to rhyme with other words ending in [FP] for a perfect rhyme, as well as with [NP], [B], and [P]. Their distribution is shown in the plot in Figure 8, below.

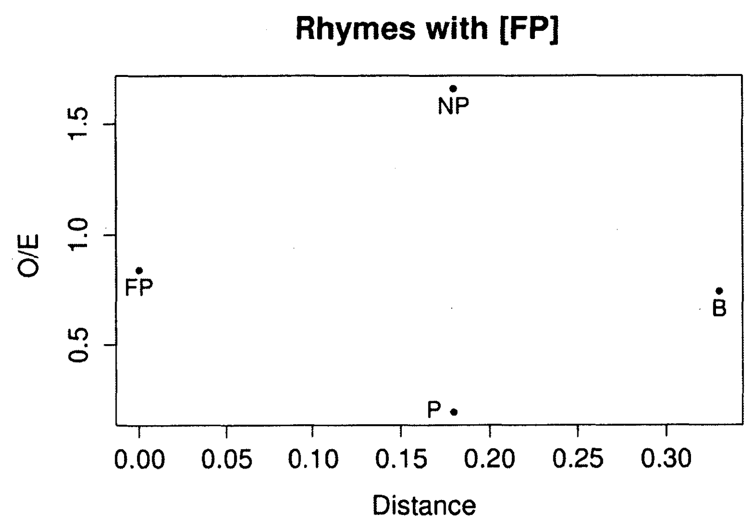


Figure 8: Rhymes with [FP]

Words ending in [FP] have an O/E of just 0.85 in perfect rhymes, and show a greater preference to rhyme with words ending in [NP] clusters. A language-specific explanation for this was proposed to me by Jim McCloskey (p.c.) who mentioned that there is a dialect of Modern Irish where /r/ and /x/ have merged in such clusters. He suggested that the similarity which prompted this merger may have factored into their popularity as a rhyming pair. Using the same statistical analysis as above, I limited the available rhymes to those ending in /xt/, /lt/, and /rt/ to see if there was any preference for /xt/ to rhyme with /rt/ over /lt/. My results suggest this was not the case, with roughly equal O/E results for both /xt-rt/ and /xt-lt/ pairs, at 0.68 and 0.77, respectively, although /xt-rt/ pairs occur more frequently in the corpus.

This section has shown how the sonority profile account can be applied to consonant cluster rhymes. The availability of skipping a post-vocalic consonant in a cluster, which is typologically rare due to the stronger perceptual cues in this environment, can be explained if the poet was matching sonority profiles rather than individual consonants. Because the post-vocalic consonant appears in the middle of a sonority slope, skipping or mismatching it results in a smaller distance between the pair than skipping or mismatching a final consonant would. This section also showed that the sonority profile does well in predicting the attested and non-attested CC rhyme pairs in the corpus, with only a few exceptions in either direction. While the O/E rates do not correlate closely with the perceptual distance, this statistical analysis of the corpus could not take into account other factors (such as $\textsc{Max}(C)_{RD}$ violations or vowel frequency in the lexicon) that would have guided the poet in choosing his rhymes.

3.4 Bisyllabic rhyme domains

The *debide* meter of *Saltair na Rann*, introduced in §3.1.1, allows rhyme domains of either one or two syllables. The vast majority of the rhymes are monosyllabic, and have been explained in sections 2 and 3, above. However, there are also 432 bisyllabic rhyming pairs in the poem (making up 11% of the corpus). Of these, only 58 are imperfect by early Irish standards, including both "skipping" of segments or "mismatching" segments in the rhyme domain outside of their class.

This means that for the majority of these bisyllabic rhymes, every segment corresponds with another segment of its own class. This would certainly not be the case if the rhyme were only looking at matching vowels and a final consonant. Although the bisyllabic rhymes are too sparsely attested and too idiosyncratic to give good results to a statistical analysis, it is possible to analyze the imperfect ones individually.

Their sonority profiles can be quantified in a method that is an expanded version of the way I analyzed the VCC rhymes, comparing the sonority profile between each segment. An example of an imperfect bisyllabic rhyme is below, in (58), where the rhyme domain is in brackets in the orthography, and appears in phonetic transcription.

(58)a.	sl[echta]	/ɛxdə/	(*SnR* 6871-2)
	cil[ecda]	/ɛgðə/	

This pair appears to show a voiceless fricative, /x/, in correspondence with a voiced stop, /g/, followed by a voiced stop, /d/, in correspondence with a voiced fricative, /ð/, which is unexpected from the monosyllabic rhyme data. However, if we think of the sonority profile as matching the low points in sonority, then we can interpret this consonant cluster as involving two instances of "skipping" an intervening consonant between the vowels and the sonority trough of the voiced stops. The calculations of this are in (59).

(59) a.										
value	53	32	1	27	53	53	27	1	40	53
class	V_1	F	B	*	V_2	V_1	*	B	β	V_2
change		21	31	26	26		26	26	39	13

b. $(1 - (21/26)) + (1 - (26/31)) + (1 - (26/39)) + (1 - (13/26)) \div 4 = \underline{0.3}$

Because this approach involves averaging, having a closer match in some places allows for more distance in others, and there are rhyming pairs that include correspondances that would be too great to match in a one-syllable rhyme, such as matching a sonority plateau with a slight fall or rise. In the imperfect bisyllabic rhymes in my corpus, there are never more than three consecutive consonants following the first vowel, although the phonotactics of early Irish should allow it. The majority of these involve the same types of imperfect rhymes that were discussed for VCC rhymes above: skipping and mismatching. Modulo the possibility of skipping consonants in either or both a rise or a fall, as in (59), the majority of these rhymes behave similarly to previous examples of consonant cluster rhymes.

However, in addition to having more comparison points to average the sonority profile distance over, the bisyllabic rhymes introduce a new question: whether the sonority profile is only comparing two falls in sonority, or whether it compares the sonority across the falls and the rise.

To test this, I calculated the sonority profile of all 58 imperfect bisyllabic rhymes to see if it made a difference whether I average across the entire rhyme, or interpret it as two sonority falls, ignoring the rise completely. The results were that it made no real difference for a majority of the rhymes: the approach that was chosen would not affect their acceptability -- that is, whether they had sonority profile distances of over or under 0.4. It only made a difference in seven rhymes which were only acceptable under the approach of averaging the entire rhyme domain, including the rise; and two rhymes which were only acceptable if the sonority rise was excluded.

I take the approach under which more rhymes came out as acceptable to be the better one, under the assumption that the poet was striving for as many acceptable rhymes as possible. It was also the case that only eight rhymes had a mismatch in their sonority rise. (i.e., V$\underline{\text{X}}$TV~VTV has the mismatch in the fall from the vowel, VT$\underline{\text{R}}$V~VTV has a mismatch in the rise from the stop.) If the sonority rise were not taken into account in determining the acceptability of rhymes, I would expect there to be more mismatches here.

Averaging the sonority profile across the entire rhyme domain for every bisyllabic rhyme yields the following results, with the numbers of attested rhymes in a row below their distance (cut off at the tens place):

(60)

0.0	0.1	0.2	0.3	0.4	0.5
370 perfect 6 imperfect	6	14	25	7	4

Here, as in the VCC rhymes and the VC rhymes, it appears that 0.4 corresponds to what the poet considered the cut-off distance for acceptable rhymes, in that there is a sharp drop in the number of attested rhymes above this value.

The example in (61) shows what an unacceptable bisyllabic rhyme looks like:

(61) [espaib] /'esba^{i}β^{j}/ (*SnR* 5125-5126)
imr[esnaib] /esna^{i}β^{j}/

In (61), there is an exact match between every segment of the rhyme domain except that /b/ corresponds with /n/. The two /s/ segments correspond, so there is no violation of IDENT(STRIDENT)$_{RD}$, but what is problematic for this pair is that in /'esba^{i}β^{j}/, there is a fall in sonority from /s/ to /b/, but this corrsponds to a sonority rise from /s/ to /n/ in /esna^{i}β^{j}/. The sonority profile for this can be calculated as in (62), with the use of a negative fraction to indicate the diverging rise and fall in sonority from the <s> in each case.

(62) a.

value	53	32	1	53	40	53	32	43	53	40
class	V_1	F	B	V_2	β	V_1	F	N	V_2	β
change	21	-31	52	13		21	+11	10	13	

b. (1 – (21/21)) + (1 – (-11/31)) + (1 – (10/52)) + (1 – (13/13)) ÷ 4 = <u>0.54</u>

This pair, despite differing in only one segment, comes out with a sonority profile distance of 0.54, above the 0.4 cut-off for an acceptable rhyme.

As noted in (60), there are only 11 bisyllabic rhymes, out of 432, in the corpus which would not be considered acceptable by my analysis. This suggests to me that the poet was striving for similar sonority profiles in his rhymes, and he achieved acceptable rhymes by this criterion in most cases.

3.5 Summary

I have argued for the notion of similarity in sonority profiles in determining the acceptability of Early Irish rhyme. Cross-linguistic evidence from epenthesis patterns shows that perceptual similarity of changes in sonority is a relevant concept in language, and rhyme-domain-final rises in sonority in skaldic poetry provide further evidence of this as specifically relevant in poetic rhyme. I have described the rhyming system presented in the bardic manuals for Irish poets to learn, and presented an analysis of the grammar used by the *Saltair na Rann* poet in determining how to put these rules into practice. Under my analysis of this poem, there are only 60 rhyming pairs (out of 3,894, or 1.5% of the corpus) which would be considered unacceptable rhymes in terms of their sonority profile. This includes one pair involving external subsequence[24], the 44 [F]~[N] rhymes from Figure 2, four cluster rhymes, and eleven of the bisyllabic rhymes.

The division of consonants into rhymeable classes in early Irish can be explained if sonority is the relevant factor of similarity, and the patterns of attested imperfect rhymes outside of these classes provides evidence for the phonetic details of early Irish pronunciation: that the voicing distinction in stops was one of aspiration, and that the voiced fricatives were approximants, certainly by the time that the bardic grammars were written, if not at the time of the composition of this poem.

Consonant cluster rhymes show that the sonority profile is relevant, not just the level of sonority of the segments, because post-vocalic consonants in clusters can be "skipped" in early Irish rhyme, although this is uncommon cross-linguistically due to the stronger perceptual cues for consonants in this position. Bisyllabic rhymes provide more evidence that both the rises and falls in sonority across the entire rhyme domain are being compared to determine an acceptable rhyme. While the ability to skip over the first consonant in a cluster in a monosyllabic rhyme might have suggested that this position was more poorly-cued somehow, bisyllabic rhymes show that the option of skipping a consonant in a cluster is available because they are at a midpoint in a sonority change and not simply first in a consonant cluster.

This rhyme data provides additional evidence for the existence of sonority contours as a notion of similarity in language, and suggests that it is possible for fairly subtle differences in sonority contours, i.e. the sonority profile, to be compared.

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24 B[oz] - anf[ost] /os/ ~ /ost/ (*SnR* 5701-2)

Chapter 4
Rhyme domain structure and position: the case of skaldic

Skaldic rhyme was mentioned in §3.0.2 as an example of a rhyme system which will allow a mismatch at the right edge of a rhyme domain as long as both rhyme domains include a sonority rise, as a parallel to Irish rhyme which will match a similar sonority profile across the entire RD. It also features a type of word-internal rhyme that is similar to one of the types of Welsh cynghanedd discussed in §5. Description and analysis of the simpler skaldic rhyme provides an introduction to the more complicated types of line-internal rhyme which feature in cynghanedd.

Skaldic rhyme refers to the line-internal rhyme (*hendingar*) in Old Norse *dróttkvætt* poetry. Data for this chapter comes from *Þórsdrápa*, a dróttkvætt written around the year 1000, accessed at `http://notendur.hi.is/eybjorn`, and other examples are from Árnason (2007).

The dróttkvætt form involves stanzas of eight lines, which are further divided into four couplets of two lines each. Each line contains six syllables, and the penultimate syllable is always a stressed ictus position, although the position of stresses is variable in the rest of the line. There is no line-final rhyme in these poems, but there may be alliteration in addition to the line-internal rhyme. An example of this is in the half-stanza (two couplets) in (63), with explanation of the rhyme below.

(63) 01:1 Flugst<u>all</u>a réð f<u>ell</u>i (Þórsdrápa)
01:2 fjörn<u>ets</u> goða at hv<u>et</u>ja,
01:3 drj<u>úgr</u> var Loptr at lj<u>úg</u>a,
01:4 lögs<u>eims</u> faðir h<u>eim</u>an.

The stressed, penultimate, syllable is involved in line-internal rhyme with another syllable earlier in the line, which are underlined in the sample above. This rhyme can include a match of the vowel and following consonants, as in lines 2 and 4, or just the consonants, as in lines 1 and 3.

4.1 Challenges posed by skaldic rhymes

Some challenges posed to a theory of rhyme by skaldic rhyme are introduced in this section. They are described in more detail and analyzed beginning in §4.2. This section presents some data on skaldic rhyme which may be unfamiliar.

4.1.1 Unusual positions of RD boundaries

Skaldic rhyme involves rhyme domains that end not only before the end of the line, but before the end of the word. The constituent involved in the rhyme is also not a consistent size: the part of the rhyme domain that requires identity may include just a vowel, or a vowel plus one or more consonants, or just the consonants.

4.1.1.1 Right edge can be a word-internal segment

Because the second rhyme domain in a line is always the penultimate syllable of both the line and a word, this rhyme domain will always have its right edge within a word. The first rhyme domain may end inside a word, as in (64a), or at the end of a word, as in (64b). The corresponding segments which make up the rhyme are underlined in these examples.

(64) (a) Harðvaxnar lét herðir (Þórsdrápa 07:1)
(b) njarð-, ráð fyrir sér, -gjarðar. (07:4)

4.1.1.2 Rhyme domain size varies as rhyming needs arise

The rhyme domain may include a vowel plus all following consonants up to the next vowel, as in (65a), or it may include only the consonants following the penultimate vowel of the line, as in (65b):

(65) a. gall- mantælir halla (03:6)
b. Flugstalla réð felli (01:1)

The number of consonants answered may be just one, as in the examples in (65) where the full interval only includes one consonant. There are also examples where the rhyme domain includes a cluster where both consonants are answered, as in (66a) which answers the entire /rð/ cluster of the penultimate interval, or only one consonant is answered, as in (66b), where an /r/ in the penultimate interval is answered as part of a /rð/ cluster in the earlier rhyme domain.

(66) a. Þurði hrönn at herði (08:5)
b. eiðs fjarðar hug meira; (10:6)

There is also the possibility of a rhyme domain consisting of nothing but a vowel, in cases of vowel hiatus, where there are no consonants following.

(67) ey vébrautar heyja (via Árnason, 2007:100)

4.1.2 Unpredictable location of rhyme domains

While the second rhyme domain is always the penultimate syllable in the line, the first rhyme domain may occur anywhere earlier in the line, and at any position within a word, as was demonstrated in (65).

The first rhyme domain may be the first interval of the line, as in (68a), or in any position in the line up to the 4th interval, as in (68b).

(68) a. flaut, eiðsvara Gauta (08:2)

b. við skyld-Br<u>et</u>a sk<u>yt</u>ju (011:7)

According to Árnason (2007:98), it is not permitted to have the two rhyme domains in adjacent syllables, which is what rules out the fourth syllable as a possible location for a RD.

4.2 An introduction to line-internal rhyme

4.2.1 Description

As introduced above, the basic facts to cover include how to capture the asymmetry between the two RDs: one is in a fixed position, while the other is unpredictable; one must map exhaustively into the other; one is stressed and the other need not be; as well as the problem of how to allow RDs to include a non-word- or line-final string.

4.2.2 Analysis of word-internal RDs

Analysis of a rhyming grammar which allows word-internal rhyme domains will require a ranking for ALIGN$_{RD}$(RD-R, LINE-R) below RHYME! such that it is violable in a rhyming pair, as well as a similarly low ranking for a constraint favoring aligning the RD to the right edge of a word.

Additionally, analyzing a system where both rhyme domains occur in a single line, rather than in two lines that make up a couplet, will require some revision of the definition of RHYME! that was used in §3.2.3 for Irish. We can redefine this constraint for skaldic rhyme as in (69).

(69) **RHYME!$_{SKALDIC}$** = A line of skaldic verse must contain two strings, RD$_{HEAD}$ and RD$_{TAIL}$, which stand in correspondence.

The constraints on the size of the two rhyme domains are as follows. First, the head rhyme domain must contain a prominent interval:

(70) **RD$_{HEAD}$≥'I** = The head RD must contain the most prominent stressed interval of the line.

A line of skaldic poetry contains six syllables, which generally contain three stressed syllables, which may occur in a variety of positions. (There are some constraints on the positions of stressed syllables, but there is no strict, e.g. trochaic, meter.)(Árnason, 2007:95) The only aspect of the meter that is constant, and not violated in any line of skaldic verse, is that the final two syllables be occupied by a trochee and be part of the same word. Because this stressed position is fixed, and because of the general right-headedness of skaldic (Árnason, 2007: 97-8), I take this penultimate stressed vowel to be the most prominent in the line.

The tail rhyme domain, then, may consist of any earlier interval in the line, whether it is stressed or not, though it is often in an earlier strong position (Árnason 2007:86).

(71) **$\mathbf{RD_{TAIL}{\geq}I}$** = The tail RD must contain an interval.

These will both rank above RHYME!$_{SKALDIC}$ because in every line, the two rhyme domains are defined as above. There are cases where the interval may end at a morphological boundary, just as in some other systems the interval may end at a word or phrase boundary. The definition of which grammatical boundaries an interval is sensitive to is not crucial to the analysis of this rhyme.

The position of the tail RD will be determined by which interval in the line has segments which are able to correspond with the ones in the head RD.

4.2.3 Analysis of the head/tail RD contrast

Because there is an asymmetry between the two rhyme domains, a single MAX(C)$_{RD}$ constraint, as worked for Irish in §3.3.2, is not sufficient to cover the facts of skaldic rhyme. As mentioned in §4.1.1.2, the second rhyme domain must map completely into the first, whether every consonant in the earlier interval is answered, as in (72a), or not, as in (72b) which contains an unanswered /h/.

(72)	a.	Þurði hrönn at herði	(08:5)
	b.	álfheims bliku kálfa;	(019:4)

However, presumably a rhyme that looked like the line in (73) would be impossible because the /h/ of the head RD has no counterpart in the first.

(73) *kálfa bliku álfheims;

We can account for this asymmetry in the position of unanswered consonants by using both DEP(C) and MAX(C) constraints that treat the head RD as if it were the "input" and the tail RD as if it were the "output" in standard input/output constraints. While in Irish rhyme, an unanswered consonant was permissible in certain positions in either RD, for skaldic we want to allow unanswered consonants only in the tail RD. We can define these constrains as follows:

(74) **MAX(C)$_{RD}$HEAD>TAIL** = A consonant in the head RD must have a correspondent in the tail.

(75) **DEP(C)$_{RD}$HEAD>TAIL** = A consonant in the tail RD must have a correspondent in the head.

By ranking MAX(C) above RHYME!$_{SKALDIC}$ and DEP(C) below, we can allow unanswered consonants in the tail RD, but not in the head one. In the tableau in (76), (76a) has an unanswered /l/ in the tail RD, but this violates a constraint ranked below RHYME!, so the two intervals are allowed to stand in correspondence. (76b) shortens the tail RD to not include a full interval (which may be possible in the case that there is a morphological boundary there) but this violates a high-ranked constraint, and it is ruled out. (76c) is a non-rhyming candidate.

(76)

Sjálflopta kom Þjálfi (09:4)	RD$_{TAIL}$≥I	RHYME!$_{SKALDIC}$	DEP(C)$_{RD}$HEAD>TAIL
☞ a. Sj[álfl]opta kom Þj[álf]i			* (l)
b. Sj[álf]lopta kom Þj[álf]i	*!		
c. Sjálflopta kom Þjálfi		*!	

Then, in the unattested line from (73), the high ranking for MAX(C), and for the constraint requiring that the head RD be a full interval mean that the optimal candidate will be one that does not stand in correspondence as a line of skaldic rhyme.

(77)

kálfa bliku álfheims	MAX(C)$_{RD}$HEAD>TAIL	RD$_{HEAD}$≥'I	RHYME!$_{SKALDIC}$
a. k[álf]a bliku [álfh]eims	*! (h)		
b. k[álf]a bliku [álf]heims		*!	
☞ c. kálfa bliku álfheims			*

Because both RDs must contain an interval, the size of the RD cannot be adjusted to satisfy DEP(C) or MAX(C), but it is possible to violate DEP(C) in a rhyming pair. A high ranked constraint like CONTIGUITY explains why the unanswered consonants are on the right edge of the interval.

4.2.4 Analysis of the odd/even distinction between lines in a couplet

In skaldic rhyme, the full interval rhymes only in even-numbered lines. In odd-numbered lines, the vowels mismatch, but the consonants are required to match. An example of this in a half-stanza can be seen in (78), repeated from (63).

(78) 01:1 Flugstalla réð felli (Þórsdrápa)
01:2 fjörnets goða at hvetja,
01:3 drjúgr var Loptr at ljúga,
01:4 lögseims faðir heiman.

This can be thought of as related to the general right-headedness of skaldic rhyme (Árnason, 2007: 98), which means both that the stresses of the line will become more prominent towards the right, and also that within a couplet, the second one will be more prominent. We can specify that a constraint on vowel identity within the line be ranked more highly for a strong line, versus a lower-ranked constraint on vowel identity in general (which will cover the weak lines). This is similar to stricter constraints on identity in strong positions elsewhere in language, which might prevent a consonant appearing before a stressed vowel from lenition, for example.

We can define these constraints as follows:

(79) **IDENT(V/STRONG LINE)$_{RD}$** = Correspondent vowels in an RD in a strong line (the second in a couplet, for skaldic) should be identical.

(80) **IDENT(V)$_{RD}$** = Correspondent vowels in an RD should be identical.

A violation of the constraint in (79) will also necessarily mean a violation of the constraint in (80). If we rank the more specific version of the constraint (from (79)) above RHYME!$_{SKALDIC}$ and the more general version below it, we will permit mismatched vowels in non-strong lines, but will require strict identity in strong lines.

For example, if we were to try to use the first line of the Þórsdrápa from (78) in an even-numbered line, it would violate the high-ranked constraint against mismatched vowels in these lines.

(81)

Flugstalla réð felli (even)	IDENT(V/STRONG LINE)$_{RD}$	RHYME!$_{SKALDIC}$	IDENT(V)$_{RD}$
a. Flugst[all]a réð f[ell]i	*! (a~e)		*
☞ b. Flugstalla réð felli		*	

However, using the same rhyme in an odd-numbered line, as it is attested, only the general constraint on vowel identity is violated, and the RDs are able to stand in correspondence for skaldic rhyme.

(82)

Flugstalla réð felli (odd)	IDENT(V/STRONG LINE)$_{RD}$	RHYME!$_{SKALDIC}$	IDENT(V)$_{RD}$
☞ a. Flugst[all]a réð f[ell]i			* (a~e)
b. Flugstalla réð felli		*!	

By splitting a constraint on vowel identity into a general version and a specific version to hold in a more prominent position, we can account for the asymmetry in what segments match in weak and strong lines. Just as every segment in the stressed, penultimate interval that makes up the head rhyme domain must be answered, we also expect to see stricter requirements for identity in the stronger position of the second line of a couplet.

4.2.5 Sonority rises within the RD

There is also a question of how to analyze the imperfect matches allowed in a sonority rise in skaldic rhyme. These were introduced as a system similar to that of the Irish imperfect rhymes, which still match for sonority profile, but skaldic rhyme do not allow mismatch throughout the RD: only in the rise. An example is in (83), where the /j/ and the /r/ correspond.

(83) meina n[iðr] í m[iðj]an (Þórsdrápa 17:7)

According to the traditional grammar written by Snorri Sturluson (Árnason, 2007: 86, 99), every consonant up until the next vowel must be included in the rhyme. In practice however, it seems only one consonant was required to match, but even to this there are two major categories of exceptions: rhymes that cut off after a sonority trough as in (84a), and rhymes that cut off before a morphological boundary, as in (84b).

(84) a. meina niðr í miðjan (Þórsdrápa 17:7)
b. liðfæð ok skip smæri (via Árnason, 2007:101)

Árnason (2007) interprets rhymes of the type in (84a) as ending where the right brackets are placed in the example, i.e. such that only the answered consonants are included in the RD. The example in (84b) shows a line where both consonants may be left out of the rhyme domain because they occur after a morphological boundary. The final <ð> of *liðfæð* is a derivational formative, and the <r> of *smæri* is a comparative ending (Árnason 2007: 100-1).

To show that the rhyme domain boundary is sensitive to sonority, Árnason provides the examples which I reproduce in (85). The example in (85a) shows a line where an entire sonority-falling consonant cluster is included in the rhyme domain, while (85b) shows an unattested line, where the lower-sonority consonants do not match, but only the first part of the sonority fall corresponds. This contrasts with the example in (84a) to show that while one matching consonant of a cluster is an acceptable rhyme, the sonority of the consonants relative each other does matter.

(85) a. morgun, Rúðuborgar (2007:106)
b. *morðun, Rúðuborgar (2007:106)

Árnason (2007: 105-7) uses these facts to point out a similarity between alliteration and rhyme: that both end on a low-point in sonority. This is why <ST> clusters (where S = /s/ and T = any stop) alliterate only with themselves, but <TR> clusters (where T = any stop and R = any sonorant) can alliterate with any <T>-initial word. He considers the glide or /r/ that forms the sonority rise to be outside of the rhyme domain, and not a part of an imperfect rhyme.

Although Árnason (2007:107) considers the rhyme domain to end at the sonority trough, in a parallel to alliteration of falling-sonority onsets, Steriade (2011:5) interprets such lines as an imperfect rhyme consisting of an entire interval. By her analysis, the rhyme domain extends over the entire interval as marked in (86), but a slight mismatch on the edge is permitted as long as both RDs end in a sonority rise.

Analyzing these examples in this way requires splitting the rhyme domain into a body and a rise. The body extends over a sonority fall or plateau, and the rise includes any sonority rise before a following vowel. This allows one to demand a strict match over the body of the RD, but some mismatch in the rise. This division would look as parsed out in (86) for the rhyming words from the line in (83).

(86) *n*[[ið]$_{\text{BODY}}$[r]$_{\text{RISE}}$]$_{\text{INTERVAL}}$ (Þórsdrápa 17:7)
m[[ið]$_{\text{BODY}}$[j]$_{\text{RISE}}$]$_{\text{INTERVAL}}$*an*

With this approach, the rhyme domain can include the entire interval, a perfect match can be required in the body, and a mismatch can be allowed in the rise.

Similar to the division of the IDENT(V)$_{\text{RD}}$ constraint into two different constraints depending on the position of the vowel, we can split an IDENT(C)$_{\text{RD}}$ constraint into two which reference the position of the consonants in either the body or the sonority rise of the interval.

(87) **IDENT(C/BODY)$_{\text{RD}}$** = Consonants in correspondence in the body of an RD must be identical.

(88) **IDENT(C/RISE)$_{\text{RD}}$** = Consonants in correspondence in the rise of an RD must be identical.

By ranking the constraint requiring identity in the rise below RHYME!$_{\text{SKALDIC}}$ and the constraint requiring identity in the consonants in the body of the RD above it, we can create rhymes with perfect identity in the body of the rhyme, but allow mismatch in a rise.

This can be demonstrated in the tableau in (89). Here, candidate (89a) has a mismatch, but only in the rise, so it violates the lower-ranked of the two IDENT(C) constraints. Candidate (89b), for comparison, does not contain a rhyme.

(89)

meina niðr í miðjan	IDENT(C/BODY)$_{\text{RD}}$	RHYME!$_{\text{SKALDIC}}$	IDENT(C/RISE)$_{\text{RD}}$
☞ a. meina n[[ið]r] í m[[ið]j]an			* (r~j)
b. meina niðr í miðjan		*!	

However, in cases where there is no sonority rise, the higher ranked of these two constraints will rule out any rhymes where consonants in the body of the RD are not identical. An example of this is the unattested line presented by Árnason, reproduced in (90).

(90) *m<u>orð</u>un, Rúðub<u>org</u>ar (Árnason, 2007:106)

This line can be evaluated as in (91). Here, there is no sonority rise at the end of the interval, so the rise portion of the RD is empty. The consonant mismatch in (91a) happens in the body, violating the higher-ranked IDENT(C) constraint. The winning candidate is (91b) which does not rhyme.

(91)

morðun, Rúðuborgar	IDENT(C/BODY)$_{RD}$	RHYME!$_{SKALDIC}$	IDENT(C/RISE)$_{RD}$
a. m[[orð]]un, Rúðub[[org]]ar	*! (ð~g)		
☞ b. morðun, Rúðuborgar		*	

4.3 Summary

This chapter has provided a brief analysis of how the constraints presented in §2 can be used for what appears to be a very unfamiliar type of rhyme. The rhyme domains still contain intervals, but the align constraints that would place them at the end of a word and the end of a line are ranked too low to have a role in determining the position of the rhymes in a line.

The idea of asymmetry between rhyme domains is also new, but can be analyzed by naming one rhyme domain the head and one the tail. The head rhyme domain has more prominence prosodically and the segments it contains must be repeated more faithfully in the tail rhyme domain. This asymmetric relation is similar to a base-reduplicant relation in natural language in that the two strings are in correspondence, but subject to different requirements in terms of markedness and faithfulness. The idea of faithfulness to prosodically stronger positions is also seen in the stricter requirements for vowel identity in the even-numbered line in a couplet.

While this analysis has not posited any sub-line constituents, Fabb (1999: 237) argues that skaldic rhyme communicates the division of the line into sub-constituents (hemistichs) and links the two together. The two hemistichs are also linked by alliteration. The patterns of rhyme and alliteration are such, he notes, that they do not occur in ways that would create ambiguity between which sub-constituent contained the word that bears the rhyme or alliteration. That is, while it is theoretically possible to have a word in the middle of the line that carries both the 1st rhyme and the 2nd alliteration, this does not occur because the word's status as a member of one constituent or the other would be ambiguous.

These ideas of connected hemistichs and asymmetries between rhyme domains are developed further in §5, on Welsh cynghanedd.

Chapter 5
Welsh poetry and rhyme

Welsh cywydd poetry is composed of lines of seven syllables in an irregular meter, which are paired into couplets. Line-end rhyme holds between the two lines of a couplet. There can also be line-initial alliteration between the lines of a stanza. Within the line, there are several types of rhyme and alliteration-like patterns which may occur.

This chapter looks at Welsh internal rhyme, and how to tell what kind of ornamentation may be in a particular line. It is not obligatory to have this internal rhyme in every line, but what kind of ornamentation occurs, and where it occurs, are dependent on prosodic features of the line. These prosodic features are not the result of a meter based on periodic stress, however, but are due to an alignment of the linguistic (syntactic) structure and the metrical structure of the seven-syllable line. This chapter aims to tell when one type of ornamentation is either licit or required.

This analysis presents a grammar of individual lines of Welsh verse. A different part of the grammar would be responsible for end-rhyme, which determines poetic acceptability at the level of the couplet, or line-initial alliteration which looks at the level of the stanza. It is a constraint over this higher level of the poem that would rule out a stanza with no lines containing internal rhyme, or one where every line contained the same type of internal rhyme.

5.1 Challenges of Welsh rhyme

Welsh cynghanedd, a system of line-internal ornamentation, poses several challenges to a theory of rhyme and alliteration. Some of these are shared by skaldic rhyme and will be familiar from §4. These challenges are introduced in more detail in §5.1.2, but include interaction between line end rhyme and internal rhyme, unusual positions of rhyme domain boundaries, interaction with the prosody of the line, and intertwined dependencies between multiple line-internal rhyme domains. The examples in this section are to give a picture of the complexities of the system of Welsh cynghanedd before analyzing it piece by piece.

These challenges can be addressed by proposing separate grammars which draw on a set of constraints, most of which are attested elsewhere in poetic ornamentation. Although cynghanedd appears to be an extreme example of poetic grammars, it fits into a larger typology of rhyme and alliteration.

5.1.1 A note on the formatting of examples

The format of examples in this section is as follows: The line appears in a broad phonemic IPA (see §5.2.3.2 for notes on my practices) between slashes, where a pipe (|) represents a caesura, dividing the line into hemistichs. The main (most prominent) stress of the hemistich, which will be relevant to rhyme, is indicated with a vertical line. Rhyme domain boundaries are marked with square brackets. The final interval of the line is underlined, because it participates in line-end rhyme with the other line in its couplet. To the right of that, in angled brackets, is the line in Welsh orthography, in the edited form appearing at `dafyddapgwilym.net`. In parentheses is the reference number of the poem, according to the list at the aforementioned website, and the line number of the example.

5.1.2 Interaction between end-rhyme and internal rhyme

There is a restriction on which intervals (defined in §2.2.2.1.4) of the line may participate in line-internal rhyme. The final interval is nearly always off limits to the internal rhyme, because the final-interval participates in line-end rhyme. An example of this is shown in the pair of lines in (92a-b). The final /aʊr/ of each line rhymes, and is excluded from being a part of any other rhyme domain. To avoid overlapping with the line-end rhyme, the line in (92a) only includes the consonant /m/ of the third triolet in a rhyme. The line in (92b) ends its sequence of repeating consonants before the final interval. A weaker restriction on having the final interval of any hemistich rhyme with the final interval of the line prevents the final /ɔm/ of the first hemistich from being included.

(92) a. /a 'gʷl[eːð] | am an'r̥ʌd[eð] | 'maʊr/ <A gwledd am anrhydedd mawr> (73:15)
m m

b. /[a 'wnaɪθ]ɔm | [mʊi no 'neɪθj]aʊr/ <A wnaethom, mwy no neithiawr> (73:16)
n θ (m) n n θ

However, this is not a general ban on overlapping rhyme domains. Line-internal rhyme domains may overlap with each other in certain cases. In (93), the /d/ of the second rhyme domain serves a dual purpose in both the interval rhyme of /id/ and the consonant rhyme of /d/.

(93) /ɪ g[id] | ə xʷedl dʌbr[id] | ɔɪð/ <I gyd, a chwedl dybryd oedd> (73:62)
d d

5.1.3 Unusual positions of RD boundaries

Like skaldic, Welsh rhyme can begin and end in the middle of a word. In the example in (94), the penultimate syllable of the line, [as] rhymes with a word-final [as] earlier in the line:

(94) /fənhɔn:aɪ 'dɪv[as] | 'gl[as]teɪgr/ <Ffynhonnau difas glasteigr> (131:21)

The line in (95) shows two rhyme domains ending in the middle of words, splitting the consonant cluster of /'ʊɪst]l/ and ending before a vowel in /'ɔst]ɛg/.

(95) /[mal ar 'ʊɪst]l | [mil ɪur 'ɔst]ɛg/ <Mal ar wystl, mul yw'r osteg> (22:58)
m l r st m l r st

There are also rhyme domains that do not begin on a vowel, but rather begin on a pre-vocalic consonant, even the first one of the line. Two examples of this are in (95) and (96).

(96) /['deɪθ]im | i ðɪnas ['dɛθ]ɔl/ <Deuthum i ddinas dethol> (73:1)
d θ (ð n s) d θ

5.1.4 Interaction with prosody

The type of internal rhyme that a particular line can contain is dependent on the prosody of the line. A line can contain either two or three main stresses, which divide it into hemistichs or triolets. There is only one type of rhyme which can occur over triolets. An example of it is in (97).

(97) /a 'gʷl[e:ð] | am an'r̥ʌd[eð] | 'maʊr/ <A gwledd am anrhydedd mawr> (73:15)
m m

For lines which contain two main stresses and are split into hemistichs, there are three types of rhyme available. If the line ends in a polysyllabic word stressed on the penultimate interval, that stressed interval may rhyme with the final interval in the previous hemistich, as in (98).

(98) /fənhɔn:aɪ 'dɪv[as] | 'gl[as]teɪgr/ <Ffynhonnau difas glasteigr> (131:21)

If the final word of the line is monosyllabic, then the line can be used for one of two types of consonant rhyme, where only the consonants of the line are in correspondence, similar to alliteration. In (99), the consonants in the first hemistich are repeated in the second hemistich following a series of unanswered consonants.

(99) /'pla | ar hɔɬ vɛrxɛd ə 'plʊiv/ <Pla ar holl ferched y plwyf!> (137:2)
pl (r h ɬ v rx d) pl

In the other type of consonant rhyme, there is no sequence of unanswered consonants, and every consonant from the first hemistich must be repeated in the second. This form of rhyme is more suited to a caesura placement that divides the line into two nearly-equally-sized hemistichs, as in (100). For the rhyme in (99), it is easier to create consonantal rhyme when the first hemistich is smaller than the second.

(100) /[mal ar 'ʊɪstl] | [mil ɪur 'ɔst]ɛg/ <Mal ar wystl, mul yw'r osteg> (22:58)
m l r st m l r st

The different requirements of these different types of rhyme allow a poet to choose the form which best matches the prosodic structure of the line he is writing.

5.1.5 Intertwined dependencies

Another challenge of Welsh cynghanedd is the fact that in one type of rhyme, two pairs of rhyme domains are required in the line. The line is divided into triolets by three main stresses, each of which must contain an RD that is in correspondence with an RD in its neighboring triolet. The first two are joined by rhyming their final intervals, with the /eð/ in (101). The second two are joined by consonant rhyme, below with the /m/.

(101) /a 'gʷl[eːð] | am an'r̥ʌd[eð] | 'm<u>aʊr</u>/ <A gwledd am anrhydedd mawr> (73:15)
m m

These facts will be described in more detail and analyzed in this chapter.

5.2 Descriptive introduction to Welsh rhyme

This section provides some background on Welsh poetry and the particular corpus that this work is based on.

5.2.1 Historical background of Welsh poetry

In medieval Welsh literature, a poetic form called cywydd /'kʌ.ʊɪð/ was popularized by poets such as Dafydd ap Gwilym (c. 1315-1350). The rules for composing this kind of poetry were laid out in the bardic grammars (Williams & Jones, 1934) and were employed with varying degrees of faithfulness in practice. This poetry is characterized by the use of cynghanedd, /kəŋ'hanɛð/, which is a form of line-internal ornamentation consisting of both interval rhyme and repeated sequences of consonants. The rules of cynghanedd developed out of the alliteration and internal rhyme used in the earliest forms of Welsh poetry, which were then used in more complicated ways in the saga poetry (Rowland, 1990) and formalized by the poets of the princes (Williams, 1994).

In 1523, after Dafydd ap Gwilym's time, the Statute of Gruffudd ap Cynan (Parry, 1929) was written, holding poets to stricter forms of the meters in order to compete in the eisteddfod /əɪ'stɛðvɔd/ poetry competitions. These rules are used in composing cywydd today, though individual modern poets vary in how important they consider these rules in composing good poetry. Rhys (2009) includes surveys of poets' judgments of the acceptability of poetic faults in cynghanedd.

5.2.1.1 Historical background of Dafydd ap Gwilym

I use Dafydd ap Gwilym's poetry as a corpus because it reflects more the intuitions of a poet on what makes a good rhyme rather than careful adherence to prescribed rules. Because Dafydd ap Gwilym was a member of the nobility, he was well educated in formal poetry, but because he was not a professional poet, he was free to adapt the rules as he saw fit. (See Bromwich, 1982, for some background on his life and works.) That is, his use of cynghanedd is developed enough to be predictable and consistent, but not so developed that it is over-formalized and without exceptions or near-rhymes.

5.2.1.2 The works of Dafydd ap Gwilym

The entire known corpus of Dafydd ap Gwilym's known works is available edited on-line at `dafyddapgwilym.net`, which was the source of data for this analysis. It consists of 171 poems, totaling 8,140 lines of poetry. Most of these are cywydd, but some are *englyn*, /eŋglɪn/, a different meter of Welsh verse that also uses cynghanedd. It has slightly different requirements for the number of syllables in a line and the number of lines in a poem, but the cynghanedd in it functions in the same way and has been included in the data for this analysis.

5.2.1.3 About the corpus and data-collection methods

The data was downloaded from the above website, converted to a phonemic representation, and analyzed for the presence of cynghanedd by Python scripts written by David Ricardo, an undergraduate student at MIT. The scripts had a 100% success rate on a testing corpus of 188 hand-checked lines of poetry, but were likely less accurate than this on the entire corpus. The hand-checked lines, and the general guidelines for identifying the four types of cynghanedd, were based on the descriptions of cynghanedd found in Llwyd (2007), Rowlands (1976), and others, which describe the rules for an ideal line of each type of cynghanedd, as well as the attested and allowable (to some degree, in some traditions) exceptions.

The four types of cynghanedd and the methods used to recognise them in the corpus are introduced below. All lines were checked against a few automatic failure conditions. These include ruling out lines that are the titles of poems; lines which are fragmentary, containing either two words or fewer, or containing fifteen characters or fewer; lines with nine or more words (indicating that it is clearly a line of a different meter and might confuse the script), and lines which contain a symbol that is not a part of the modified alphanumeric phonemic alphabet used for this project.

5.2.1.3.1 Cynghanedd lusg

One of the four recognised types of cynghanedd is cynghanedd lusg, where some portion of the stressed penultimate interval of the line is matched with a word-final interval earlier in the line (in italics in the example below):

(102) /fənhɔn:aɪ 'dɪv*as* 'gl*as*teɪgr/ <Ffynhonnau difas glasteigr> (131:21)

To find these in the corpus, the script searched for odd-numbered lines with polysyllabic final words. Then, the penultimate interval was compared with the final intervals of earlier words in the line. A match of minimally one vowel (of a diphthong, for example) and one following consonant was counted as cynghanedd lusg. In the examples that the script missed, there was generally vowel hiatus that the script did not count properly.

In initial work on this corpus, I tested the accuracy of the grammatical descriptions of this type of cynghanedd in work such as Llwyd (2007) and Rowlands (1976). There are no examples of cynghanedd lusg in even-numbered lines, and no examples where the first RD is not either identical to, or a proper substring of, the second.

5.2.1.3.2 Cynghanedd groes

Another type of rhyme is cynghanedd groes, where a sequence of consonants is repeated in two parts of the line:

(103) /[mal ar 'ʊɪst]l [mil ɪur 'ɔst]<u>ɛg</u>/ <Mal ar wystl, mul yw'r osteg> (22:58)
m l r st m l r st

To recognise this, the script extracted the consonants and the spaces from the line, ignoring the vowels. For the line above, this would be as in (104):

(104) <ml r stl ml r stg>

Starting from the left edge, it takes the first segment that is non-optional (see §5.5.2.2.1 for explanation of the optional segments, but, briefly stated, obstruents are always required to find a match in consonantal cynghanedd, while not all sonorants are). In the case of the line above, the first non-optional segment is <l>. This gives the latest possible start point for the first sequence of answered segments.

It then searches for the earliest possible start point for the second sequence of answered segments. In this case, because the optional segment <m> is not the only <m> in the line, the script tries to form a rhyme including it. The earliest possible start point for the second sequence, in this line, is the second <m>.

The script then tries to create a regular expression that will find matches for every non-optional segment beginning from this position, to the end of the line. In cases where the final word ends in a consonant, this consonant will not be a part of the cynghanedd. So, the script tries to find a match again, excluding the final consonant of the second sequence until it is able to find a match. Because only the final interval of each hemistich may be excluded from the repeating consonant sequence, the spaces were left in the consonantal representation to prevent the script from excluding more than a word at the end of the line or hemistich.

In the example from (104), the script would find a match by starting each repeating sequence at the <m>, and excluding the final <l> that appears before the second <m>, and the final <g> at the end of the line.

Once this regular expression has been found to be successful on the consonantal representation of the line, it is plugged into a different regular expression that accounts for vowels. This allows it to place a caesura at a word boundary, and to be certain that only the final interval is excluded from either end of either hemistich. Without reference to the position of the vowels, it would allow lines where the second rhyme domain ends well before the final interval of the line. This is disallowed according to the rules of cynghanedd, and such lines do not occur.

5.2.1.3.3 Cynghanedd draws

In cynghanedd draws, a sequence of consonants is repeated in two parts of the line, similar to cynghanedd groes, but with a sequence of unanswered consonants between them:

(105) /['pl]a ar hɔɬ vɛrxɛd ə '[pl]ʊiv/ <Pla ar holl ferched y plwyf!> (137:2)
pl (r h ɬ v rx d) pl

To test this, the script starts as it did for cynghanedd groes, looking for the latest allowable starting position of the first sequence, and the earliest possible starting position of the second. If it is able to find a sequence that matches every consonant from the second sequence to the end of the line (excluding consonants in the final interval), it checks to make sure that every consonant in the line is either in one of the two answered sequences, or is in a hemistich-final interval. If there are any unanswered consonants appearing between these two matching answered sequences, the line is categoriezed as cynghanedd draws.

5.2.1.3.4 Cynghanedd sain

Cynghanedd sain described a line where two non-final words end in the same interval, and there is also consonant correspondence towards the end of the line. In the example in (106), the /eð/ sequences rhyme, and the consonance is between the two /m/.

(106) /a 'g^{w}l[e:ð] am an'r̥ʌd[eð] 'maʊr/ <A gwledd am anrhydedd mawr> (73:15)
m m

These lines were recognised by searching for a match between two non-line-final words consisting of a single vowel segment, to allow imperfect rhyme of diphthongs and to catch as many examples of hiatus as possible, plus every consonant to the end of the word. The consonant rhyme was not checked for by the script, because the rhyming intervals alone were sufficient to diagnose the presence of cynghanedd sain in a line – there appears to be no accidental rhyme without the consonant rhyme present as well. This also allowed the script to not discount the cases where the consonant matching consisted of a pair of empty rhyme domains. (See §5.6.3.2 on this.)

5.2.1.3.5 Multiple cynghanedd lines

The script analyzed every line for each of the four types of cynghanedd. The corpus contained 881 lines which were recognised as having more than one type of cynghanedd in them, therefore the total number of lines in the analyzed corpus (9,021) is higher than the total in the corpus of the works of Dafydd ap Gwilym (8,140).

For example, the line in (107) can be interpreted both as cynghanedd lusg (which will be described more fully in §5.2.2.2.1) as in (107a) with the [ɛs] interval rhyming, but also contains a complete repetition of all the consonants across both hemistichs, which can be interpreted as cynghanedd groes (§5.2.2.2.2) as shown in (107b) with a repetition of the consonants <dglns>. (See Rowlands (1976:xliv) for more on double cynghanedd.)

(107) a. /dɛglen 'n[ɛ:s] | dʊi glɪn '[ɛs]ɪθ/ <Degle'n nes, dwy glun esyth> (25:31)

b. /[dɛglen 'nɛ:s] | [dʊi glɪn 'ɛs]ɪθ/
d gl n n s d gl n s

The presence of lines containing multiple types of cynghanedd suggests that the grammars for each type of cynghanedd were available to the poet simultaneously, and that each line was evaluated for each type of cynghanedd.

About 19%, or 1,572 of the 8,140 lines, have no recognizable cynghanedd in them. However, this number should be thought of as the upper limit for lines without cynghanedd in this corpus. This number also includes the lines which are fragmentary, either for stylistic reasons or because the original manuscripts were illegible, as well as lines in a different meter which were so long that they would cause difficulties for the script. The script also missed examples which feature correspondence based on the assimilated values of particular segments, such as voicing assimilation or nasal place assimilation. The phonemic representation of the poems was not able to capture this phonetic data. There are also some lines which include cynghanedd that was not recognised by the script, usually due to difficulties in parsing sequences of multiple vowels. The Python script also erred on the side of counting ambiguous cases as not cynghanedd. Some lines which met certain conditions of being difficult for the script to parse that were encountered in the testing corpus, such as including a large number of optional consonants, were checked by hand.

Lines which truly contain no cynghanedd may show some alliteration instead as line-internal ornamentation. In Dafydd ap Gwilym's time, it was permitted to have lines without cynghanedd (Bromwich, 1982: xvi) but later, more restrictive, rules for this type of poetry insist that every line include cynghanedd. (Parry, 1929) This alliteration can look like the word-initial alliteration that is found in other poetic traditions. Two examples of this are below, with the alliterating segments in bold italic. In these two examples, the liquids following the bold consonants also match. Further work is needed to show whether this is a regular pattern.

(108) a. /***m***aʊr ɪu ***m***ɪragl eɪ gʊɪnbrɪd/ <Mawr yw miragl ei gwynbryd> (139:17)
b. /***d***ɪlaɪs ə ***d***eɪli hɛb ʌstrɪu/ <Dilaes y deily heb ystryw> (124:29)

The scripts written to search the corpus for lines of cynghanedd was based on grammatical descriptions, which means that the presence of patterns not described by the grammarians would be missed. However, reading through the database of lines not recognised as containing cynghanedd, there does not appear to be any pattern of correspondence not described by the grammars. Although this corpus analysis is not detailed enough to allow for statistical analysis, it does allow me to test how often particular noted exceptions to the strictest rules do occur, so that I can make a decision on which to incorporate into the analysis based on their frequency.

For example, although Dafydd ap Gwilym will imperfectly rhyme <ai> and <ei> in cynghanedd lusg quite often (see §5.4.3.1.2), he almost never produces the fault in which the order of the consonants relative the stressed vowel is different in two hemistichs in consonantal cynghanedd. Additionally, the grammars described the consonantal correspondence that is a part of cynghanedd sain simply as "loose consonant rhyme", although Dafydd ap Gwilym's rhymes have a regular pattern to the location of the consonantal rhyme domain in cynghanedd sain.

5.2.2 Meter and ornamentation of Welsh poetry

5.2.2.1 Welsh meters

The types of meters that are used by Dafydd ap Gwilym are the cywydd and the englyn. The cywydd, is a form of Welsh verse, and makes up the majority of the poems in the corpus and will be the focus of this introduction. The number of syllables per line is more variable in englyn, between four and ten, depending on the line's position in the stanza and the specific sub-type of englyn.

In cywydd, lines of seven syllables are paired into couplets, which are linked by line-final rhyme that consists of a matching interval. In one line of a couplet, the line must end on a stressed syllable, and in the other on an unstressed syllable. Because Welsh stress is penultimate, this has an effect similar to *debide* in middle Irish poetry (refer to §3.1.1 on the Irish), where a line ending in a monosyllable will be paired with a line ending in a polysyllabic word.

An example of this is below in (109), the first four lines of the poem *Morfudd fel yr Haul*, by Dafydd ap Gwilym. In the first couplet, the line-final rhyme /aɪs/ is seen in a bisyllabic word in the first line and a monosyllabic one in the second. However, in the second couplet, the order is reversed, and it is the polysyllabic word which is in the second line. This is different from Irish *debide,* (§3.1.1) where the rhyme domain containing a stressed vowel must always be in the first line of a couplet.

(109)	'gorɬʊin əð ʊiv ðin 'geɪrɬ*aɪs*	Gorllwyn ydd wyf ddyn geirllaes,	(111:1-4)
	gorɬɪu eɪri 'ma:n marɪan 'm*aɪs*	Gorlliw eiry mân marian maes.	
	gʊil 'ðɪu maɪ golaɪ o 'ð*in*	Gwŷl, Dduw, mae golau o ddyn,	
	go'leɪ.ax nɔg aɪl 'ɛʊ*in*	Goleuach nog ael ewyn.	

This sample, combined with the fact that Welsh stress is penultimate, and the two lines of a couplet alternate between ending in a stressed syllable or a trochee, suggest that the seven-syllable line of cywydd may result from a loose trochaic meter. If this were the case, we would expect to find more lines beginning with either a bisyllabic word or four-syllable word, in order to begin the line with a trochee. However, comparing the number of 2- or 4-syllable words in line initial position to their distribution elsewhere in the line shows they are no more likely to occur here than anywhere else:

(110)

Number of syllables in word:	First word in line:	Elsewhere in line:
One	65.1%	67.0%
Two	28.3%	27.2%
Three	6.2%	5.3%
Four	0.3%	0.4%

This alone cannot be taken as evidence against a violable meter of periodic stresses, but it does show that the simplest test possible gives no evidence for such a meter.

These couplets of two seven-syllable lines form stanzas of any length, which may be further linked by line-initial alliteration (where every line in the stanza begins with the same consonant) or some less predictable pattern such as rhyme in the first word of each line, or repetition of a word at the beginning of the line. Stanzas may also be grouped by subject or theme, much like a paragraph in prose.

In the example in (109), each line in the stanza, which goes on for ten more lines, begins with /g/. Additionally, in the first couplet, repeated in (111), the first word of the second line, /gorɬɪu/ repeats the /grɬ/ sequence of the first line in addition to the cynghanedd of its own line. This is an irregular occurance but is an example of the types of additional ornamentation that can occur within stanzas.

(111) /'gorɬʊin | əð ʊiv ðin 'geɪrɬ*aɪs*/ <Gorllwyn ydd wyf ddyn geirllaes> (111:1-2)
g rɬ (ð v ð n) g rɬ
/gorɬɪu eɪri 'm[a:n] | marɪ[an] | 'm*aɪs*/ <Gorlliw eiry mân marian maes>
g rɬ m m

None of these line-peripheral ornamentation (that is, the alliteration and line-end rhyme) are examined further in this chapter, except so far as they interact with cynghanedd.

5.2.2.2 Types of cynghanedd

Cynghanedd likely developed out of increasingly complex patterns of alliteration and rhyme in earlier Welsh poetry, and falls into four main types. These are cynghanedd groes, or "cross harmony"; cynghanedd draws, or "bridge harmony"; cynghanedd sain, or "sound harmony"; and cynghanedd lusg, or "drag harmony".

In each of these types of cynghanedd, the line, which consists of seven syllables/intervals in cywydd, is divided into parts – either two or three – each of which must be linked by corresponding segments, while not interfering with the line-final rhyme. I introduce the basic facts of each of these types briefly below before turning to a more detailed analysis of each.

The Statute of 1523, mentioned above, required that every line by ornamented by some form of cynghanedd in addition to the line-final rhyme, but in Dafydd ap Gwilym's poems, some lines may only contain final-rhyme and perhaps some alliteration.

While there are four different kinds of cynghanedd, for the most part, any of them may be used in any line as long as the line meets the metrical requirements and is divided into the correct number of hemistichs or triolets. This is contrary to, e.g., assonance in the Spanish *Cantar de Mio Cid*, where changes in its use can mark a shift between narration and dialogue in a poem. (Bayo, 2001:85) The only restriction for Welsh is that cynghanedd lusg is limited to use in odd-numbered lines, or the first line of a couplet. This line is considered the weaker of the two, and because cynghanedd lusg is considered a less ornamental form of cynghanedd, it is considered more suitable for use in weaker lines. This is similar to skaldic rhyme, which is limited to the second line of a couplet, felt in that poetic tradition to be the stronger line, while consonance is used in the odd numbered lines. (Árnason, 2007: 97-8)

5.2.2.2.1 Cynghanedd lusg

The type of Welsh cynghanedd that is most similar to skaldic rhyme is cynghanedd lusg, or 'drag harmony', which is limited to the first line of a couplet, or the odd numbered lines of a poem. These make up only 8%, or 652/8140, lines of my corpus. In this type of cynghanedd, there are two main stresses in the line, one of which must be the penultimate vowel in the line (which, because the final main stress must fall on the final word, means that the last word of the line must be polysyllabic). The other main stress will be earlier in the line, on a word of any length, and the caesura will be immediately after that stressed word.

The left RD will be the interval immediately before the caesura. The right RD is the final stressed interval of the line, meaning the penult.

(112) /prʌni 'r̥[ɔst] | nɪd ɛr 'b[ɔst]jaʊ/ <Prynu rhost, nid er bostiaw> (73: 11)

In (112), the two rhyme domains contain stressed vowels. The left RD contains all the consonants to the end of the word, and the right RD contains all consonants up to the following vowel, though in some cases, some of these will be unanswered.

5.2.2.2.2 Cynghanedd groes

There are two types of consonantal cynghanedd, one of which is called cynghanedd groes, or 'cross harmony', which makes up 24%, or 2,018/8,140, of the examples in the corpus.

In cynghanedd groes, the line is divided into two hemistichs by a caesura which falls after the word containing a prominent stress. Both RDs extend across entire hemistich (in most cases excluding final interval of each, underlined in the example below), and no consonants are unanswered.

(113) /[mʊi no 'd]<u>ɪm</u> | [am ɛnaɪd] <u>ɪu</u>/ <Mwy no dim, a'm enaid yw> (111:16)
m n d m n d

In (113) the sequence <mnd> is repeated in each hemistich. The location and identity of the vowels separating the consonants does not matter. The syllabic position of the consonants in correspondence need not match.

5.2.2.2.3 Cynghanedd draws

The other type of consonantal cynghanedd is similar to the above, and called cynghanedd draws. (This also means cross harmony, but in a slightly different sense. It is sometimes translated as "bridge" harmony because it bridges over some segments.) Examples of this type of rhyme account for 22%, or 1,838 out of 8,140 lines in my corpus.

The left RD extends from the left edge up to (or sometimes including) the final interval of the hemistich. The right edge of the right RD precedes the final interval, and its left edge will go as far left as possible without including an unanswered consonant.

(114) /['deɪθ]im | i ðɪnas ['dɛθ]ɔl/ <Deuthum i ddinas dethol> (73:1)
d θ (ð n s) d θ

In the example in (114), the sequence <dθ> is repeated from the first rhyme domain at the end of the second hemistich, and the consonants <ðns> are skipped over with no correspondents.

The rules regarding the location and contents of the rhyme domain are the same as for cynghanedd groes, except that the second RD need not extend all the way to the caesura. That is, there may be consonants in the middle of the line which do not correspond with anything, but the first RD must extend to the left edge of the line.

5.2.2.2.4 Cynghanedd sain

The fourth kind of cynghanedd is called cynghanedd sain, or sound harmony. It is a mix of interval rhyme and consonantal cynghanedd. This makes up 36%, or 2,941 out of 8,140 lines in the corpus. In this type of rhyme, the line is broken into three parts, instead of two, with caesuras falling after three main accents, one of which marks the end of the line.

The final intervals of the first and second parts rhyme: in (115), the /eð/ in square brackets.

(115) /a 'g^{w}l[e:ð] | am an'r̥ʌd[eð] | 'maʊr/ <A gwledd am anrhydedd mawr> (73:15)

The second and third parts are connected by consonant harmony. Every consonant in the third part of the line, excluding the final interval, must find a correspondent consonant in the second part of the line. The second part may contain unanswered consonants.

(116) /a 'g^{w}l[e:ð] | am an'r̥ʌd[eð] | 'maʊr/ <A gwledd am anrhydedd mawr> (73:15)
m m

In (116), the <m> of the third part of the line also appears in the second part. However, there are also the unanswered consonants /n,r̥,d/ in the second part. Note that this consonant correspondence is not just alliteration, if one takes alliteration to consist of a single word-initial consonant (or cluster). While in many cases the only consonant participating in the line from the third triolet will be a word-initial consonant or cluster, this may correspond to a post-vocalic consonant in the second triolet, as is the case above. There are also cases where a sequence of consonants across multiple syllables will be included in the rhyme domain.

5.2.3 Phonology of Welsh

The following description is intended to give a minimal reference for understanding this chapter. For a more detailed account of the phonology of Welsh, see Hannahs (2013).

5.2.3.1 Stress and pitch accent

Welsh stress falls on the penultimate syllable of a polysyllabic word. In the few exceptions that exist, the stress is final. These exceptions are mostly the result of fused vowel hiatus. For example, in (117):

(117) /kəm'raɪg/ < /kəm'ra.ɪg/ *Cymraeg*, "Welsh language"

or words that were originally a preposition plus a noun, as in (118):

(118) /ə'm̥ɛɬ/ < /ən + 'pɛɬ/ *ymhell* < yn + pell, "far"

In addition to the stress accent, there is also a pitch accent on the final syllable. For details on the accent system of Welsh, including its phonetic realization, see Williams (1983) and Cooper (2015).

5.2.3.2 Phoneme inventory

The phonemic transcription used here differs from that used by other linguists in a few ways. First, I transcribe the shorter vowel of a diphthong as a vowel, and not as a glide, as does Watkins (1961: 9,14). This helps to distinguish these short vowels from the 'hiatal' /w/ (in §5.2.3.3.2) and the glide /j/ that can occur before a diphthong. I also differ in my transcription of the vowel written as <y> in the Welsh orthography. While many linguists transcribe it as /ə/ in its 'obscure' pronunciation under stress, I use /ʌ/ to represent it, and use /ə/ for its pronunciation in a position before stress. The transcription here is, to the extent of my knowledge, more representative of a southern Welsh dialect, which is what would be spoken in the region where Dafydd ap Gwilym lived. There are several differences in vowel quality in northern varieties of Welsh.

5.2.3.2.1 Consonants

Below are the Welsh consonants that will be relevant to the poetry of Dafydd ap Gwilym. The voiceless nasals occur mainly as a result of consonant mutation, but do not appear in the citation form of words, except where the mutation has occurred at the morpheme boundary in a compound.

	Labial	Dental	Alveolar	Postalveolar	Velar	Glottal
Plosive	p b		t d		k g	
Nasal	m̥ m		n̥ n		ŋ̊ ŋ	
Trill			r̥ r			
Fricative	f v	θ ð	s	ʃ	x	h
Lateral			ɬ l			
Approximant	w			j		

Figure 9: Welsh consonants

There are also affricates in some loanwords in Modern Welsh. The approximant /w/ in the figure above represents labialization on a preceding /g/ or /x/, or the glide that is the result of a mutation on these labialized velars. The distribution of /w/ and /j/ as glides will be discussed with diphthongs in §5.2.3.3.2. The velar fricative /x/ is generally realized as a uvular fricative in most dialects of Modern Welsh.

5.2.3.2.2 Vowels and diphthongs

Welsh vowels, except for the schwa, contrast for length. The length contrast is only licensed in monosyllabic words, before certain consonants.

	Front	Central	Back
High	i(:) ɪ		ʊ u(:)
Mid	e(:) ɛ	ə ʌ	ɔ o(:)
Low		a ɑ(:)	

Figure 10: Welsh vowels

Welsh has many diphthongs. For the purposes of poetry, they are divided into two groups based on which part of the diphthong is more sonorous. The first of these is called *deuseiniaid talgron*, 'rising diphthongs', because they rise from a glide to a vowel.

What I call here a glide is perhaps better explained as a short vowel. These short, high semi-vowels pattern as vowels in hiatus resolution (see §5.2.3.3.2) and in the consonant cynghanedd. I use /ɪ/ and /ʊ/ to denote them, rather than /j/ and /w/ for this reason.

Rises from /ɪ/	Rises from /ʊ/
ia /ɪa/ ie /ɪe/ io /ɪo/ iw /ɪu/ iy /ɪi/	wa /ʊa/ we /ʊe/ wo /ʊo/ wi /ʊi/ wy /ʊi/ ~ /ʊʌ/

Figure 11: Rising diphthongs

These may rhyme with each other or with a short monophthong as long as the second part is the same. i.e. /ʊe/ may rhyme with /e/ or /ɪe/.

The second kind of diphthong is called *deuseiniaid lleddf*, or 'falling diphthongs', because the more sonorous part of them is the first element. These are divided into three groups, based on whether they fall to a front or back high vowel, and whether they arose from historical hiatus. Similar to the rising diphthongs above, these may rhyme (imperfectly) as long as the second element matches and they are part of the same group.

Fall to /ʊ/	Fall to /ɪ/	Former hiatus
aw /aʊ/ ew /eʊ/ ow /oʊ/ yw, uw, iw /iʊ/	ae, ai /aɪ/ oe, oi /ɔɪ/ wy /uɪ/ ei /eɪ/	au /aɪ/ eu, ey /eɪ/ ou /ɔɪ/

Figure 12: Falling diphthongs

5.2.3.3 Relevant phonological processes

Some phonological processes that occur in Welsh will be relevant to understanding why particular imperfect rhymes are permitted.

5.2.3.3.1 Consonant mutations

Welsh, like all the modern Celtic languages, has consonant mutations which show morpho-syntactic relations between lexical items. The initial consonant of the affected word will, if possible, become voiced, spirantized, or nasalized, depending on the trigger, but will maintain the same place of articulation. The details of this are largely unimportant for this study, except to mention that the surface (post-mutations) form of a word is what is compared for cynghanedd, unlike Irish alliteration, which compares the citation form. (Murphy, 1961:37)

One place where mutations occur is in adjectives following feminine nouns, such as *cynghanedd.*

(119) a. croes /krɔɪs/ ⟶ cynghanedd [g]roes, "cross harmony"
b. traws /traʊs/ ⟶ cynghanedd [d]raws, "bridge harmony"
c. sain /saɪn/ ⟶ cynghanedd [s]ain, "sound harmony"
d. llusg /ɬɪsk/ ⟶ cynghanedd [l]usg, "drag harmony"

More details of what consonants under go what changes where and when are available in King (2003: 13-19).

5.2.3.3.2 Glides vs. short vowels

The question of whether the glides in Welsh are considered consonants or not is a relevant question with a different answer depending on the type of cynghanedd involved. One test for this in Welsh grammar is hiatus resolution after the definite article. The definite article takes the form *y*, /ə/, before consonants and *yr*, /ər/, before vowels and /h/. (King, 2003: 29-30)

Testing some words with the so-called "rising diphthongs" which begin with the more glide-like part, we see that they use the hiatus-resolving form of the definite article, suggesting they pattern as vowels in this part of the grammar as well as for poetry. The correct forms are in (120a-b) while the unattested forms with hiatus are in (120c-d). As an additional example, (120e) shows the hiatus-resolving form of the definite article appears before an /h/.

(120)	a. yr wy	b. yr yw	c. *y wy	d. *y yw	e. yr hebog
	/ər ʊi/	/ər ɪu/	/ə ʊi/	/ə ɪu/	/ər hɛbɔg/
	'the eggs'	'the yews'			'the hawk'

Feminine nouns undergo a mutation following the definite article where an initial /g/ becomes null. This allows us to test the <w> which represents labialization on a preceding /g/. (121a) shows that the form of the definite article is the one used before consonants. (121b) shows that when the mutation leaves a word undeniably vowel-initial, the definite article takes on the hiatus-resolving form, which means that it is concerned with the surface form of the word, and not correspondence to the hiatus form. (121c) shows an example where the <w> is part of a "rising" diphthong and not marking labialization on the <g^w>. In this case, we see the <w> is treated like a vowel.

(121)	a. /DEF + 'g^{w}agva/ , <gwagfa>	b. /DEF + 'gɔrsav/ , <gorsaf>	c. /DEF + 'gʊʌlan/ , <gwylan>
	[ə wagva]	[ər ɔrsav]	[ər ʊʌlan]
	'the vacuum'	'the station'	'the seagull'

Writing the diphthong onset as /ʊ/ disambiguates this sound from the /w/ that is the result of a mutation on /g^w/.

5.2.3.3.3 Vowel alternations under stress

There are two vowel alternations which occur between stressed and unstressed syllables which will play a role in rhyme.

5.2.3.3.3.1 The vowel written with <y>

There are two regular vowel alternations under stress in Welsh. The first is the two pronunciations of <y>. In the stressed, penultimate syllable, it takes on what is called its 'obscure' sound, /ʌ/. In the final, pitch-accented syllable, it has what is called its 'clear' sound, /i/ or /ɪ/. Elsewhere, pronunciation varies among dialects, usually as either /ə/ or /ɨ/.

In the example in (122), adapted from Hannahs (2013:60) but adjusted to match my transcription style, the word for 'mountain' has two vowels, each written with <y>. In the singular, shown in (122a), the first of these is stressed, and realized as /ʌ/. The second falls under the pitch accent, and is realized as /ɪ/. When the plural suffix is added, the stress shifts, so that in (122b), the first <y> is unstressed, and realized as a schwa. The second <y> then moves from being pitch accented to stressed, and changes from the 'clear' to the 'obscure' pronunciation.

(122) a. /'mʌnɪð/ , mynydd , "mountain"
b. /mə'nʌðɔɪð/ , mynyddoedd , "mountains"

Welsh vowels in general do not reduce, so even in unstressed, non-final positions, the transcription of <y> with /ə/ may be misleading. The monophthong written with <w> shows a similar alternation in final and non-final positions.

5.2.3.3.3.2 Stress alternations of diphthongs

The second stress-related vowel change is that the diphthong /aɪ/ (by any orthography) can become /eɪ/ in the stressed penultimate syllable. For example, in (123a), the word for 'animal' contains an /aɪ/ diphthong in an unstressed final syllable. When the plural suffix, *-iaid*, is added, in (123b), that diphthong is placed in the penultimate, stressed syllable, and its pronunciation changes to /eɪ/. (See Allen (1975) for more details and analysis of this process and how it can diagnose different types of compounds.)

(123) a. /a'ni:vaɪl/ , <anifail>, 'animal'
b. /anɪ'veɪljaɪd/ , <anifeiliaid> , 'animals'

The diphthongs involved in this alternation will be permitted to rhyme in certain circumstances.

5.3 The location of the caesura(s) in cywydd

For cywydd, every line consists of seven syllables. This, I assume, is derived by mapping a sequence of seven syllables onto a metrical template. Despite the lack of a periodic meter for Welsh verse, the seven syllable line is derived by a metrical template, which may be violated quite freely to fit the stresses of the utterance being mapped to it. A similar approach is used for the meter of French alexandrines, which were also thought to be based purely on syllable counting, but upon inspection turn out to show a strong preference for certain patterns of stress. (Porohovshikov 1932, Gasparov & Tarlinskaja 2008) The analysis of caesura placement in this section does not consider any lines which do not contain exactly seven syllables.

Cynghanedd requires the line to be split into hemistichs (or triolets, for cynghanedd sain) which contain sequences of segments in correspondence. Traditional descriptions describe the line as being split based on the position of two or three main stresses of the line. While cynghanedd is dependent on these subdivisions of the line to exist, it is not necessary for every line to contain cynghanedd at the time of Dafydd ap Gwilym's writing. In his corpus of 8,140 lines, 1,572 (or 19%) of these contain no cynghanedd that was recognised by the Python scripts I used, but may have alliteration as line-internal ornamentation instead.

The alignment of the rhyme domains analyzed in later sections will make reference to sub-divisions of the line, either hemistichs or triolets. This section looks at the definition of these variably-sized divisions. A seven-syllable line of cywydd is said to be split into two hemistichs (or three triolets) ending after a word containing a main stress of the line. This means that the types of cynghanedd that are available for a line depend on its prosodic structure and the number of prominent stresses it contains. One of these main stresses will be in the final word of the line, with the main stress falling on its penultimate or final syllable. The other one or two main stresses may fall on any stressed vowel earlier in the line, and the choice among these is said to be determined by the phrasal stress of Welsh.

For example, I present the line in (124), where main stress is indicated by a vertical line and word-stress by an acute accent. There is a main stress on the final word of the line, /ˈdʌ́vaɪ/, and one on the first word of the line, /ˈdíveθ/. The caesura falls after the first main-stressed word.

(124) /ˈdíveθ̣ | írgɪrs ə ˈdʌ́vaɪ/ <Difeth irgyrs a dyfai> (32:3)

While the caesura represents the break between hemistichs and only occurs line-medially, both hemistichs end after the main-stressed words. Because the second hemistich aligns to the end of a line, there is no need to represent the break with a hemistich.

5.3.1 Grammatical descriptions of the stresses in cynghanedd

Describing this system, Rowlands (1976: xxvii) writes: "Cynghanedd [...] is based on the relationship between emphasized or stressed words within the line, and its analysis depends upon the accentuation of those emphasized words." For cynghanedd groes and cynghanedd draws, "the line is divided into two halves, each ending in an emphasized word. The pause or caesura after the first emphasized word is called the gorffwysfa." (/gor'fuɪsva/) (1976: xxix) An example of this is the cynghanedd draws in (125), where the <dv> pattern repeats on both sides of the caesura, in order relative to the main-stressed vowels:

(125) /ˈdíveθ | írgɪrs ə ˈdʌ́vaɪ/ <Difeth irgyrs a dyfai> (32:3)
d v d v

In cynghanedd sain, another prosodic structure is required of the line, so here, "there are three emphasized words, and two pauses, dividing the line into three parts." (1976: xxxvi) An example of this is in (126). Here, there are three main stresses in the line and two caesuras. There is rhyme between the final intervals, [an], before the two caesuras, and there is consonant correspondence of /m/ between the second and third triolets, centered around the stressed vowels.

(126) /díu ˈkál[an] | mis ˈmʊ́ɪnl[an] | ˈmáɪ/ <Dyw calan mis mwynlan Mai> (32:4)
m m

For cynghanedd lusg, in addition to there being two main stresses in the line, there is also a restriction on the location of the second main stress: "the last word and one other word are metrically emphasized. The last word in the line must have more than one syllable and be accented on the penultimate syllable." (1976: xxvii) The example of this below shows rhyme between the final interval, /ɔ́ɪd/, before the first caesura, and the stressed penultimate interval of the final word of the line.

(127) /dɪgrínvlaɪn 'g[ɔ́ɪd] | a-m '[ɔ́ɪd]aɪ/ <Digrinflaen goed a'm oedai> (32:5)

Other scholars discuss the relation between the syntax of the line and the main stresses which divide it into hemistichs in more general terms, such as Conran (1995: 326) who describes cynghanedd as being organized around the main stresses of the line. Ford (1996) also writes about the relationship between the ictus positions of the line and the syntax, and how those both determine the cynghanedd patterns and affect the meaning of the line. He mentions ap Gwilym's use of stress to create and resolve ambiguities in the readings of his lines. For example, he notes that in the first line of the poem, *Mis Mai*, a word, /maɪ/, which, without any information about stress is ambiguous between the stressed proper noun *Mai*, 'May', and unstressed *mae*, 'that'. By using the cynghanedd pattern to show that this particular word would be unstressed, it disambiguates between the readings, although Ford mentions that having both interpretations available contributes to the complexity and beauty of the poem. (1996: 24-25) He also mentions that consonant mutations, another way of disambiguating grammatical relations in Welsh, do not hold across a caesura (1996: 26), which suggests the caesura corresponds to an intonational phrase break, according to the analysis of Welsh soft mutation proposed in Hannahs (1996).

As a guide to determining which words are the emphasized ones, Jones (2015: 1) suggests that one "note the natural speech accents" of the line in trying to determine what kind of cynghanedd it contains. He gives the examples of four sequential lines of the poem *Mis Mai* by Dafydd ap Gwilym, which I reproduce in §5.3.2, glossed, and with translation from `dafyddapgwilym.net`. While the phrasal stress of Welsh, particularly in this somewhat archaic and poetic syntax, is a topic that needs to be explored further, I explain the syntax of the following sample of lines as an illustration. In these examples, and a handful more that are not included, the generalization seems to be that the main stress will fall on the right-most stressed vowel of an XP. However, I also include in §5.3.2.1 some apparent counter-examples to this, which would need to be accounted for in a more complete theory of Welsh prosody and meter.

5.3.2 Towards syntax-prosody mapping for Middle Welsh

I assume that the phrasal-level metrical prominences are derived through the constraint interaction of an ALIGN-XP constraint and other prosodic constraints, based on the constituent structure. Therefore it is important to understand something of Middle Welsh syntactic structure, which I introduce here.

In the examples below, each lexically stressed vowel, which is a potential site for a main stress, is marked with an acute accent, and the two or three main stresses of the line are marked with vertical lines.

The line in (128) is an example of cynghanedd draws, with repetition of the <dv> sequence around the two main-stressed vowels. In this line, the adverb /díveθ/ appears as the first word of the sentence, possibly in a focus position. Middle Welsh was verb-second (for more on Middle Welsh grammar, see Willis, 2010) and this sentence is an example of that, with the subject, /írgɪrs/, in topic position.

(128) /ˈdíveθ írgɪrs ə ˈdʌ́vaɪ/ <Difeth irgyrs a dyfai> (32:3)
unfailingly green-reeds PRT grow
'Fresh stalks grew unstintingly'

I take the syntactic structure of this line to be as in (129), loosely following the analysis presented in Borsley, Tallerman, & Willis (2007: 286-33). I diverge from their proposed structure for Middle Welsh in placing the adverb in a focus position, while they take a more neutral stance and say adverbials may join freely to a CP either before or after the topic position (2007: 294). Their analysis also mentions that there is no evidence to show whether the verb remains in T or moves to C with the particle <a>[25], but following their approach I show the verb raising to C.

In the examples below, I show three levels of stress. Line 0 indicates a vowel that fills a syllabic position in the line. Line 1 indicates word stress, and line 2 indicates a main stress of a hemistich. There is a general tendency for the second member in a pair to be stronger, and it is said [source] that the last main stress of the line is more strongly emphasized. An additional

25 This particle appears as 'a' if the topic is an argument of the verb, and as 'y' if the topic is an adjunct.

level of stress could fall on the last of the stresses at level 2, but this additional layer of prominence has no affect on the rest of the analysis of cynghanedd.

```
(129) 2      x                    x
      1      x          x         x
      0      x x        x x     x x x
```
$[_{FocP}$ $[_{AdvP}$ 'díveθ] $[_{CP}$ $[_{NP}$ írgɪrs] $[_{C'}$ $[_{C}$ ə 'dʌvaɪ$_{j}$] $[_{TP}$ $[_{T}$ t_j] $[_{VP}$ …]]]]]

Taking the adverb to be in a focus position adds some rationale for it bearing some additional prosodic emphasis and for /'díveθ/ bearing one of the main stresses of the line, though my observation that the caesura follows an XP would not be affected by having the adverb attach to CP instead of a focus position. Of this example, Jones (2015:1) writes that "it wouldn't matter if you heard a third [main accent]", which suggests that the topic, /írgɪrs/ is another potential site for the main accent in this example. Perhaps interpreting the adverb as attaching in CP accounts for a reading where /írgɪrs/ bears an equally prominent stress to /'díveθ/.

However, interpreting the adverb in a focus position means that it will be more prominently stressed, and marks the end of a hemistich. That makes this line eligible for the types of cynghanedd that use two hemistichs. Because the first one only contains two syllables, it would be difficult to find a match for every consonant across both hemistichs. Because cynghanedd draws allows a sequence of consonants in the middle to go unanswered, it is a good candidate for this line structure. So, we see the /dv/ of /'díveθ/ repeated around the second stress in /'dʌvaɪ/ with <rgrs> skipped in the middle.

In the next line, in (130), with a syntactic structure in (133), every word is lexically accented and is a potential site for a main stress of the line. This line is an example of cynghanedd sain, with the /an/ of the first two stressed words rhyming, and consonant correspondence between the /m/ of /máɪ/ and the /m/ of /mʊ́ɪnlan/.

(130) /díu 'kálan mis 'mʊ́ɪnlan 'máɪ/ <Dyw calan mis mwynlan Mai> (32:4)
day calends month pure-gentle May
'on the first day of the pure gentle month of May.'

The line is a series of three nouns forming a genitive noun phrase. In Welsh genitives, the possessor follows the possessee, with no overt genitive morphology. Borsley, Tallerman, & Willis (2007: 184-195) offers some proposed analyses of Welsh noun phrases, which have informed the very simplified structure I use below. However, due to the complex facts of Welsh construct-state nominals and the distribution of consonant mutations which are often used as a diagnostic for syntactic relations, there is no agreed-upon structure for Welsh noun phrases. The viability of the generalization that a main stress falls at the right edge of an XP depends on the structure one adopts for the Welsh NP/DP.

The first words of this example, /díu kálan/, 'the first day of the month', are a genitive phrase of their own. This is followed by a noun, 'month', which is modified by an adjective, 'pure-gentle', which is then followed by the noun 'May'. The three main stresses of the line are the second part of the compound noun phrase, /kálan/; the adjective /mʊ́ɪnlan/ following a noun; and, as we expect, the last word of the line, /máɪ/.

```
(131) 2              x                          x           x
      1        x     x                x         x           x
      0        x     x x              x         x   x       x
      [NP [N' [N díu ] [NP 'kálan ]] [NP [NP [N mís ] [AP 'mʊ́ɪnlan ]][NP 'máɪ ]]]
```

Because this line contains three main stresses, it is eligible for cynghanedd sain, because the stresses divide the line into triolets.

The line in (132), is an example of cynghanedd lusg where the /ɔ́ɪd/ of the first main-stressed word rhymes with the /ɔ́ɪd/ of the final word in the line. This line is another example of a V2 sentence, where the topic is a noun modified by a pre-posed adjective, /dɪgrɪnvlaɪn gɔɪd/, and the second element of this bears a main stress of the line.

(132) /dɪgrínvlaɪn 'gɔ́ɪd a -m 'ɔ́ɪdaɪ/ <Digrinflaen goed a'm oedai> (32:5)
unwithered-top trees PRT-1SG delay
'Trees with unwithered tops detained me,'

```
(133) 2                    x                    x
      1          x         x                    x
      0       x  x   x     x              x     x x
      [CP [NP [A dɪgrínvlaɪn ] [N 'gɔ́ɪd ] [AP t]] [C' [C a -m 'ɔ́ɪdaɪ ] [TP [T t ] [VP ...]]]]
```

The second main stress of this line is the final word, the verb /ɔ́ɪdaɪ/. The second stress is penultimate in the line, which makes the line a candidate for cynghanedd lusg. Pre-posing the adjective allows the noun, which rhymes with the stressed /ɔ́ɪd/, to be final in the NP and to bear the phrasal stress. This allows it to be final in the hemistich and to be in the position to form cynghanedd lusg.

In (134), there are two main stresses in the line, before which a sequence of <dm> forms cynghanedd draws. The first of these stresses on an adjective following a noun, which is where we saw the main stress in a noun-adjective pair in (130) as well. This line is another V2 word order with the subject in first position. It is translated as a cleft in the English, though this semantics does not necessarily follow from this word order (Evans, 2003: 141, 180) but this reading could explain some flattening of the accented words following a clefted subject, which ensures that the temporal adverb /dɔ́ɪ/ does not receive a phrasal stress. If it had, this line would have three main stresses and could only have cynghanedd sain. The second main stress is the last word of the line.

(134) /díu 'máʊr ə rɔ́ɪs dɔ́ɪ ə 'máɪ/ <Duw mawr a roes doe y Mai> (32:6)
god great PRT provided yesterday DEF May
'it was the great Lord who provided May yesterday.'

(135)
```
2             x                                            x
1        x    x        x                x                  x
0        x    x     x  x                x               x  x
```
$[_{CP}$ $[_{NPi}$ $[_{N}$ díu] $[_{AP}$ 'máʊr]] $[_{C'}$ $[_{C}$ ə rɔ́ɪs$_j$] $[_{TP}$ $[_{T}$ t_j]$[_{T'}$ $[_{AdvP}$ dɔ́ɪ]$[_{VP}$ t_i $[_{V}$ t_j $[_{NP}$ ə 'máɪ]]]]]]]

From these examples, it appears that the main stress marks the right edge of an XP, which also explains the possibility of perceiving a third main stress in the line in (128). However, a larger sampling of lines and a more thorough investigation into the syntax of Middle Welsh would likely show that the situation is not as straightforward as that.

The above examples have shown noun-noun genitive phrases and nouns modified by adjectives, where the last element in the phrase bears the stronger stress. We might expect to find a different pattern with compound nouns. Because Welsh NPs are generally head-initial (Borsley, Tallerman & Willis 2007: 152) we might expect the first element to be more strongly stressed in the case of compounds. Looking at stress in Welsh compounds and using stress-conditioned vowel mutations as a diagnostic, Allen (1975) determines there are two types of compounds in Welsh: one which is stressed on the penultimate syllable of the entire compound as if it were a single word, and one type in which each element of the compound bears its own stress. However, she does not mention which of these two stresses is stronger.

An informal survey of native Welsh speakers has confirmed a preference to stress the final element in a noun phrase with a greater or equal prominence to the first element in the NP, whether it is a compound, genitive phrase, or noun modified by an adjective. Confirming the results of the survey, Watkins (1961: 28) describes the stress of Welsh noun phrases and compounds by using some minimal pair examples of nouns followed by adjectives in either a 'syntactic expression' or a 'compound combination'. He lays out the patterns as follows, where '1' denotes a primary stress, '2' a secondary, and so on:

(136)

Syntactic expressions	Compound combinations
1 3 1 deryn du ('black bird')	2 3 1 deryn du ('blackbird')
1 3 1 cadair fawr ('big chair')	2 3 1 cadair fawr ('arm-chair')
1 3 1 3 cadair esmwyth ('comfortable chair')	2 3 1 3 cadair esmwyth ('easy chair')

This supports the descriptions of cynghanedd as being based around main stresses which are determined by the syntax and prosody of Welsh. Native speakers and Watkins (1961) describe the most prominent stress of an NP as falling on its final element, which corresponds to the generalization that cynghanedd tends to be centered around the stress of the final element of an XP.

5.3.2.1 Further questions in Welsh phrasal stress

In this section, I present a few counter-examples to the generalization that the main stress will appear on the final element of an XP. These examples cannot be explained under the simple account above which uses only three levels of stress and reserves the third level for the final stress in an XP.

In (137), diagnosing the location of the caesura by the location of the rhyming segments (/ɪg/ forming cynghanedd lusg), it must follow the second word of the line. This means the the caesura comes between an adjective and a degree adverb, when we might expect it to coincide with the (editor-placed) comma after /ɬɛ́ti/, which suggests that this adjective phrase is right-dislocated, and not a part of the NP containing /ɬɛ́ti/.

(137) /ɬɛ́ti ir'ðɛ́dɪg 'ðígaʊn/ <Llety, urddedig ddigawn> (73:5)
accomodation, dignified enough
'... pretty dignified public lodging'

The Modern Welsh analogue of 'enough' precedes the adjective it modifies, suggesting this example could involve adjective pre-posing of some kind that might affect the prosody.

(138)

2		x	x
1	x	x	x
0	xx	x x x	x x
	[$_{NP}$ [$_{N}$ ɬɛ́ti]]	[$_{AP}$ [$_{A}$ ir'ðɛ́dɪg]	[$_{DegP}$ 'ðígaʊn]]

However, under the assumption that the main stress will fall on the final element in an XP, I would expect the stress of the line to be as in (139), but the cynghanedd pattern does not support this reading.

(139)

2	x		x
1	x	x	x
0	xx	x x x	x x
	[$_{NP}$ [$_{N}$ ɬɛ́ti]]	[$_{AP}$ [$_{A}$ ir'ðɛ́dɪg]	[$_{DegP}$ 'ðígaʊn]]

The line below in (140) shows cynghanedd sain with rhyme between the two word-final /an/ sequences, and consonant correspondence with the <s> of /sɛ́rx/ and /sʌ́vrdan/. The first main stress, on /bʌ́xan/, aligns to the right edge of an XP, but then the next main stress falls on a noun which is not final in its NP, assuming the structure in (141).

(140) /tá:l 'bʌ́xan am 'sʌ́vrdan 'sɛ́rx/ <Tâl bychan am syfrdan serch> (137:36)
reward small for love stupified
'meagre payment for my stupefied love.'

```
(141) 2              x                     x          x
      1      x       x                     x          x
      0      x       x x       x           x    x     x
```
[$_{NP}$ [$_{N'}$ [$_{N}$ tá:l] [$_{AP}$ 'bʌ́xan]] [$_{PP}$ [$_{P}$ am][$_{NP}$ [$_{N}$ 'sʌ́vrdan][$_{AP}$ 'sɛ́rx]]]]

In similar examples posed in my informal survey of Welsh phrasal stress, and as described by Watkins (1961) in (136), nouns modified by adjectives were judged to be equally prominent or only slightly less prominent than the adjectives that modified them, despite not being final in the NP. A more complex analysis of Welsh prosody with more levels of prominence might predict a line like (141) to be very natural.

Analysis of the caesura placement in the 74 lines of *Trafferth Mewn Tafarn* showed that in 57 lines, the caesuras were aligned to the right edge of an XP. The 17 lines which had exceptions to this showed a caesura between an NP and either an AP or another NP. This suggests that examples such as (141) are a fairly common exception to the generalization that the main stress of a phonological phrase falls on the final lexical item in an XP. This fits with the observation about stress in Welsh NPs from Watkins (1961).

Hannahs (1996) looks at the syntax-prosody mapping for Welsh by finding the boundaries of intonational phrases and phonological phrases, but does not discuss the relative position of stress within these. He defines the phonological phrase, which seems to correspond to the hemistich in these lines, as follows: "Since Welsh is a right-branching language, the mapping from syntactic structure to ϕ starts with the rightmost lexical head and proceeds leftward, i.e., towards the nonrecursive side. For the purposes of phonology, Nespor & Vogel argue that 'lexical head' refers to a maximal projection headed by N, V or A, but not P." (1996:53)

While the question of what relation exists between the prosodic structure of Welsh and the location of the main stress of the line remains open for future research, for the purposes of this work, I adopt the descriptions cited above and consider the location of the caesuras to be determined by the location of the most prominent stresses of the line.

5.3.3 Constraints on the location of the caesuras

I present the constraints involved in determining the location of the caesura here. These constraints reference the prominent stresses of the line, which, as explained above, are said to be determined by the syntax and prosody of Welsh. I take these to be a part of the structure of the line which the poetic grammar breaking the line into hemistichs can access.

In Welsh cywydd poetry, the line consists of seven syllables and according to the traditional grammars there is not said to be any metrical (i.e. foot) structure limiting where the stressed vowels fall in the line. (Rowlands, 1976: xx-xxi) However, see Hammond (2012: 7-9) for an approach that does put some loose metrical restrictions on the line.

These lines of seven syllables are further divided into either two or three parts by caesura. Lines consisting of two hemistichs are eligible for cynghanedd groes, traws, or llusg. Lines consisting of three triolets are eligible for cynghanedd sain.

5.3.3.1 Alignment of the caesura for hemistichs

A line that is divided into two hemistichs will have one main stress on the final word of the line, falling on either the final or penultimate syllable of the line, and one other main stress at some point before that. Taking the position of this main stress as determined by the prosody, we can use the following constraints to determine the placement of the caesura, where the caesura marks the right edge of a hemistich. This analysis is a stand-in for a more complex system of text-setting. The examples in the previous section show that there is not a perfect mapping between hemistichs and phonological phrases, but that prominent stresses within a phonological phrase may also serve as a main stress of a hemistich.

This analysis assumes that the caesura wants to be as close as possible to the nearest main stress, described by the constraint in (142), but that it cannot fall in the middle of a word, described by the constraint in (143). As mentioned in §5.2.3.1, stress in Welsh falls on the penultimate syllable of a word. Because (143) outranks (142), the caesura will be positioned at the nearest word-break following a main stress.

(142) **ALIGN$_{\text{CAESURA}}$('I-R)** = Assign one violation mark per interval that intervenes between the right edge of a main stress-bearing interval and the nearest following caesura.

(143) **ALIGN$_{\text{CAESURA}}$(ω-R)** = Assign one violation mark to each instance of a caesura that does not align to the right edge of a word.

I begin with an example where both main stresses are in monosyllabic words, like the line in (144), where the two main stresses are marked by vertical lines. In this line, the rhyme is cynghanedd groes with <mnd> repeated in each hemistich. The translation and structure of the line are in (144) and (145), respectively.

(144) /mʊ́i no 'dím a -m ɛ́naɪd 'ɪu/ <Mwy no dim, a'm enaith yw> (111:16)
worse than anything and-my soul is.3SG
'worse than anything, and [yet] she is my darling.'

(145)
```
2                    x                   x
1       x            x           x       x
0       x      x     x     x     x  x    x
```
$[_{\&P}\ [_{AP}\ [_{A}$ mwy$]\ [_{PP}\ [_{P}$ no$]\ [_{NP}$ dim$]]][_{\&}$ a-m $[_{CP}\ [_{NP}$ enaid$][_{C'}\ [_{C}$ yw$][_{TP}$ ...$]]]]]$

In the tableau in (146), the candidate (146a) places the caesura right after each main stress. This analysis also places a caesura after the final stress, somewhat redundantly at the line boundary, to mark the edge of the second hemistich. This caesura aligns to the nearest main stress, but incurs four violations of the ALIGN$_{\text{CAESURA}}$('I-R) constraint

(146) mʊi no 'dɪm am ɛnaɪd 'ɪu	ALIGN$_{CAESURA}$(ω-R)	ALIGN$_{CAESURA}$('I-R)
☞ a. mʊi no 'dɪm | am ɛnaɪd 'ɪu |		
b. mʊi no 'dɪm am | ɛnaɪd 'ɪu |		*!

Because the right edge of the main-stressed interval in (144) coincides with the right edge of a word, any candidate which violated the word-boundary constraint would be harmonically bounded by a candidate which did not. The constraint for aligning with a word boundary becomes useful when we look at lines where at least one of the main stresses occurs in a polysyllabic word with penultimate stress. The example in (147), with the prosodic structure in (148), which contains cynghanedd lusg between the <ɪg> of the last two words in the line, shows more potential unattested (word-internal) caesura placements than the line in (144), because the right edge of the stressed syllable does not line up with a word boundary.

(147) /ɬéti ir'ðédɪg 'ðígaʊn/ <Llety, urddedig ddigawn> (73:5)
accomodation, dignified enough
'... pretty dignified public lodging'

```
(148) 2                  x          x
      1    x             x          x
      0    xx        x   x  x       x  x
```
[$_{NP}$ [$_{N}$ ɬéti]] [$_{AP}$ [$_{A}$ ir'ðédɪg] [$_{DEGP}$ 'ðígaʊn]]

In (149b), both caesuras appear immediately following a main stressed interval, but they each interrupt a word and do not align to the right edge of a word boundary, violating the constraint against this twice. In (149a), both caesuras align to the nearest word-boundary following a main stress.

(149) ɬɛti ir'ðɛdɪg 'ðɪgaʊn	ALIGN$_{CAESURA}$(ω-R)	ALIGN$_{CAESURA}$('I-R)
☞ a. ɬɛti ir'ðɛdɪg | 'ðɪgaʊn |		*, *
b. ɬɛti ir'ðɛd|ɪg 'ðɪg|aʊn	*!*	
c. ɬɛti ir'ðɛdɪg 'ðɪgaʊn		

(149c) is a candidate which has failed to place any caesuras in the line. I interpret this as a possible option, though this line would then not be available for cynghanedd, which is the case for at most 19% of the lines in my corpus. It is not possible to predict from the prosody of the line whether it will contain cynghanedd and a caesura or not. However, by not having any caesura, it does not violate any of the constraints. Presumably, there would be another constraint favoring lines which are parsed into hemistichs. Without cynghanedd to communicate the presence of a hemistich, it is not clear what it would mean for a line to have, or not have, hemistichs.

Although a line which does not contain cynghanedd is permissible, and this analysis looks at the grammar which determines whether a line is acceptable or not, a rhyming grammar operating at a higher level, such as the stanza, or the poem, would likely have a cut-off for the number of lines which may occur without cynghanedd. Additionally, because another purpose of rhyme (in addition to communicating poetic form) is for the poet to show off their skills, a poem without as much ornamentation as possible would fail badly at this goal.

5.3.3.2 Alignment of the caesuras for triolets

This constraint from (142) will also ensure that in lines with three prominent stresses that project to gridline two, a caesura is placed after each of them in the optimal candidate, while the other align constraint will ensure that the caesuras follow the words (rather than the intervals) containing the main stresses.

An example of a line with three main stresses, which will be used for cynghanedd sain, is below in (150) with the prosodic structure in (151). This line shows interval rhyme between two word-final /an/ sequences, and consonant correspondence between the two initial /s/ appearing before the main-stressed vowels.

(150) /tá:l 'bʌ́xan am 'sʌ́vrdan 'sɛ́rx/ <Tâl bychan am syfrdan serch> (137:36)
reward small for love stupefied
'meagre payment for my stupefied love.'

```
(151) 2            x                  x         x
      1     x      x                  x         x
      0     x      x x       x        x    x    x
     [NP [N' [N tá:l] [AP 'bʌ́xan ]] [PP [P am ][NP [N 'sʌ́vrdan ][AP 'sɛ́rx ]]]]
```

In (152), the winning candidate in (152a) is one which places a caesura (meaning, the right edge of a hemistich/triolet) at the end of each word containing a main stress. This incurs two violations of the ALIGN$_{CAESURA}$('I-R) constraint. The candidate in (152b) only places two caesura in the line, giving it two hemistichs rather than three triolets, but this means that the distance from the second main stress to the nearest caesura is greater than it could be, so this candidate is ruled out. The candidate in (152c) aligns each caesura to the end of the main-stressed interval, but places the caesuras in the middle of a word, and is ruled out for violating ALIGN$_{CAESURA}$(ω-R).

(152)

ta:l 'bʌxan am 'sʌvrdan 'sɛrx	ALIGN$_{CAESURA}$(ω-R)	ALIGN$_{CAESURA}$('I-R)
☞ a. ta:l 'bʌxan | am 'sʌvrdan | 'sɛrx |		*, *
b. ta:l 'bʌxan | am 'sʌvrdan 'sɛrx |		*, **
c. ta:l 'bʌx|an am 'sʌvrd|an 'sɛrx|	**	
d. ta:l 'bʌxan am 'sʌvrdan 'sɛrx		

(152d) again shows the possibility of excluding a line from containing cynghanedd by not dividing it into hemistichs at all.

5.3.4 Summary

Traditional descriptions of cynghanedd say that the position of the caesura(s) in the line is determined by the location of two or three main stresses, which are in prosodically prominent positions. There is evidence for a relation between the syntax and the location of main stresses, though further work is needed to explain all cases. The output of this OT analysis of the positioning of the caesuras relative these main stresses will be considered as input to the later analyses of the particular types of cynghanedd. That is, these analyses will take the position of main stresses and the caesura as part of the input on which the grammar evaluates potential rhyming candidates. However, in reality it may be that there is some ability to adjust the syntax to create a line that has a caesura position and lexical content that is favorable for rhyme.

5.4 Analysis of Cynghanedd lusg

In cynghanedd lusg, a type of line-internal interval rhyme, the line is divided into two parts by a caesura. The interval immediately preceding the caesura will rhyme with the penultimate (stressed) interval of the last word in the line. This leaves the final interval of the line (underlined in examples) outside the cynghanedd rhyme domains, so that it may participate in line-end rhyme with the other line that it is paired with to make up a couplet.

(153) /ɬɛti ir'ðɛd[ɪg] | 'ð[ɪg]<u>aʊn</u>/ <Llety, urddedig ddigawn> (73:5)

Because Welsh stress is almost exclusively penultimate (review §5.2.3.1 for more details), this means that a line must end in a polysyllabic word, in order to meet the criteria for cynghanedd lusg. (i.e. the final word of the line must bear a main stress, the final interval of the line cannot participate in cynghanedd, cynghanedd lusg must involve the final main stress.) This type of rhyme is further limited to the first line of a couplet, that is, to odd-numbered lines. (Conran, 1995: 333) Cynghanedd lusg is seen as less ornamental, and is therefore restricted to the less prominent first lines of couplets, much like the full rhyme in skaldic which includes matching vowels occurs in even-numbered lines while the rhyme which only matches consonants occurs in odd-numbered lines (Árnason, 2007: 80).

In this chapter, more detailed description is in §5.4.1, followed by analysis of the size and position of the RD in §5.4.2.1 and §5.4.2.2, and description and analysis of the types of imperfect rhyme allowed in §5.4.3. §5.4.4 is a summary.

5.4.1 Description of basic case, VC examples

In the simplest examples of cynghanedd lusg, where the rhyme domain consists of a vowel and one consonant, the entire final interval of the first hemistich rhymes with the stressed penultimate interval of the last word of the line. In the example below, this rhymes the /ɪg/ of /ir'ðɛdɪg/ with the /ɪg/ of / 'ðɪgaʊn/.

(154) ɬɛti ir'ðɛd[ɪg] | 'ð[ɪg]aʊn <Llety, urddedig ddigawn> (73:5)

In examples like the one above, the rhyme domain includes the entire interval from the stressed vowel of the last word in the line up to the beginning of the final interval, which cannot be a part of any line-internal cynghanedd rhyme domain. Unlike in skaldic rhyme, where both rhyme domains may begin and end in the middle of a word, the first RD must occur at the end of a word, and only the second RD ends in the middle of a word.

5.4.1.1 Consonant clusters in cynghanedd lusg

There are also cases where the intervals in a cynghanedd lusg rhyme domain include more than one consonant. Although every consonant in the final interval of the first rhyming word is always answered, it is permissible to leave some consonants in the second word unanswered. The general pattern is that at least one consonant of the second RD must be answered, and that there is a strong preference for the consonants to be answered up to a morpheme boundary.

In the example in (155), the entire <st> cluster is found in both rhyme domains:

(155) /kʌvɔd er kr[ist] | ən ð[ist]aʊ/ <Cyfod, er Crist, yn ddistaw> (69:37)

The second option is shown with the same cluster in the example in (156). Here, although the second RD has an <st> cluster, only the <s> from it is answered in the earlier RD:

(156) /fənhɔn:aɪ dɪv[as] | gl[ast]eɪgr/ <Ffynhonnau difas glasteigr> (131:21)

Although the lines in (155) and (156) are a near minimal pair to show that leaving part of a consonant cluster unanswered is not due to the non-existence of words ending in that same cluster making it unanswerable, there are examples where this is the case. In the line below in (157), it would be impossible to find a word ending in a <θrgn> cluster.

(157) /gʷɪnder dis[aθr] | ar l[aθrgn]aʊd/ <Gwynder disathr ar lathrgnawd> (86:31)

In such cases, it is said (Llwyd, 2007:109) to be acceptable to answer the cluster only up to a morpheme boundary. However, not every morpheme boundary needs to serve as a division in a cluster. For example, in both (155) and (156), the <st> cluster falls across a morpheme boundary. (Though (155) is an affix+adjective and (156) is a compound.)

(158)	a. ð[ist]aʊ	dis + taw	'very silent'
	b. gl[ast]eɪgr	glas + deigr	'blue tears'

Like in skaldic rhyme, it is possible to end a rhyme at a morpheme boundary as an alternative to including the full interval. In my corpus of cynghanedd lusg lines, a quick pass at checking for morpheme boundaries that line up with where a consonant cluster is split showed only nine examples (6%) where the split was clearly *not* on a morpheme boundary; two examples where the split occurred in a mono-morphemic word, but where the first part of the split word happened to exist as a separate word; and 128 examples (92%) where the split coincides with a morpheme boundary (whether derivational, inflectional, or compound).

While it is true in a majority of cases that a consonant cluster will split on a morpheme boundary, there are also lines which show this is not necessarily a strict requirement for splitting a cluster. In the example in (159a), the split cluster is part of a mono-morphemic word, 'Israel'. In (159b), the cluster is answered to a point past the morpheme boundary (marked with a dash) but not including the entire interval.

(159)	a. /hun a'ðɛʊ[ɪs] | ɪr '[ɪsr]aɪl/	<Hwn a addewis i'r Israel>	(153:23)
	b. /hon a 'w[ask] | və ŋrið 'gl[as-kr]ɪx/	<Hon a wasg fy ngrudd glasgrych>	(80:23)

However, unlike in skaldic rhyme, there seems to be no general tendency to include the sonority trough in a rhyme, although it may be tempting to view the example in (159b) that way.

5.4.1.2 Position of the first stressed word

While the position of the second stressed vowel is required to be penultimate in the line in cynghanedd lusg, there is some freedom for the position of the first stressed vowel. The last word of the line must be at least bisyllabic and this is all that must be in the second hemistich, so to have a minimum size for the second hemistich in a line of seven syllables, the caesura would fall after the fifth syllable. The first hemistich must contain at the very least a monosyllabic word to provide an interval for the RD, so to create a line with a minimally small first hemistich and maximally large second, the caesura would fall after the first syllable. This means that for a line of cynghanedd lusg, the caesura may fall anywhere between right after the first syllable of the line, to right after the 5th syllable of the line.

The illustration in (160) shows the left and right limits for caesura placements in a line. The first of these minimizes the first hemistich while maximizing the second. The second caesura placement maximizes the first hemistich and minimizes the second.

(160) Minimum size for hemistich 1 ↘ ↙ Maximum size for hemistich 1

$$\sigma_1 \mid \sigma_2 \;\; \sigma_3 \;\; \sigma_4 \;\; \sigma_5 \mid \sigma_6 \;\; \sigma_7$$

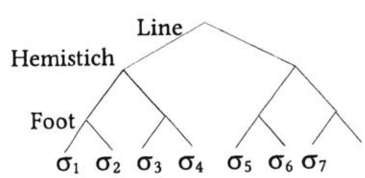
In my corpus I find the following frequencies for different positions of the caesura. The most common line division is to have a caesura four syllables from the left edge of the line. This means that there will be one syllable between the two rhyme domains. Lines with 'multiple' are generally lines that contain both cynghanedd sain and cynghanedd lusg.

(161)

Syllables from the left edge:	Number of lines:
1	6
2	55
3	153
4	337
5	85
Multiple:	4
Total:	640

Although there is no prescribed requirement for a strict foot-based meter and stress distribution among the seven syllables of a line of Welsh poetry, the distribution of caesura placements above suggests that there were some metrical preferences that shaped the division of the line into two hemistichs. The most common location for the caesura is after the fourth syllable of the line, followed by having the caesura after the third syllable of the line. This suggests the preference was for a line that was nearly evenly split, with most lines consisting of a full metron (§2.1.2.1.2) making up the first hemistich, and a catalectic one making up the second.

(162)



The second most attested caesura placement shows the mirror image of this – with a catalectic metron in the first hemistich and a full one in the second. This ideal structure would have been violable to meet the syntactic structure of the line, but 77% of the examples of cynghanedd lusg show either the structure in (162) or its mirror image.

Additional factors may also have influenced the position of the caesura. The fifth syllable of the line may be a less common choice in order to avoid a possible stress clash, if the first stress fell on a monosyllable, or to avoid having two interval rhyme domains in adjacent syllables, which is not permitted in skaldic rhyme (Árnason 2007:98).

5.4.2 Analysis of cynghanedd lusg

In skaldic rhyme, there is a clear division between the head and the tail rhyme domains. The asymmetry is such that the second rhyme domain is more prominent in stress and more predictable in location. (Árnason 2007: 97-8) While there is an asymmetry between the two rhyme domains in cynghanedd lusg, it is less clear which should be considered the more prominent 'head' rhyme and which should be the less prominent 'tail' or 'supporting' rhyme. This division is explored more thoroughly for Welsh in §5.7, but for the purposes of this analysis, I refer to the rhymes by their position in the line: first and second.

Based on the definition of RHYME! introduced for Irish rhyme in §3.2.3, I propose the following constraint to favor lines which contain rhyme domains. Constraints ranked above this one will signify constraints which cannot be violated in a rhyming pair – the winning candidate would be one that violates RHYME!CYNGHANEDD and did not have line-internal rhyme. Such lines are reasonably frequent in the poetry of Dafydd ap Gwilym. As mentioned above in §5.2.1.3, 19% of the lines in his corpus do not have any cynghanedd.

To account for the fact that there are four different types of cynghanedd, each with their own requirements for rhyming, the RHYME!CYNGHANEDD constraint is broken down into separate indexed constraints, which form a grammar with a set of identically indexed constraints and their rankings. These constraints are indexed to the rhyme domains that they create in a line. These will be ranked relative some general markedness constraints which hold across all four types of cynghanedd in a fixed ranking. For cynghanedd lusg, the constraint favoring a line containing cynghanedd is defined as in (163).

(163) **RHYME!CYNGHANEDD$_{LUSG}$** = For any pair of adjacent hemistichs H_1, H_2 in a line, there is a substring (=RD) in H_1 that has a correspondent in H_2.

The next sections will introduce these indexed constraints on the size, location, and contents allowed in cynghanedd lusg, as well as the general markedness constraints that hold for any type of cynghanedd.

5.4.2.1 Position, size of first RD

The first rhyme domain aligns to the right edge of the first hemistich, and is at least one interval in size. These facts can be described with the constraints in (164) and (165), neither of which is violated in an attested rhyme, which means they will outrank RHYME! CYNGHANEDD$_{LUSG}$. Both are indexed as specific to cynghanedd lusg.

(164) **ALIGN$_{RD1}$(RD-R, HEMISTICH-R)$_{LLUSG}$** = The right edge of the first RD aligns to the right edge of a hemistich. Assign one violation per segment intervening between these.

(165) **RD$_1$≥I$_{LLUSG}$** = The first rhyme domain must equal at least one interval.

These constraints never interact with other constraints, and are never violated. Their ranking can be shown by the lack of corpus examples that violate them. For example, a line such as in (166a) would not be permitted to rhyme, and so the non-rhyming candidate is the optimal one. This hypothetical example is based on the line in (155), but is missing the /t/ in the last word of the line that allows it to rhyme with an earlier [ist]. The candidate in (166c) is ruled out by violating MAX(C), which is introduced in §5.4.2.3.1 more thoroughly.

(166)	kʌvɔd er krist | ən ðisaʊ	ALIGN$_{RD1}$(RD-R, HEMI-R)$_{LLUSG}$	RD$_1$≥I$_{LLUSG}$	MAX(C)	RHYME! CYNGHANEDD$_{LUSG}$
	a. kʌvɔd er kr[is]t | ən ð[is]aʊ	*	*!		
	☞ b. kʌvɔd er krist | ən ðisaʊ				*
	c. kʌvɔd er kr[ist] | ən ð[is]aʊ			*! (t)	

Similarly, the example in (167) is edited from the line in (153) in that the final two intervals of the original /ir'ðɛdɪg/ have been reversed to illustrate that even a full rhyming interval cannot be paired for cynghanedd lusg if it does not align to the right edge of the hemistich.

(167)	ɬɛti ir'ðɪgɛd | 'ðɪgaʊn	ALIGN$_{RD1}$(RD-R, HEMI-R)$_{LLUSG}$	RD$_1$≥I$_{LLUSG}$	RHYME! CYNGHANEDD$_{LUSG}$
	a. ɬɛti ir'ð[ɪg]ɛd | 'ð[ɪg]aʊn	*!*		
	☞ b. ɬɛti ir'ðɪgɛd | 'ðɪgaʊn			*

The only possible size and location for the first RD in a line of cynghanedd lusg is one that satisfies both these constraints, such as the attested versions of the lines in (166) and (167). I show the attested version of the line from (166) in (168), and the line from (167) in (169).

(168)	kʌvɔd er krist | ən ðistaʊ	ALIGN$_{RD1}$(RD-R, HEMI-R)$_{LLUSG}$	RD$_1$≥I$_{LLUSG}$	RHYME! CYNGHANEDD$_{LUSG}$
	☞ a. kʌvɔd er kr[ist] | ən ð[ist]aʊ			
	b. kʌvɔd er krist | ən ðistaʊ			*!

(169)	ɬɛti ir'ðɛdɪg | 'ðɪgaʊn	ALIGN$_{RD1}$(RD-R, HEMI-R)$_{LLUSG}$	RD$_1$≥I$_{LLUSG}$	RHYME! CYNGHANEDD$_{LUSG}$
	☞ a. ɬɛti ir'ðɛd[ɪg] | 'ð[ɪg]aʊn			
	b. ɬɛti ir'ðɛdɪg | 'ðɪgaʊn			*!

Review of constraints determining the size and location of the first RD:

(170) ALIGN_{RD1}(RD-R, HEMI-R)$_{LLUSG}$, $RD_1 \geq I_{LLUSG}$ $\gg$ RHYME!CYNGHANEDD$_{LUSG}$

The align constraint and the constraint requiring the first rhyme domain contain at least an interval are undominated, and outrank RHYME!CYNGHANEDD$_{LUSG}$.

5.4.2.2 Position of the second rhyme domain

As mentioned in §5.4.1, the second RD begins on the stressed penultimate vowel of a polysyllabic line-final word. The placement of the second RD for cynghanedd lusg can be understood as an interaction between constraints wanting the RD to be aligned to the right edge of its hemistich, wanting the RD to contain the main stressed vowel of the hemistich, and excluding the final interval from the rhyme domain in order not to interfere with the line-final rhyme.

A sample of two couplets of one of Dafydd ap Gwilym's poems appears in (171). This sample is the example from (154) and the three lines following, including another example of (imperfect) cynghanedd lusg in the other odd-numbered line. The underlined segments indicate the line-final rhyme which occurs between the two lines of a couplet. The line-internal cynghanedd rhyme is restricted from overlapping with this rhyme, which means that the final interval of every line is off-limits for cynghanedd.

(171) Llety, urdded[ig] dd[ig]<u>awn</u>, (73: 5-8)
Cyffredin, a gwin a g<u>awn</u>.
Canfod rhi[ain] addf[eind]<u>eg</u>
Yn y tŷ, f'un enaid t<u>eg</u>.

We can formulate these generalizations into the following constraints. First, we will require that the second rhyme domain include the main-stressed interval of its hemistich. We already know from §5.4.1.1 that the entire interval will not be answered in all cases, so this will rank below RHYME!CYNGHANEDD$_{LUSG}$.

(172) **$RD_2 \geq$'I_{LLUSG}** = Assign a violation to any candidate of cynghanedd lusg where the second RD does not include the full main-stressed interval of the hemistich.

Next, we take the position of the second rhyme domain on the penultimate syllable to be a compromise between wanting the rhyme domain to contain the most prominent stressed interval of the hemistich, which will be either in the final or penultimate interval of the line, depending on the length of the last word, and needing to exclude the final interval from participating in any cynghanedd.

To disallow the final interval of the line participating in cynghanedd, we use the constraint in (173). This constraint penalizes a line where the final interval, which participates in end-rhyme to communicate the end of a line, also participates in line-internal rhyme. This is highly ranked because violating it would impede the role of poetic ornamentation as a way to communicate form. This is one of the general markedness constraints that will apply in a fixed ranking (to the other markedness constraints) for every type of cynghanedd. It will outrank the constraint in (172) to derive the position of the second RD for cynghanedd lusg.

(173) ***LINE-FINAL-I-IN-RD** = Assign a violation to any candidate which includes (any segment of) the line-final interval in a cynghanedd RD.

This ranking can be illustrated in the tableau in (174). Here, the pattern that matches the attested cynghanedd lusg rhymes is the winning candidate in (174a), where the second rhyme domain contains the penultimate interval of the second hemistich. Candidate (174b) does not rhyme.

(174)

σ σσ 'CVC | σ 'CVCVC	*LINE-FINAL -I-IN-RD	$RD_2 \geq 'I_{LLUSG}$	RHYME! $CYNGHANEDD_{LUSG}$
☞ a. σ σσ '$C[V_iC_j]$ | σ '$C[V_iC_j]VC$			
b. σ σσ 'CVC | σ 'CVCVC			*!

Then, in the tableau below, the candidate in (175a) is one where the rhyme domain contains the stressed interval, but it is also the final interval, so this candidate violates the highly-ranked *LINE-FINAL-I-IN-RD constraint.

(175)

σ σσ 'CVC | σ σ 'CVC	*LINE-FINAL -I-IN-RD	$RD_2 \geq 'I_{LLUSG}$	RHYME! $CYNGHANEDD_{LUSG}$
a. σ σσ '$C[V_iC_j]$ | σ σ '$C[V_iC_j]$	*!		
☞ b. σ σσ 'CVC | σ σ 'CVC			*

Although it was ambiguous which constraint ruled out (174b) above, the constraint from (172), requiring the second rhyme domain include the stressed interval, is what will prevent the second rhyme domain from containing the penultimate syllable of the line which is not in the final word. As §5.3, on the location of the caesura, described, the main stress of the final hemistich must be in the last word of the line.

The table in (176) shows violations incurred by cynghanedd lusg rhyme domains on the final words of a line, showing how unattested patterns are ruled out. (176a) includes the stressed interval, but it is line-final. Candidate (176b) includes the penultimate interval of the line, but it is not the main-stressed one, so it is ruled out. The winning candidate in this case is (176c), which does not rhyme.

(176)

traɪl dr'em	*LINE-FINAL -I-IN-RD	RD$_2$≥'I$_{LLUSG}$	RHYME! CYNG.$_{LUSG}$
a. traɪl dr['em]	*!		
b. tr[aɪl dr]'em		*!	
c. traɪl dr'em			*

The interaction of these three constraints can be used to show that cynghanedd lusg can only occur as the stressed penultimate syllable of a polysyllabic word.

If it is truly the case that the tail rhyme wants to include the main stressed interval, and not just to be as close to the right edge as possible in the same word as the main stress, then we should see no examples of a line of cynghanedd lusg where the line ends in a polysyllabic word which has irregular final stress, (see §5.2.3.1) such as the example below:

(177) σσσ[ymr] | σ C[ymr]'aeg

Such rhymes do not seem to occur. I sought to search the corpus for irregularly stressed words. However, these are not indicated in any way in the orthography, limiting my ability to extract every example of them.

Interim review of constraints determining the size and location of the second RD:

(178) *LINE-FINAL-I-IN-RD, RD$_2$≥'I$_{LLUSG}$ ≫ RHYME!CYNGHANEDD$_{LUSG}$

5.4.2.3 Both rhyme domains

This section looks at the constraints governing the contents of both rhyme domains in relation to each other.

5.4.2.3.1 Size of second RD, unanswered consonants

There is an asymmetry between the two rhyme domains in cynghanedd lusg, as there was in skaldic rhyme. As seen above, the second RD will be in a fixed location, as the main-beat-carrying vowel of the line. It will also always be stressed. The placement in the line of the first RD will be dependent on the size of the first hemistich, and this RD may include the main stress or not.

An additional asymmetry exists in the contents of the rhyme domains. The entire interval of the first rhyme domain must map into that of the second, but the second RD may contain unanswered consonants. An example of this is below, repeated from (156) above.

(179) /paɪn as'gɛɬ[as] | di'n[ast]aɪ/ <Paun asgellas dinastai> (32:39)

The unanswered consonant must always be in the second rhyme domain, and never the first. A line like the made-up one in (180) does not occur in the corpus:

(180) */paɪn as'gɛɬ[ast] | di'n[as]aɪ/

To analyze these facts, I will use DEP/MAX constraints on the RDs. Although requiring that the RD contain at least one consonant is initially appealing, the possibility of cynghanedd lusg that ends on vowel hiatus rules this out. An example of a line with vowel hiatus is in (181), where the RD is a full interval in each case, but consists only of a vowel.

(181) /amaɪr ʊiv 'v[i] | eɪ 'ð[i]ɔsk/ <Amau'r wyf fi ei ddiosg> (155:11)

Similar examples where the rhyme consists solely of vowels exist in skaldic as well:

(182) geirþ[ey] á Skán[ey]ju (via Árnason, 2007:100)

A better way to look at which consonants must be answered is to require that, minimally, the consonant appearing immediately after the stressed vowel in the second hemistich be answered in a RD. While many rhymes in the corpus of Dafydd ap Gwilym's works have rhyme domains including more than one consonant of a cluster answered, there are none that fail to answer the post-stressed-vowel one. To again base an unattested example off of the line from (179), the line in (183) is not a possible line of cynghanedd lusg.

(183) */paɪn as'gɛɬ[a] | di'n[ast]aɪ/

In contrast to(183), skaldic does allow vowel-only rhyme domains before consonants, provided there is a morphological boundary there. (Review §4.1.1.2 for details.)

(184) liðf[æ]ð ok skip sm[æ]ri (Árnason, 2007:101)

In modern Welsh rhyming practices, according to the statute defining the rules of cynghanedd that was written after Dafydd ap Gwilym's time (review §5.2.1 for a brief historical introduction), it was decided that the entire interval of both RDs must always be answered in cynghanedd lusg. (Parry, 1929) However, it seems that some modern poets are willing to be somewhat flexible on this point. A survey of poets in Rhys (2009: Ch. 4, p.166) found that as the percentage of the interval answered rose, more poets were willing to accept a rhyme that does not answer the entire interval, despite it being against the stricter rules of modern cynghanedd.

(185)

Consonants answered:	Poets who rated it 'good', out of 34:
1 out of 3	3
1 out of 2	8
2 out of 3	9

Despite having looser standards where answering the post-stressed-vowel consonant in the second rhyme domain is the minimum, in many cases, Dafydd ap Gwilym will match two or more consonants in a cluster. The distribution of answered consonants in 632 examples of cynghanedd lusg in the corpus of the works of Dafydd ap Gwilym that the Python script was able to pick out is as follows (excluding examples of vowel hiatus). The rows show the number of consonants in the interval following the main-stressed vowel of the second hemistich, and the columns show the number of these that were answered in the rhyme. Dark shaded cells indicate an impossible rhyme (e.g. answering more consonants than were available to answer).

# answered → / ↓ C in RD_2	1	2	3	4	Total:
1	341				341
2	135	101			236
3	14	17	3		34
4	1	3	0	0	4
Total:	491	121	3	0	615

Figure 13: *Number of consonants answered in cynghanedd lusg*

We can define the constraint requiring a rhyme answer the consonant following the main-stressed vowel as follows. The constraint in (186) will outrank RHYME!CYNGHANEDD$_{\text{LUSG}}$, meaning it cannot be violated in a line of cynghanedd lusg.

Although unanswered consonants in Irish rhyme could be penalized with a single, unidirectional MAX(C) constraint (see §3.3.2) because there was no asymmetry between the two rhyme domains, for cynghanedd the constraint will be different. For cynghanedd lusg, we need to be able to penalize more harshly a pair that has unanswered consonants appearing in the first RD than in the second. To do this, I follow Steriade (2011b) who formulates DEP and MAX constraints that reference the head and tail rhyme domains of skaldic. However, because it is not clear which should be considered the more prominent for Welsh, the constraint references rhyme domains by their positions, as the rest of the analysis has done. Here, the second is treated as if it were 'input' and the first rhyme domain as 'output' in assigning violations.

(186) **Max(C/'V_)$_{RD}$2>1$_{LLUSG}$** = Assign a violation to a candidate where the consonant immediately following the main-stressed vowel in the second rhyme domain does not have a correspondent in the first.

The constraint in (187) is a general constraint against having a consonant appearing in the second rhyme domain but not the first.

(187) **MAX(C)$_{RD}$2>1** = Assign one violation per C which appears in the second RD and does not have a correspondent in the first RD.

These constraints on the contents of the second rhyme domain can be seen in the tableau in (188). This uses the line from (179) which answers one of the two consonants in the interval following the stressed vowel of the second hemistich. According to this analysis, because of the high ranking of RD2≥'I$_{LLUSG,}$ in the winning candidate (188a), the second rhyme domain includes the entire main-stressed interval, and answers the /s/ following the main-stressed vowel which satisfies Max(C/'V_)$_{RD}$2>1$_{LLUSG,}$ but it leaves the final /t/ unanswered, which violates the lower-ranked MAX(C)$_{RD}$2>1. Candidate (188b) adjusts the size of the second rhyme domain in order not to include any unanswered consonants, which avoids a violation of MAX(C)$_{RD}$2>1 at the cost of violating the higher ranked RD2≥'I$_{LLUSG}$. Candidate (188c), for comparison, does not contain a cynghanedd lusg rhyme domain.

(188)

paɪn as'gɛɬas | di'nast<u>aɪ</u>	RD2≥'I$_{LLUSG}$	Max(C/'V_)$_{RD}$ 2>1$_{LLUSG}$	RHYME! CYNG.$_{LUSG}$	MAX(C)$_{RD}$2>1
☞ a. paɪn as'gɛɬ[as] | di'n[ast]<u>aɪ</u>				* (t)
b. paɪn as'gɛɬ[as] | di'n[as]t<u>aɪ</u>	*!			
c. paɪn as'gɛɬas | di'nast<u>aɪ</u>			*!	

In every candidate in (188), the /s/ that appeared following the stressed vowel was answered. For an example that could violate this constraint, I use the made-up example based on the non-rhyming line from (108a). Here, although having unanswered consonants in a rhyme domain is acceptable (compare (188a)), it is not possible do this when it would leave the consonant following a main-stressed vowel unanswered, as (189a) does. In the tableau in (189), the winning candidate is (189c) which does not have a cynghanedd lusg rhyme, despite having identity in the vowels (in this constructed example).

(189)

'mʊɪ | ɪu mɪragl eɪ 'gʊɪnbrɪd	RD2≥'I$_{LLUSG}$	Max(C/'V_)$_{RD}$ 2>1$_{LLUSG}$	RHYME! CYNG.$_{LUSG}$	MAX(C)$_{RD}$ 2>1
a. 'm[ʊɪ] | ɪu mɪragl eɪ 'g[ʊɪnbr]ɪd		*!		*** (nbr)
b. 'm[ʊɪ] | ɪu mɪragl eɪ 'g[ʊɪ]nbrɪd	*!	*!		
☞ c. 'mʊɪ | ɪu mɪragl eɪ 'gʊɪnbrɪd			*	

Instead, there is alliteration between the /m/ of /mʊɪ/ and /mɪragl/, as is true for a number of the non-cynghanedd lines of the poem.

5.4.2.3.2 Consonants in the first RD

Here, I introduce the DEP constraint that is parallel to the MAX one introduced above. This will penalize a rhyme pair which contains a consonant in the first rhyme domain which is not answered in the second. I introduce the parallel DEP(C) below in (190).

(190) **DEP(C)$_{RD}$2>1** = Assign one violation per C which appears in the first RD and does not have a correspondent in the second RD.

The unattested line from (183), repeated below, is an example of a rhyme that would violate DEP(C), in this case for failing to answer the /t/ in the first rhyme domain.

(191) */paɪn as'gɛɬ[ast] | di'n[as]aɪ/

DEP(C) is never violated in an attested line of cynghanedd lusg, but it does not outrank ALIGN$_{RD1}$(RD-R, HEMISTICH-R) because the first rhyme domain will not move to avoid an unmatched consonant. However, it would not be possible to distinguish whether a candidate that moved the right edge of the first rhyme domain away from the right edge of the hemistich was ruled out by a violation of this align constraint or by a violation of RD$_1$≥I.

Interim constraint rankings:

(192) MAX(C/'V_)$_{RD}$2>1$_{LLUSG}$, DEP(C)$_{RD}$2>1 ≫ RHYME!CYNGHANEDD$_{LUSG}$ ≫ MAX(C)$_{RD}$2>1

5.4.2.4 Summary

This analysis shows the constraints that govern the size and positions of the two rhyme domains in a line of cynghanedd lusg. The constraints introduced above are listed in (193) with their rankings.

(193) *LINE-FINAL-I-IN-RD ≫ RHYME!CYNGHANEDD$_{LUSG}$ ≫ MAX(C)$_{RD}$2>1
ALIGN$_{RD1}$(RD-R, HEMI-R)$_{LLUSG}$
RD$_1$≥I$_{LLUSG}$
RD$_2$≥'I$_{LLUSG}$
DEP(C)$_{RD}$2>1
MAX(C/'V_)$_{RD}$2>1$_{LLUSG}$

These constraints and their ranking form a grammar which evaluates potential candidates for cynghanedd lusg. The general, unindexed, constraints, *LINE-FINAL-I-IN-RD, DEP(C)$_{RD}$2>1, and MAX(C)$_{RD}$2>1 will apply across all four types of cynghanedd, with the same relative ranking, while the specific, indexed constraints will be ranked around the general ones.

The indexed constraints are indexed to the rhyme domains that they create in a line. Having separate constraints for RHYME!CYNGHANEDD for each of them will allow multiple rhyme domains in one line, all subject to a different set of ranked constraints.

5.4.3 Differences within the RD

Although having segments completely absent from one rhyme domain of a pair is penalized by MAX/DEP constraints, there are also some phonological differences that are tolerated in a rhyming pair for cynghanedd lusg. These are described in this section. Outside of these exceptions, perfect identity is required within the RDs for them to stand in correspondence.

5.4.3.1 Vowel stress

While the second rhyme domain will always include a main-stressed vowel due to the high ranking of RD$_{RD2}$≥'V, the first RD of the line may be stressed or just pitch-accented. (Refer to §5.2.3.1 on Welsh stress.) For example, the line in (194a) shows a stressed vowel in the first rhyme domain, but (194b) shows a pitch-accented one in the final syllable of a polysyllabic word.

(194) a. /kʌvɔd er 'kr[ist] | ən 'ð[ist]<u>aʊ</u>/	<Cyfod, er Crist, yn ddistaw>	(69:37)
b. /ɬɛti ir'ðɛd[ɪg] | 'ð[ɪg]<u>aʊn</u>/	<Llety, urddedig ddigawn>	(73:5)

To describe this, we can say that IDENT(STRESS)$_{RD}$ ranks below RHYME!CYNGHANEDD.

5.4.3.2 Vowel mismatches conditioned by stress

The possibility of a stress mismatch in vowels leads to mismatched vowel qualities between stressed and non-stressed syllables. Welsh has a number of vowel alternations that occur between stressed and unstressed vowels, which differ in how they are treated in rhymes: one rhymes based on its input value and one based on its output realization.

5.4.3.3 Rhyming vowel alternations

When writing cynghanedd involving the vowel written <y>, this vowel is rhymed based on its pronunciation, so a <y> that is pronounced /i/ may rhyme with an orthographically distinct vowel that is also pronounced /i/, but it may not rhyme with such a vowel when it is stressed and pronounced /ʌ/. (Refer to §5.2.3.3.3.1)

The situation with the /aɪ/ ~ /eɪ/ diphthong alternations is different, however. Rather than being based on the similarity of the realization of the vowels, it is based on the fact that they can alternate. That is, when rhyming the vowel written with <y>, it is based on the output or surface form, but for this diphthong alternation, rhyming is based on the input or underlying form. With these diphthongs, if the /aɪ/ is in an unstressed, final syllable in the first RD, it may rhyme with an /eɪ/ in the stressed penultimate syllable in the second RD. An example is below.

(195) kanvɔd 'r̥i.[aɪn] | að'v[eɪn]d<u>eg</u> <Canfod rhiain addfeindeg> (73:7)

Although their pronunciations are different, they are able to rhyme because these diphthongs alternate under the same stressed and unstressed environments that the meter of cynghanedd lusg creates. Skaldic rhyme exhibits a similar phenomenon in which a vowel that arises only through umlaut can rhyme with the vowel that it would be underlyingly (Anderson, 1973).

I have no analysis of this or the possibly paradigm-conditioned imperfect rhymes in Irish from §3.2.4.2 (see, e.g. Hume & Johnson (2003) on alternations influencing the judgment of similarity) but present the data which may be of interest for future work.

5.4.3.4 Vowel length mismatches

Long vowels may rhyme with short vowels of the same quality in cynghanedd lusg. Long vowels only occur in monosyllabic words (§5.2.3.2.2), and can therefore only appear in the first RD.

(196) /mʊi karav '[oːl] | mɛʊn 'd[ol]g<u>ɔɪd</u>/ <Mwy caraf ôl mewn dolgoed> (117:15)

This shows us that that RHYME!CYNGHANEDD ≫ IDENT(LONG)$_{RD}$.

5.4.3.5 Word-final rising sonority clusters

Aspects of the phonotactics of Welsh may make it easier to find rhymes between word-final intervals and word-medial intervals. While many languages (such as Irish) would not allow the same clusters to appear pre- and post-vocalically, making it difficult to find a word-final match to an entire interval, Welsh allows a number of word-final rising sonority clusters, such as /pɛdr/ in (197), and they are not uncommon. In speech these will tend to be pronounced with a short epenthetic vowel between the two final consonants, which would not occur when this sequence of consonants occurs between two vowels, as in /ɛdrɪx/.

(197) /ə maɪ 'p[ɛdr] | da ə guɪr '[ɛdr]ɪx/ <Y mae Pedr, da y gŵyr edrych> (4:23)

These rising-sonority final clusters are mentioned in the bardic grammar (Williams & Jones, 1934: 41) as an example of a type of syllable, suggesting that the epenthetic vowel was also pronounced at the time of Dafydd ap Gwilym's writing and that there was confusion over the number of syllables in such words. The orthography of the time would also often include a vowel splitting the cluster, however this epenthetic vowel was invisible for the purposes of stress assignment on the penultimate vowel and do not count as an extra syllable for metrical purposes. Discussion of the ongoing debate on whether to consider these clusters syllabic or not in modern times can be found in Rhys (2009: Ch. 4, §22).

These examples might be covered by a low-ranked constraint such as the one below:

(198) **DEP(ə)/T_R$_{RD}$2>1** = A schwa in a rising sonority final cluster in the first rhyme domain must also appear in the second rhyme domain

Another approach would be to treat it like the demi-syllabic glides described below, involving a violation of IDENT(SYLLABIC).

5.4.3.6 Glides are consonants

While Welsh grammar distinguishes between glides and short vowels in a particular way for the purposes of hiatus resolution, as described in §5.2.3.3.2, the status of glides as either consonants or vowels for the purpose of cynghanedd varies depending on the type of cynghanedd. In consonantal cynghanedd, glides are treated as vowels and are overlooked in creating sequences of repeating consonants. However, in cynghanedd that involves interval rhyme, as in cynghanedd lusg, glides count as consonants. There are many examples where a glide is excluded from the beginning of a RD, such as the one in (199) where the first rhyme domain starts on the first full vowel following the glide /j/.

(199) /kʌvarɬ 'karj[ad] | ag '[ad]ar/ <Cyfaill cariad ac adar> (33:5)

Examples where a glide appears as a consonant at the end of a RD, such as the one below in (200), are rarer, due to the low number of words ending in a consonant + glide. These words were historically monosyllabic, but in modern speech, the glides have been vocalized and are now pronounced as bisyllabic.

(200) /əŋ ŋ̊ɛvn kɔɪd 'b[edʊ̯] | ən 'ð[ɛdʊ̯]ið/ <Yng nghefn coed bedw yn ddedwydd> (163:13)

Words such as /bedʊ/ would have already been pronounced as bisyllabic in Dafydd ap Gwilym's time, but it was considered correct to treat them as monosyllabic in verse. The bardic grammar (Williams & Jones, 1934: 40) which is contemporary to Dafydd ap Gwilym's writing, specifically discusses such examples in its definition of what counts as a syllable for the purpose of metrics, suggesting that there was already ambiguity on this point then.

These glides are treated as non-syllabic for the purpose of counting syllables in a line and determining the size and position of rhyme domains as well as in terms of rhyming with other non-syllabic glides.

While the general status of these glides and of the rising sonority clusters above as non-syllabic as regards the meter, if not pronunciation when reading the line, may complicate an analysis somewhat, a constraint such as the one below could be used for both cases:

(201) **IDENT(SYLLABIC)$_{\mathbf{RD}}$** = Two segments in correspondence in RDs must match for syllabicity.

5.4.4 Summary

The constraints on imperfect matches that are tolerated in cynghanedd lusg rhyme domains will all rank below RHYME!CYNGHANEDD$_{\text{LUSG}}$, and below the two constraints on the size and location of the rhyme domain that also rank below it. The types of imperfect matches that are allowed in cynghanedd varies between the different types of rhyme.

5.5 Consonantal cynghanedd

As introduced in §5.2.2.2.2, there are two types of cynghanedd that are based on a sequence of consonants being repeated across two hemistichs. These both share with cynghanedd lusg the fact that they require the line be split into two hemistichs, which are determined by the position of two main stresses. Unlike cynghanedd lusg, however, there are no other requirements on the line, such as that it be the first or second line in a couplet, or that it end in a polysyllabic word with penultimate stress. The lack of restrictions on the structure may partially account for these styles of consonant cynghanedd being more frequently attested in the corpus of the works of Dafydd ap Gwilym: together they make up 46% of the lines, compared to only 8% for cynghanedd lusg.

5.5.1 Descriptions, review of basic facts

Consonantal cynghanedd are the types of cynghanedd introduced in §5.2.2.2.2 and §5.2.2.2.3, which involve a series of consonants repeated across both hemistichs. Cynghanedd groes and cynghanedd draws can both be accounted for under the same set of indexed constraints. Cynghanedd draws, I show, is simply cynghanedd groes with a different ranking of one ALIGN constraint.

An example of cynghanedd groes is in (202)(repeated from (113) above). Here, as previously, the pipe represents the caesura, whose placement is determined by stress and word-boundaries, as explained in §5.3) dividing the seven syllable line into two hemistichs. The underlined final intervals of each hemistich are obligatorily non-similar (as described in §5.5.2.1.3.1). In the rest of the line, every consonant which appears in the first hemistich must be repeated in the second, in the same order (though some exceptions are discussed in §5.5.2.2.1). In the example in (202) below, the consonant sequence <mnd> appears in both hemistichs. The location and identity of vowels does not matter.

(202) /mʊi no 'dɪm | am ɛnaɪd 'ɪu/ <mwy no dim, a'm enaid yw> (111:16)
m n d m n d

In cynghanedd draws, the pattern is similar. The line is again split by a caesura into two hemistichs. The entire consonant sequence appearing in the first hemistich must also appear in the second, but it is permissable to have a sequence of unanswered consonants at the beginning of the second hemistich, as long as they do not interrupt the repeating sequence. An example of this appears in (203)(repeated from (114)), where, again, the underlined intervals are obligatorily distinct. The unanswered consonants appear in parentheses between the repeated <dθ> sequence.

(203) /'deɪθim | i ðɪnas 'dɛθɔl/ <deuthum i ddinas dethol> (73:1)
d θ (ð n s) d θ

At a minimum, any consonants appearing immediately before the main-stressed vowel of each hemistich should match:

(204) /'pla | ar hɔɬ vɛrxɛd ə 'plʊiv/ <Pla ar holl ferched y plwyf!> (137:2)
pl (r h ɬ v rx d) pl

Although this example looks like alliteration, it is also completely possible to form rhymes in which one or both of the hemistichs would involve intervocalic consonants corresponding in cynghanedd draws, such as the /θ/ in (203).

5.5.2 Constraint-based analysis

The analysis of consonantal cynghanedd is based on the positioning of the two pairs of rhyme domain edges, which is in §5.5.2.1, and ensuring correspondence between their contents, in §5.5.2.2.

The constraint favoring a candidate which rhymes according to the rules of consonantal cynghanedd is repeated below in (205).

(205) **RHYME!CYNGHANEDD**$_{CONS}$ = For any pair of adjacent hemistichs H_1, H_2 in a line, there is a substring (=RD) in H_1 that has a correspondent in H_2.

5.5.2.1 Location of RD edges

A constraint-based analysis of these types of consonant cynghanedd will require align constraints for each edge of the two rhyme domains in the line. Unlike for cynghanedd lusg, which had a requirement that one RD contain at least the final interval, and that the other contain at least the stressed interval, there is no minimum size of the RD in consonantal cynghanedd. This is similar to alliteration, where even empty onsets will alliterate. It is the location of the RD that matters, not its contents.

There are asymmetries between the two rhyme domains, as there were for cynghanedd lusg, so this analysis will make reference to RD_1, the first rhyme domain of the line, and RD_2, the second. The differences between the two, and discussion of which might be considered more prominent, is in §5.7.

5.5.2.1.1 RD_1-Left

There is no variation in the locations of the outside two RD edges which align to the edges of the line, that is, in the left edge of the first rhyme domain and the right edge of the second. The first RD in both cynghanedd groes and cynghanedd draws will begin at the left edge of the line, which is also the left edge of its hemistich, as marked with the square bracket in (206).

(206) /[mʊi no 'd<u>ɪm</u> | am ɛnaɪd '<u>ɪu</u>/ <mwy no dim, a'm enaid yw> (111:16)
m n d m n d

This constraint is never violated, so the left edge of the first rhyme domain always aligns to the left edge of the hemistich and line. Thus, there is no line where every consonant has a correspondent except the first one in the line, as below.

(207) */g[olaɪ 'd]a | [ɪ lɪuio 'd]<u>ið</u>/
(g) l d l d

The constraint for this is defined in (208), and it is undominated.

(208) **ALIGN$_{RD1}$(RD-L, HEMISTICH-L)$_{CONS}$** = The left edge of the first RD aligns to the left edge of a hemistich. Assign one violation per segment intervening between these.

Interim constraint rankings:

(209) ALIGN$_{RD1}$(RD-L, HEMISTICH-L)$_{CONS}$ ≫ RHYME!CYNGHANEDD$_{CONS}$

5.5.2.1.2 RD_2-Right

Now looking at the other invariably positioned rhyme domain boundary, the right edge of the second rhyme domain will always appear directly before the final interval of the line. This positioning is due, to a constraint forcing the RD to align to the right edge of its hemistich being outranked by a constraint, already introduced for cynghanedd lusg in §5.4.2.2, against including the line-final interval in a cynghanedd rhyme domain. This is demonstrated in (210), where the line-final /x/ is not included in a rhyme domain.

(210) /[ə 'grɪm]ɔg | [a gʷaɪr 'ɔm]ax/ <y grimog a gwae'r omach> (73:32)
gr m g r m

There are no examples of cynghanedd groes or cynghanedd draws where the line-final interval participates in a RD.

The constraint in (211) is repeated from (173) in the cynghanedd lusg analysis, where it was introduced as a high-ranked markedness constraint that would hold across all types of cynghanedd. It penalizes any cynghanedd rhyme that includes a segment from the line-final interval in its rhyme domain, because doing so would interfere with the line-end rhyme.

(211) ***LINE-FINAL-I-IN-RD** = Assign a violation to any candidate which includes (any segment of) the line-final interval in a cynghanedd RD.

The indexed constraint in (212) expresses the requirement that the right edge of the second rhyme domain align to the right edge of the hemistich.

(212) **ALIGN$_{RD2}$(RD-R, HEMISTICH-R)$_{CONS}$** = The right edge of the second RD aligns to the right edge of a hemistich. Assign one violation per segment intervening between these.

Because the constraint in (211) outranks the one in (212), we see consonantal cynghanedd rhymes where the second rhyme domain extends as far right as it is able to without including any of the final interval.

This ranking can be demonstrated in the tableau in (213) of the line from example (203). (213a) is the winning candidate, with the RD edge placed as far right as possible without including the final interval. (213b) aligns the RD border exactly to the right edge of the hemistich, but includes the final interval in it.

(213)	'deɪθim | i ðɪnas 'dɛθɔl	*FINAL-I-IN-RD	ALIGN$_{RD2}$(RD-R, HEMI-R)$_{CONS}$
	☞ a. ['deɪθ]im | i ðɪnas ['dɛθ]ɔl		**
	b. ['deɪθ]im | i ðɪnas ['dɛθɔl]	*!	

To prevent the rhyme domain from moving farther from the right edge than merely the one interval that must be excluded, we must use a constraint ranked above RHYME! CYNGHANEDD$_{CONS}$ which penalizes a line where there is more than an interval between the right edge of the second rhyme domain and the right edge of the hemistich.

(214) ***]$_{RD}$(σ)|** = Assign one violation to any candidate where there is more than an interval between the right edge of the rhyme domain and the right edge of the hemistich.

This is shown in the tableau in (215) where (215a) moves the right edges of both rhyme domains away from the right edges of the hemistich in order to avoid an imperfect match between the /θ/ and /t/. (215b) does not rhyme, and is the winning candidate.

(215)

'deɪθim | i ðɪnas 'dɛtɔl	*FINAL-I-IN-RD	*]$_{RD}$(σ)|	RHYME! CYNGHANEDD$_{CONS}$
a. ['d]eɪθim | i ðɪnas ['d]ɛtɔl		*!*	
☞ b. 'deɪθim | i ðɪnas 'dɛtɔl			*

These rhyme domain edges that align to the edges of the line occur in a predictable location. However, there is considerable variability in the location of the RD edges which occur on the interior of the line. The right edge of the first rhyme domain varies based on how many syllables are in the final word of each hemistich.

Interim constraint rankings:

(216) *FINAL-I-IN-RD, ≫ RHYME!CYNGHANEDD$_{CONS}$ ≫ ALIGN$_{RD2}$(RD-R, HEMISTICH-R)$_{CONS}$

5.5.2.1.3 RD1-Right

The right edge of the first rhyme domain varies based on whether there is another syllable following the main stressed syllable that defines both hemistichs. In (217a) both hemistichs end in a monosyllable, and neither final consonant is included. In (217b), both hemistichs end in a polysyllable, with an unstressed syllable appearing after the main stress in both cases, and again neither final consonant is included. However, in (217c), only the second hemistich has an unstressed syllable after the main stress, and in this case the final consonant of the first hemistich is included in the rhyme.

(217) a. /mʊi no 'dɪm | am ɛnaɪd 'ɪu / <Mwy no dim, a'm enaid yw> (111:16)
m n d _ m n d

b. /ə 'grɪmɔg | a gʷaɪr 'ɔmax/ <Y grimog a gwae'r omach> (73:32)
gr m _ g r m

c. /anad 'gwir | an:ʊid 'garʊi/ <Anad gwŷr annwyd Garwy> (137:15)
n d g r n: d g r

Having a line where the first hemistich ends in a polysyllabic word and the second ends in a monosyllable is unattested. E.g., switching the hemistichs around from (217c) would not be a possible line of consonantal cynghanedd.

(218) */an:ʊid 'garʊi | anad 'gwir/
n: d g r n d g r

This is because it would be necessary to extend the second rhyme domain into the line-final interval to find a match for the /r/. It would also not be possible to rescue such a line by answering the post-vocalic /r/ of the first hemistich with a pre-vocalic /r/ in the second, as in the example below.

(219) */an:ʊid 'garʊi | anad 'grir/
n: d g r n d gr

This is because the consonants which are included in the RD must be repeated in order not only relative each other, but relative the main-stress-bearing vowel of the hemistich.

An analysis of these facts is set out in the section below.

5.5.2.1.3.1 Excluding the final interval of the hemistich

The table in (220) shows the distribution of rhyme domain positions between words of different lengths. The number of syllables in the first RD are in the rows, while the number of syllables in the second RD are in the columns. When both words are either mono- or poly-syllabic, the rhyme domain, marked by a right square bracket, ends before the final interval of the hemistich.

(220)

Left ↓ / Right →	Monosyllabic	Polysyllabic
Monosyllabic	...'b]ɛɫ | ...'b]id	...'bɛɫ] | ...'baɫ]an
Polysyllabic	* ...'baɫ]an | ...'bɛɫ] * ...'b]aɫan | ...'b]ɛɫ	...'bɛɫ]ax | ...'baɫ]an

When the first word is monosyllabic, and the second is polysyllabic, the rhyme domain in the tail will include the final interval, while the head rhyme domain ends in its usual position. No matter the location of the RD boundary, it is not permissible to have a rhyme where the first hemistich ends in a polysyllabic word and the second ends in a monosyllable (in the grey cell).

There is a requirement that the consonant appearing immediately before the main-stressed vowel be the same in both hemistichs. That is, the repeated sequence of consonants across both hemistich must have the same order not only relative the other consonants, but relative the main stressed vowel. This is what prevents the RD location from being determined solely through MAX/DEP violation avoidance.

The pattern in (220) can be derived with the constraints already introduced, and a few additions. The align constraint for the right edge of the first RD will favor alignment to the right edge of the hemistich:

(221) **ALIGN$_{RD1}$(RD-R, HEMISTICH-R)$_{CONS}$** = The right edge of the first RD aligns to the right edge of a hemistich. Assign one violation per segment intervening between these.

In addition to the unviolated constraint against including the final interval in a cynghanedd rhyme domain, we will make use of the lower-ranked, general version of this constraint against including the hemistich-final interval in a rhyme domain. This will also be a general constraint in a fixed ranking across all types of cynghanedd, though it only interacts with other constraints here in consonantal cynghanedd.

(222) ***HEMISTICH-FINAL-I-IN-RD** = Assign a violation to any candidate which includes (any segment of) the hemistich-final interval in a cynghanedd RD.

While the reasoning behind excluding the line-final interval in a cynghanedd rhyme domain is clear – it participates in its own rhyme and should not be used in another – it is less obvious how this should rule out rhymes including the final interval of a hemistich. However, this interval is considered able to interfere with the line-end rhyme as well. The final interval of a hemistich is not permitted to rhyme, even imperfectly, with the final interval of the line (Rowlands, 1976: xxix) and excluding both the hemistich-final and the line-final intervals from cynghanedd is a sure way to avoid that.

Both of these constraints may be violated in an attested line of cynghanedd groes or cynghanedd draws, which shows us that both must be ranked below RHYME!CYNGHANEDD$_{CONS}$. The fact that *HEMISTICH-FINAL-I-IN-RD outranks ALIGN$_{RD1}$(RD-R, HEMISTICH-R)$_{CONS}$ is why most lines of consonantal cynghanedd do not include the hemistich-final interval.

In the tableau in (223), the outputs use indexing on the consonants to show which ones are in correspondence. The candidate in (223a) is the attested pattern from the figure in (220), where both rhyme domains exclude the final interval. It is possible to have two identical consonants in one rhyme domain correspond with a single consonant in the other (see §5.5.2.2.2), so the example in (223b) would not be ruled out for that. (Though the scarcity of words in Welsh which have a C_iVC_i pattern helps prevent this from being an attested rhyme to my knowledge.) (223b) extends the first RD onto the final interval of the hemistich, and is able to find a correspondent for the final consonant, but it violates the constraint against having the final interval in the RD. (223c) is a candidate that does not rhyme. Not included is a candidate that is trivially different from (223b), but includes only the vowel and not the final consonant in the rhyme domain. It would have the same violation profile as (223b), but would be impossible to distinguish from it because vowels are not required to correspond in consonantal cynghanedd.

(223) σ σ σ 'CVC | σ σ 'CVC	Rhyme! Cyng.$_{cons}$	*Hemi-Final -I-in-RD	Align$_{RD1}$ (RD-R, Hemi-R)$_{cons}$
☞ a. [σ σ σ 'C$_j$]VC | [σ σ 'C$_j$]VC			**
b. [σ σ σ 'C$_j$VC$_j$] | [σ σ 'C$_j$]VC		*!	
c. σ σ σ 'CVC | σ σ 'CVC	*!		

An actual line of poetry exemplifying the pattern of (223a) – with both hemistichs ending in a monosyllabic word – can be seen in (224) where neither hemistich-final interval is included in the RD.

(224) [mʊi no 'd]ɪm | [am ɛnaɪd] 'ɪu <Mwy no dim, a'm enaid yw> (111:16)
m n d m n d

When both hemistichs end in a polysyllabic word, we again see that neither rhyme domain extends into the final interval of its hemistich in the attested pattern, (225a). (225b) again is able to have multiple consonants correspond with a single consonant in the other RD, but is penalized for having a RD in the final hemistich of the line without something to motivate that. For comparison, (225c) does not rhyme.

(225) σ σ 'CVCVC | σ 'CVCVC	Rhyme! Cyng.$_{cons}$	*Hemi-Final -I-in-RD	Align$_{RD1}$ (RD-R, Hemi-R)$_{cons}$
☞ a. [σ σ 'C$_i$VC$_j$]VC | [σ 'C$_i$VC$_j$]VC			**
b. [σ σ 'C$_i$VC$_j$ VC$_j$] | [σ 'C$_i$VC$_j$]VC		*!	
c. σ σ 'CVCVC | σ 'CVCVC	*!		

An example of an attested line of cynghanedd groes showing this pattern is (226), where the consonants of the final intervals are not included in RDs or answered.

(226) [ə 'grɪm]ɔg | [a g^{w}aɪr 'ɔm]ax <y grimog a gwae'r omach> (73:32)
gr m _ g^w r m

We only see the first rhyme domain extend into the final interval in cases where the first hemistich ends in a monosyllabic word and the second ends in a polysyllabic one. This is shown in (227a). We know from the analysis above in §5.5.2.1.2 that the right edge of the second RD always occurs just before the final interval of the line. This means that a line where the first rhyme domain did not extend into the final interval would incur a violation of Max(C) for having a consonant in the second rhyme domain that was not in the first.

It is possible to imagine a line where, like in the tableaux in (223) and (225), the consonants in the second rhyme domain in (227b) shared an index and could be answered by a single consonant in the first RD. There are a few words that fit this pattern in Welsh, but I find no such examples in my corpus.

(227)

σ σ 'CVC | σ σ 'CVCVC	MAX(C)$_{RD}$ 2>1	RHYME! CYNG.$_{CONS}$	*HEMI-FINAL -I-IN-RD	ALIGN$_{RD1}$(RD-R, HEMI-R)$_{CONS}$
☞ a. [σ σ 'C$_i$VC$_j$] | [σ σ 'C$_i$VC$_j$]VC			*	
b. [σ σ 'C$_i$]VC | [σ σ 'C$_i$VC$_j$]VC	*!			**
c. σ σ 'CVC | σ σ 'CVCVC		*!		

An example of this is below, where the first rhyme domain includes the final consonants of the first hemistich in order to match the medial consonant of the final word of the second hemistich.

(228) /[anad 'gʷir̲] | [an:ʊid 'gar]ʊi/ <Anad gwŷr annwyd Garwy> (137:15)
n d g r̲ n: d g r

It is also possible for a rhyme domain to cross the caesura into the other hemistich in order to satisfy MAX(C). This is called *cynghanedd groes o gyswllt.* In the example of this in (229), the first rhyme domain has extended into the second hemistich in order to include the /n/.

(229) /[ɔs daʊ 'hi | n][ɔs da ɪu 'hʊɪn]eb/ <Os daw hi, nos da i'w hwyneb> (162:53)
s d h n s d h n

The final task then is to rule out the unattested pattern of a line where the first word ends in a polysyllabic and the second in a monosyllabic word. The constraints we have already seen will not be sufficient for this. In (230a), there is a violation of DEP(C) for having a consonant in the first rhyme domain that is not answered in the second. Because this pattern does not occur, we would like the non-rhyming candidate (230c) to win, but (230b) is the optimal candidate based on these constraints. Because we know the right edge of the first rhyme domain will move to avoid including the final interval when possible, there is no reason it should not move to avoid an even higher-ranked DEP(C) violation.

(230)

σ 'CVCVC | σ σ σ 'CVC	DEP(C)$_{RD}$ 2>1	RHYME! CYNG.$_{CONS}$	ALIGN$_{RD1}$ (RD-R, HEMI-R)$_{CONS}$
a. [σ 'C$_j$VC$_i$]VC | [σ σ σ 'C$_j$]VC	*!		**
☞ b. [σ 'C$_j$]VCVC | [σ σ σ 'C$_j$]VC			****
☹ c. σ 'CVCVC | σ σ σ 'CVC		*!	

To ensure the correct candidate is chosen, I posit a constraint requiring the main-stress carrying interval of each hemistich be included in a correspondence domain of some type. This can either be in the anti-correspondence domain which requires its contents to meet distinctiveness requirements (marked by underline in tableaux and examples), or in a rhyme domain where they must meet similarity requirements (marked by square brackets). An example like (230b) then would be ruled out because the stressed, beat-carrying interval is included in neither such domain.

(231) **'I-IN-DOMAIN** $_{\text{CONS}}$ = An entire main-stress carrying interval must be in either a correspondence or anti-correspondence domain. Assign one violation per segment of this interval that is not in some domain.

The poetic dissimilation seems related to an account of anti-correspondence under the Agreement-by-Correspondence model presented in Bennett (2013) where segments dissimilate in order to avoid being forced into correspondence. It is similar in poetry. If a metrically prominent sequence were too similar, it would be forced into correspondence. This is similar to the kinds of accidental rhymes in speech that prompt a collocutor to respond, "You're a poet and you don't even know it."

The constraint in (231) is a shorthand for a more complicated analysis that would rule out the specific kinds of identity that are forbidden in the final and stressed intervals of each hemistich. The final interval of the line is always (except in rare cases involving the consonant rhyme of cynghanedd sain) off-limits to the rhyme domains in cynghanedd. The reason for this is that this line-final interval will be participating in end rhyme with the other line in the couplet. If we follow Fabb (1999) in interpreting the purpose of rhyme as being to signal the edge of a prosodic unit, the line, in this case, then having this interval participate in both line-internal and line-end rhymes reduces its ability to signal either one of these and creates conflicting cues for the edges of the hemistich and the line.

The grammarians describe this anti-correspondence for consonantal cynghanedd, saying that the stressed interval of the first hemistich must not form rhyme or imperfect rhyme (called *proest*, /prɔɪst/) with the stressed interval of the second hemistich. Due to the principles underlying this requirement, I assume that it holds for all types of cynghanedd, but the fact that cynghanedd lusg and sain already involve interval rhyme at the end of the first hemistich(s), means that it would be more difficult to accidentally rhyme an adjacent interval with the line-final one.

For example, in (232), if there is already cynghanedd lusg between the hemistich-final [ab] and the stressed ['ab], the chances that the stressed interval of the first hemistich will rhyme with either the stressed or the final interval of the line are low. I believe it is because of this that the grammarians had no need to explicitly rule out such a case.

(232) σσ 'ec[ab] | σ '[ab]<u>ec</u>

Descriptively, the anti-correspondence requirements are as follows. (Rowlands, 1976:xxix) First, the two vowels bearing the main stresses of their hemistichs must not be identical. Second, the two hemistich-final intervals must not rhyme, even imperfectly (which is called *proest* /prɔɪst/). Two intervals are said to form proest when the consonants are identical and the vowels match for quantity. When the vowels are diphthongs, it is the second part of the diphthong which must not match.

We can describe these with the following NONIDENT constraints. These penalize identity between segments in a line, whether they are part of a rhyme domain or not.

(233) **NONIDENT(C/_|)** = The consonant(s) which are final in the hemistich must not be the same as those which are final in the line.

(234) **NONIDENT(V-QUANT/_|)** = The vowel which is final in the hemistich must not be the same quantity as that which is final in the line.

(235) **NONIDENT('V)** = The main stressed vowels in a line must not be identical.

If these constraints are violated, the hemistich is interpreted as rhyming with the final or stressed interval of the line.

Repeating the winner and desired winner from (230) in (236), we can see that by ranking the constraint that the stressed interval must be wholly included in some domain above RHYME!CYNGHANEDD$_{CONS}$, the constraints now favor the non-rhyming candidate (236c). The candidate in (236b) shows that it is important that the entire interval be in a domain, and not just the main-stressed vowel.

(236)

σ 'CVC<u>VC</u> ¦ σ σ σ 'C<u>VC</u>	'I-IN-DOMAIN$_{CONS}$	RHYME! CYNG.$_{CONS}$	ALIGN$_{RD1}$ (RD-R, HEMI-R)$_{CONS}$
a. [σ 'C$_j$]VC<u>VC</u> | [σ σ σ 'C$_j$]<u>VC</u>	*!*		****
b. [σ 'C$_j$V]C<u>VC</u> | [σ σ σ 'C$_j$]<u>VC</u>	*!		
☞ c. σ 'CVC<u>VC</u> ¦ σ σ σ 'C<u>VC</u>		*	

In the cases where the first rhyme domain does extend into the final interval of the hemistich, if that interval includes a consonant cluster, the rhyme may choose to answer some or all of the consonants there.

5.5.2.1.3.2 Splitting clusters

There are attested lines of cynghanedd where the end of the rhyme domain splits a final cluster. The existence of these suggests that the align constraints ought to be violated per segment and not per interval, to disambiguate between a candidate that keeps the entire interval in a rhyme and one that does not. These examples are described below.

In lines where the final consonant(s) of the first hemistich might be included in the rhyme domain, and when the monosyllable of the first hemistich ends in a consonant cluster, it is acceptable to leave some consonants unanswered, such as the /l/ at the end of the first hemistich in (237).

(237) /[gʷaʊr ə 'bɔb]l | [gʷiʊra 'bɛb]ɪɬ/ <Gwawr y bobl, gwiwra bebyll> (111:9)
g r b b g r b b

However, the entire interval of the second RD must be answered, making this the reverse of the pattern that we saw in cynghanedd lusg, where the second was allowed to have unanswered consonants.

(238) /[mal ar 'ʊɪst]l | [mil ɪur 'ɔst]ɛg/ <Mal ar wystl, mul yw'r osteg> (22:58)
m l r st m l r st

Another difference between this pattern and the one seen in cynghanedd lusg is that there, it was often the case that the split of a consonant cluster would correspond to a morphological boundary. Here, the more common split is after a sonority trough – the other frequent break point for a cluster in skaldic rhyme. However, it is not always the case that the cluster is split after a sonority trough – the line in (239) breaks during a slight fall between a liquid and a nasal.

(239) /[hɔn ɪur 'sal]m | [hɪn ir 'ʃjɛl]ɛr/ <Hon yw'r salm, hyn i'r sieler> (43:14)
h n r s l h n r ʃ l

Of the 121 lines of cynghanedd groes and cynghanedd draws that split a final cluster, the distribution of where the split occurs relative to sonority is in the table in (240).

(240)

Cluster type:	Splits on son. rise	Splits on plateau	Splits on son. fall	No split
CC	97	2	16	92
CCC	5	Ø	1	

By comparing this distribution to the distribution of all words ending in VCC in the entire corpus, we can see that rising sonority clusters make up a much larger share of the clusters in these rhymes than they do overall in the corpus:

(241)

	Rising sonority	Sonority plateau	Falling sonority
Number in corpus:	1540	40	2474
Percentage in corpus overall:	38%	1%	61%
Percentage in split rhymes (from (240)):	84%	2%	14%

Rising sonority clusters make up the majority of cases where the edge of a rhyme domain falls within a word in consonantal cynghanedd, and are also over-attested in this position compared to in the corpus as a whole, suggesting the poet chose to put these clusters in this position because they were more splittable.
Interim constraint rankings:

(242) 'I-IN-DOMAIN$_{\text{CONS}}$, *]$_{\text{RD}}$(σ)|, DEP(C)$_{\text{RD}}$2>1, MAX(C)$_{\text{RD}}$2>1

≫

RHYME!CYNGHANEDD$_{\text{CONS}}$

≫

*HEMI-FINAL-I-IN-RD

≫

ALIGN$_{\text{RD1}}$(RD-R, HEMI-R)$_{\text{CONS}}$

5.5.2.1.4 RD$_2$-Left

The left edge of the second rhyme domain, whose position determines whether a line is cynghanedd groes or cynghanedd draws, is determined by avoidance of MAX/DEP violations. Looking at both types of consonantal cynghanedd together, we see that the left edge of the second RD shows a degree of flexibility in its position, contributing to an overall pattern of more flexibility for rhyme domain edges which occur within the line, and less flexibility for those occurring at either end of the line.

5.5.2.1.4.1 Deriving cynghanedd groes & traws by ALIGN$_{\text{RD2}}$(RD-L, HEMISTICH-L)$_{\text{CONS}}$

In cynghanedd groes, every consonant in the second hemistich will be answered, so we can say that the left edge of the second rhyme domain aligns to the left edge of the hemistich with the constraint below:

(243) **ALIGN$_{\text{RD2}}$(RD-L, HEMISTICH-L)$_{\text{CONS}}$** = The left edge of the second RD aligns to the left edge of the hemistich. Assign one violation per segment intervening between these.

However, recalling the example of cynghanedd draws introduced above in (203), and repeated below, we see that it is also permissible to have cynghanedd where there is a sequence of one or more consonants that is unanswered at the left edge of the second hemistich, suggesting the constraint in (243) can be violated in this type of rhyme:

(244) /['deɪθ]<u>im</u> | i ðɪnas ['dɛθ]<u>ɔl</u>/ <Deuthum i ddinas dethol> (73:1)
d θ (ð n s) d θ

The left edge of the second rhyme domain will move to avoid having unanswered consonants in the rhyme domain. However, in a line where the second RD does not extend across the entire hemistich, the rhyme is called cynghanedd draws, and is seen, particularly in cases where very few consonants correspond, as a less impressive display of a poet's skill.

To explain the unanswered series of consonants that characterize cynghanedd draws, I propose that Align$_{RD2}$(RD-L, Hemistich-L)$_{CONS}$ is variably ranked relative the constraint favoring a line with rhyme. These both are a part of the consonantal cynghanedd grammar of constraint rankings, but one has a stricter ranking regarding the align constraint in (243). When Rhyme!cynghanedd$_{CONS}$ is ranked below Align$_{RD2}$(RD-L, Hemistich-L)$_{CONS}$, it requires that the second RD be aligned to the left edge of the hemistich, and when Rhyme! cynghanedd$_{CONS}$ ranks below the Align-L constraint, it allows violations of this constraint in a rhyming pair.

I show examples of this in the tableaux in (245) and (246). Because the location of the other edges of both RDs can be determined through the constraints and rankings already explained above, only candidates showing the correct positions are included in the candidates in these tableaux.

Here, the winning candidate is (245a) where Align$_{RD1}$(RD-L, Caesura)$_{CONS}$ has been violated in order to avoid a violation of Max(C)$_{RD}$. (245b) is ruled out for violating the Max(C)$_{RD}$ constraint. (245c) does not rhyme.

(245)	'deɪθim | i ðɪnas 'dɛθɔl	Max(C)$_{RD}$ 2>1	Rhyme! Cyng.$_{CONS}$	Align$_{RD2}$ (RD-L, Hemi-L)$_{CONS}$
	☞ a. ['deɪθ]im | i ðɪnas ['dɛθ]ɔl <dθ> <dθ>			******
	b. ['deɪθ]im | [i ðɪnas 'dɛθ]ɔl <dθ> <ðnsdθ>	*!** (ðns)		
	c. 'deɪθim | i ðɪnas 'dɛθɔl		*!	

Because Align$_{RD1}$(RD-L, Hemistich-L)$_{CONS}$ is ranked below Rhyme!cynghanedd$_{CONS}$, it can be violated many times and still be an acceptable rhyming line, beating out a candidate which does not contain rhyme domains.

Then, for an example of cynghanedd groes, it is simply a line which requires every consonant in both hemistichs be repeated in order, because the alignment constraint for the left edge of the second hemistich outranks Rhyme!Cynghanedd$_{CONS}$. An example of this is shown in (246). Here, the winning candidate is (246a) where the left edges of both RDs extend as far left as possible within their hemistich. Every consonant in the head has a correspondent in the tail, and no consonant in the tail is without a correspondent in the head.

(246) mʊi no 'dɪm | am ɛ'naɪd ɪu	DEP(C)$_{RD}$ 2>1	ALIGN$_{RD1}$ (RD-L, HEMI-L)$_{CONS}$	RHYME! CYNG.$_{CONS}$
☞ a. [mʊi no 'd]ɪm | [am ɛ'naɪd]ɪu <mnd> <mnd>			
b. [mʊi no 'd]ɪm | am [ɛ'naɪd]ɪu <mnd> <nd>	*! (m)	**	
c. mʊi no 'dɪm | am ɛ'naɪd ɪu			*

There are no attested lines where the first rhyme domain contains a consonant that is not answered in the second. For example, a line such as in (247) does not occur in the corpus.

(247) pʊi no 'dɪm | am ɛ'naɪd ɪu	DEP(C)$_{RD}$ 2>1	ALIGN$_{RD1}$ (RD-L, HEMI-L)$_{CONS}$	RHYME! CYNG.$_{CONS}$
a. [pʊi no 'd]ɪm | [am ɛ'naɪd]ɪu <pnd> <mnd>	*! (p)		
☞ b. pʊi no 'dɪm | am ɛ'naɪdɪu			*

Both types of consonantal cynghanedd can be derived from the same set of constraints, and only the ranking of the particular RHYME!CYNGHANEDD constraint relative the ALIGN-L constraint distinguishes between them. Satisfying the stricter of the two constraint rankings in order to have a line considered cynghanedd groes would be more desirable.

Interim constraint rankings:

(248) DEP(C)$_{RD}$2>1, MAX(C) $_{RD}$2>1 $\gg$ RHYME!CYNGHANEDD$_{CONS}$ $\ll\gg$ ALIGN$_{RD1}$(RD-L, HEMI-L)$_{CONS}$

5.5.2.1.5 Constraint rankings for the size of the RDs

Here is a review of constraints and rankings for the two types of consonantal cynghanedd. These constraints and rankings are specific to the grammar that determines cynghanedd groes and traws. The unindexed constraints, *LINE-FINAL-I-IN-RD, DEP(C), MAX(C), and *HEMISTICH-FINAL-I-IN-RD maintain their same ranking relative each other from the cynghanedd lusg analysis. Here, there is no evidence to rank DEP(C) and MAX(C), but the data is compatible with DEP(C) outranking MAX(C). *HEMISTICH-FINAL-I-IN-RD is ranked too low to play a role in cynghanedd lusg – it is always violated, but it does play a role in consonantal cynghanedd.

*LINE-FINAL-I-IN-RD, ALIGN$_{RD1}$(RD-L, HEMISTICH-L)$_{CONS}$

DEP(C)$_{RD}$2>1, MAX(C)$_{RD}$2>1

≫

ALIGN$_{RD2}$(RD-L, HEMISTICH-L)$_{CONS}$ ≪≫ RHYME!CYNGHANEDD$_{CONS}$

ALIGN$_{RD2}$(RD-R, HEMISTICH-R)$_{CONS}$, *HEMISTICH-FINAL-I-IN-RD

ALIGN$_{RD1}$(RD-R, HEMISTICH-R)$_{CONS}$

*LINE-FINAL-I-IN-RD is unviolated, its ranking above ALIGN$_{RD2}$(RD-R, HEMISTICH-R)$_{CONS}$ describes the positioning of the second rhyme domain's right edge being just before the final interval. ALIGN$_{RD1}$(RD-L, HEMISTICH-L)$_{CONS}$ is unviolated, and describes the constant location of the left edge of the first rhyme domain at the left edge of the line.

*HEMISTICH-FINAL-I-IN-RD outranking ALIGN$_{RD1}$(RD-R, HEMISTICH-R)$_{CONS}$ explains why the first rhyme domain usually ends before the final interval of the hemistich. However, the ranking of MAX(C)$_{RD}$2>1 outranking *HEMISTICH-FINAL-I-IN-RD describes the fact that the first rhyme domain will go into the final interval to match a consonant.

The difference in ranking between the two RHYME!CYNGHANEDD constraints, which are indexed to the CONS constraint series, and ALIGN$_{RD2}$(RD-L, HEMISTICH-L)$_{CONS}$ describes the difference between cynghanedd groes and cynghanedd draws.

5.5.2.2 Contents of the RD

Rhyme is defined by correspondence within a domain. In consonantal cynghanedd, like in alliteration, the domain is defined by the position of its edges and not by the size of its contents. That is, the domain is defined as 'everything between points *a* and *b*' rather than, for example, 'the final interval of the line'. This section looks at what is required to correspond within a consonantal cynghanedd rhyme domain. The vowels play no meaningful role in what strings may stand in correspondence, but some consonants may be unanswered without causing the rhyme domains to fail to stand in correspondence.

5.5.2.2.1 What counts as a consonant

As the name, and the analysis above, suggests, consonantal cynghanedd is concerned with corresponding sequences of consonants. Vowels are not required to match within the rhyme domain for either quality, quantity, or position. However, the question of what counts as a consonant is not entirely straightforward. On the one hand, stops, which one might consider the Platonic ideal among consonants, are always required to correspond. Glides, which are on the other end of the spectrum from stops, are never required to correspond, even when the glide is a hiatal /w/. (Review §5.2.3.2 for explanation of the phonemes of Welsh.)

5.5.2.2.1.1 Unanswered consonants (/n,r,m,h,v/)

The line in (249) shows a consonantal /w/ and /j/ in the first hemistich not being answered in the second hemistich. Unanswered consonants are indicated here by underline in the series of consonants extracted from the example appearing below it. This example also has an unanswered /v/ in the second hemistich, and one of the /m/ of the second hemistich is unanswered.

(249) /əm weɪθjan | am və mɔɪθaɪ/ <Ym weithian am fy moethau> (125:26)
m w θj m v m θ

The other consonants which may be unanswered include the nasals /m/, as in (250), and /n/, as in (251):

(250) /ar draʊs in | ər əmdrɔɪs i/ <Ar draws un yr ymdrois i> (56:33)
r dr s r mdr s

(251) /mi ə glʌʊun | mɛʊn glɔɪʊjaɪθ/ <Mi a glywwn mewn gloywiaith> (39:21)
m gl m n gl

As well as /h/ and /v/:

(252) /dɪhɛŋgaɪs 'i | da əŋ 'saɪnt/ <Dihengais i, da yng saint> (73:73)
d h ŋ s d ŋ s

(253) /daro 'ɬaʊ | derɪu və 'ɬað/ <Daro llaw, deryw fy lladd> (111:56)
d r ɬ d r v ɬ

These unanswered consonants may appear in either hemistich. And unlike the unanswered consonants that appear outside of a RD in cynghanedd draws, these may appear either as the first element in a RD or in the middle of a repeating sequence of other consonants. More examples and discussion may be found in Llwyd (2007:29-34), Rowland (1976: xxxiv-vi).

The set of non-syllabic segments which are not required to be repeated in a consonantal cynghanedd rhyme domain appears in (254a). The remaining non-syllabic segments of Welsh, which must be answered, appear in (254b).

(254) a. {m, n, r, v, h, w, j}
b. {p, t, k, b, d, g, θ, ð, s, f, x, ɬ, ŋ, l, m̥, n̥, ŋ̊, r̥}

The consonants which do not need to be answered then form a fairly unnatural looking set. It is the glides; the nasals except for /ŋ/; the voiced liquid /r/, but not /l/; /v/, but not the other voiced fricative /ð/; and /h/.

While this appears to be a very unnatural class, we can capture this grouping through the use of MAX/DEP constraints targeting particular features. Flemming (2005) proposes reexamining the idea of natural classes being defined by shared features, and to see them instead as the result of particular ranked markedness constraints and shared environments. By this approach, the constraint set determines natural classes as well as what processes they may feature in.

Adopting this approach here, the seemingly mixed bag of non-syllabic segments from (254a) can be left unanswered by penalizing an unanswered obstruent or lateral segment more harshly.

The successful implementation of such an approach also requires we take /v/ to be the approximant /ʋ/ (as proposed in Evans, 2003:9) and the aspirate /h/ to not count as an obstruent. Laterals have been argued to be non-continuant, which explains why they can pattern separately from rhotics in other languages. (van de Weijer, 1995) Then, by replacing MAX/DEP(C)$_{RD}$2>1 with the constraints in (255) and (256) (and their analogous DEP constraints), we will have forbidden most of (254b) from being unanswered.

(255) **MAX(OBSTRUENT)$_{RD}$2>1$_{CONS}$** = Assign one violation per obstruent which appears in the second RD and does not have a correspondent in the first RD.

(256) **MAX(LATERAL)$_{RD}$2>1$_{CONS}$** = Assign one violation per lateral which appears in the second RD and does not have a correspondent in the first RD.

This leaves only /ŋ/ to be explained. Capturing its behavior by referencing place of articulation seems undesirable. The velar nasal should be no more marked than the others just for being velar. This sound is historically a geminate in Welsh having derived from an earlier /ŋg/ (Jackson, 1963:509) and that might contribute to its being slightly longer than a non-geminate nasal. However, /m/ is also historically a geminate and has a similar phonological distribution to /ŋ/ in terms of tending to disallow long vowels before it, so this explanation also seems unlikely.

Additionally, the approach of Flemming (2005) relies on shared phonetic properties and environmental factors that cause disparate groups of segments to behave similarly. While a sonority-based view would allow us to consider the phonemes of Welsh on a scale from most vowel-like to most consonant-like, nasals and approximants would fall closer to the vowel-like end of the spectrum, and therefore less likely to count as consonants in consonantal rhyme, we are still left with the question of why /ŋ/ must always be answered, though they should be no more or less consonantal than the other nasals.

5.5.2.2.1.2 Corpus numbers for skipped consonants

Of the recognised lines of cynghanedd groes and traws in the corpus of Dafydd ap Gwilym, these optionally matching consonants are attested at the following rates. The following data exclude the glides, because except for the rare /w/ rhyme, they are never included in a rhyme. All of the optional consonants are unanswered at comparable rates, around twenty percent.

(257)

Segment	Participating in a rhyme	Unanswered	Percent unanswered
/m/	1466	401	21.5%
/n/	3474	997	22.2%
/r/	3946	814	17.1%
/v/	1725	471	21.4%
/h/	803	230	22.2%

The following table, in (258), shows where in the line the unanswered segment appears. The numbers are divided as to whether they appear in the first or second hemistich (i.e. in RD_1 or RD_2) and whether they appear as the first element of the RD, as in (250) and (251), and are potentially outside the RD, or if they appear in the interior of the RD, as in (252) and (253), and are indisputably inside the RD. The beginning of the second hemistich is by far the most common place to place these unanswered segments, followed by the interior of the second hemistich.

(258)

Segment	First hemistich		Second hemistich	
	First in line	Interior	First in line	Interior
/m/	70 (17%)	23 (6%)	236 (59%)	72 (18%)
/n/	150 (15%)	66 (6%)	577 (58%)	204 (20%)
/r/	76 (9%)	100 (12%)	440 (54%)	198 (24%)
/v/	31 (6%)	61 (13%)	222 (47%)	157 (33%)
/h/	38 (16%)	27 (12%)	85 (37%)	80 (35%)

Placing unanswered consonants at the beginning of the second RD could be preferred because this is where unanswered consonants appear for cynghanedd draws. However, because these segments are allowed to be unanswered even in positions where they are clearly RD-internal, I interpret lines with an unanswered /m,n,r,v,h/ at the beginning of the second hemistich as still counting as the more ornate cynghanedd groes.

Another fact about these optionally answered consonants is that they are more likely to be answered when they occur before the beat-carrying stressed vowel of the hemistich. To capture this, I propose that there is a constraint requiring that a consonant of any kind be answered when it appears before the stressed, beat-carrying vowel of the hemistich:

(259) **Max(C)$_{RD}$/_'V!** = A consonant appearing before the stressed, beat-carrying V in one RD must have a correspondent in the same context in the other RD.

This constraint would disallow an example where the consonant appearing before the stressed, beat-carrying vowel was mismatched or skipped, regardless of whether it was a consonant which is allowed to be unanswered in a RD.

(260) /gʷɪu 'vorvɪð | gʷaɪ o'vervarð/ <Gwiw Forfudd, gwae oferfardd> (111:11)
g v rv g v rv

This constraint will also help to penalize the kind of imperfect rhyme examples in §5.5.2.2.2 where a consonant is in a different position relative the stressed vowel in the two hemistichs. Hammond (2012) and Griffen (1997) both treat this fault as related to the metrical structure of the line, but I treat it as the result of this being a salient position for a consonant.

5.5.2.2.2 Correspondence constraints

While the nature of cynghanedd groes and cynghanedd draws matching only consonants and ignoring vowels means that Contiguity and Dep/Max(V)$_{RD}$ will always be violated, more effort is made to satisfy Linearity. While I have no examples where Dafydd ap Gwilym violates this constraint, there are other poets who do, such as in the example below, via Llwyd (2007:19). Generally, this will be two adjacent consonants (ignoring intervening vowels) whose order is reversed in one hemistich. The following is from. Here, the <r n> sequence of the first hemistich is answered by a <n r> sequence in the second.

(261) /gaɪr ə wna ɬe:s | gʊin ir ɬaɪɬ/ <Gair a wna lles, gwyn i'r llaill> (Lewys Daron)
g r n ɬ g n r ɬ

Llwyd (2007: 74) has examples where a sonorant + voiceless stop may correspond to a single voiced stop, which means that a constraint for Weak Linearity is most suitable (to allow coalescence). This is defined below:

(262) **Weak Linearity**: If x precedes y and $x\mathcal{R}x'$, $y\mathcal{R}y'$ then y' does not precede x'.

Violating this constraint results in the metrical fault called *camosodiad,* /kamɔs'ɔdɪad/, 'misplacement'.

A requirement of consonantal cynghanedd that combines the requirements of stricter matching requirements on the consonant that appears immediately preceding the main-stressed vowel and the requirement that the consonants be repeated in order is that the sequence of matching consonants be repeated in the same order relative each other and relative the main stress that determined the location of the caesura. However, it is a recognized fault (that is, it is attested frequently enough that the grammarians have taken notice of it) to mis-order one or more consonants relative this stress. Doing so is called *crych a llyfn*, /krɪx ə ɬɪvn/, “wrinkled and smooth”.

Below is an example from Rowlands (1976:xlvi). Here, the stressed vowel in the first hemistich, marked by a forward slash in the second line of the example, comes before the /l/. However, in the second hemistich, it follows the /l/.

(263) /gʷlad 'ʊlstɛr | glɔd ɛ'lʌstan/ <Gwlad Wlster glod Elystan> (Iolo Goch)
g l d / lst gl d l/ st

5.5.2.2.3 Correspondence of empty RDs

This analysis, treating the RD as defined by its boundaries rather than its contents, predicts that it should be possible to have two RDs in a line of poetry where none of the high-ranked correspondence or identity constraints are violated because there is nothing in the RD strings which must stand in correspondence. While in interval rhyme, it is not possible to define an empty rhyme domain, the fact that cynghanedd groes and traws rely on matching consonants alone mean that empty strings are possible even when the RD extends across the entire hemistich. This is similar to alliteration, where it is possible to alliterate empty onsets.

This form of cynghanedd is uncommon and not considered very beautiful, but there exist a few 4-line englyn, called *englyn bogalog* ('vocalic englyn'), which are comprised entirely without consonants.

The example below contains two unanswered /h/ in the first hemistich, but is otherwise all vowels within the rhyme domains:

(264) /hɔɪu ə 'h<u>arð</u> | eɪ ʊiaɪ '<u>ev</u>/ <hoyw a hardd ei wyau ef> (Aled Llion Jones)

The poet composed this line specifically to illustrate this possibility. That this line is allowed to rhyme shows a low ranking of the constraint requiring that an /h/ be matched before a stressed vowel for this poet.

5.5.2.3 Imperfect matches

While identity among correspondent consonants within the RD is generally required to be complete, that is, consonants either have a perfect identity match or remain unanswered entirely when allowable, there are a few exceptions to this. The types of imperfect rhymes permitted in cynghanedd vary between the consonantal rhyme types and the interval rhyme types. There are no noticeable asymmetries between the rhyme domains in terms of imperfect matches.

Below are a selection of frequently attested imperfect rhymes. However, any contrast that is either fully or partially neutralized in a given environment is a candidate for imperfect rhyme. A more thorough catalogue of these can be found in Llwyd (2007: 54-101) or Rowlands (1976: xxxix-xlii).

5.5.2.3.1 ŋg~ŋ

Velar nasals may be rhymed with a sequence of a nasal plus a voiced velar stop.

(265) /o dro 'ɪaʊŋgɔv | drʊi 'aŋɛrð/ <O dro iawngof drwy angerdd> (159:31)
dr ŋg dr ŋ

The low-ranking constraint against this is:

(266) **Max(g/ŋ_)$_{RD}$** = Assign a violation per /g/ following an /ŋ/ in one rhyme domain that does not have a correspondent in the other rhyme domain.

5.5.2.3.2 n~n:

Another segment mismatch that may occur is in sonorant length. Only <n> and <r> have geminate variants in Welsh, and the difference is arguably realized in the vowel in most cases, but geminate and singleton sonorants may correspond freely.

(267) /anad 'gwir | an:ʊid 'garʊi/ <Anad gwŷr annwyd Garwy> (137:15)
n d g r n: d g r

Similarly, two instances of an identical segment across word boundaries may correspond to a single segment. Below, a single /ð/ in the first hemistich corresponds to two in the second:

(268) /maʊr 'ðɪsgʊil | mɔrvɪð 'ðɪsglaɪr/ <Mawr ddisgwyl Morfudd ddisglair> (111:25)
m r ð sg l m r ð ð sgl

The constraint against this, ranking below rhyme and any of the Align constraints is:

(269) **Ident(Long)$_{RD}$** = Assign one violation to any pair of correspondent segments in a RD which do not have the same value for length.

5.5.2.3.3 C_i~C_iVC_i

One instances of two of the same consonant in a row, even separated by vowels, may be skipped when it corresponds to a single consonant in the other hemistich. Below, the single /n/ of the first hemistich corresponds to the two /n/ of the second.

(270) /ən ə 'ti: | vin ɛnaid̥ 'tɛg/ <Yn y tŷ, f'un enaid teg> (73:8)
n t n n d̥ t

Because the doubled consonant can occur in either the head or the tail RD, both

Uniformity and Integrity can be violated:

(271) **UNIFORMITY$_{RD}$2>1** = No consonant in the second RD has multiple correspondents in the first RD.

(272) **INTEGRITY$_{RD}$2>1** = No consonant in the first RD has multiple correspondents in the second RD.

5.5.2.3.4 Assimilation/sandhi effects

There are also examples showing that in consonantal cynghanedd, consonants are matched based on their realized pronunciation and not their underlying value.

Although /r/ is said to be able to correspond freely with its voiceless counterpart, in my sample corpus, the only examples of this I have are where the /r/ is followed by an /h/ across a word boundary and has devoiced due to this context.

(273) /ar hid 'ʊibr | ə r̥ɛd 'ɔbri/ <Ar hyd wybr y rhed obry> (111:48)
r̥ d br r̥ d br

Similarly, there is an example which appears to have an unanswered /d/, but it is followed by a /t/ across a word boundary, and has assimilated in voicing. This is in (274).

(274) /ən ə 'ti: | vin ɛnaid̥ 'tɛg/ <Yn y tŷ f'un enaid teg> (73:8)
n t n n d̥ t

There are a number of other examples showing that surface pronunciation is what is being compared in these rhymes, including voicing neutralization after /s/, nasal place assimilation, Nt~Nd rhymes (where N = any sonorant), as well as vowel elision.

5.5.3 Conclusion of cynghanedd groes and cynghanedd draws analysis

The two types of consonantal cynghanedd can be captured with the same set of constraints, with the choice of satisfying one of two different RHYME!CYNGHANEDD constraints that distinguishes between them. They differ only in the positioning of the left edge of the second rhyme domain.

Both share the requirements that only obstruents and lateral segments within the rhyme domain must be answered and will tolerate an empty rhyme domain, as long as there are no DEP/MAX violations. Although cynghanedd lusg would tolerate MAX(C) violations and consonantal cynghanedd will not, the relative ranking of *LINE-FINAL-I-IN-RD ≫ DEP(C) ≫ MAX(C) ≫ *HEMISTICH-FINAL-I-IN-RD still holds here, as it did for llusg.

5.6 Cynghanedd Sain

Cynghanedd sain, introduced in §5.2.2.2.4, is the last of the four main types of cynghanedd to be addressed in this work. It is also the most well-attested type of cynghanedd in my corpus, found in 36% of the lines. It differs from the other types in that it requires a different metrical structure of the line, with three main stresses instead of two. These three stresses divide the line into three parts, which I call triolets. This division gives rise to the interlocking dependencies for rhyme that were mentioned in §5.1.2.4 as a unique challenge posed by cynghanedd. Here, each triolet must be linked by correspondent rhyme domains, which may overlap with each other, including having the same segment included in two rhymes, as in the example in (275) where the /ð/ of the second triolet is in an interval rhyme and a consonantal rhyme.

(275) /guir pɔb 'gr[að] | mad 'n[að] | 'nɛðɪv/ <Gŵyr pob gradd, mad nadd neddyf> (1:83)
n ð n ð

5.6.1 Introduction and basic facts for cynghanedd sain

In this type of cynghanedd, the first two triolets show rhyme between the final intervals of their final words, and there is consonant rhyme between the second and third triolets, similar to that of cynghanedd groes or cynghanedd draws. In the example in (276), there is interval rhyme in the final /aɪl/ intervals of the first and second triolets, and consonant rhyme between the /dr/ in the second and third triolets. The underlined final interval is, as in the other kinds of cynghanedd, unavailable for line-internal rhyme.

(276) /raɪd urθ ər 'h[aɪl] | ə 'dr[aɪl] | drem/ <Raid wrth yr haul a draul drem> (111:32)
dr dr

Cynghanedd sain requires that each pair of adjacent triolets be linked by correspondent rhyme domains. These must stand in a one-to-one relation – rhyme domains may only occur in pairs in cynghanedd. The two pairs of RDs must each be a different type of rhyme: one pair of interval rhyme and one of consonant rhyme.

The definition of the RHYME! constraint favoring a line that rhymes must be adjusted from the general cynghanedd definition that has worked, in combination with an independent grammar of constraints and rankings, for both cynghanedd lusg and consonantal cynghanedd. The new version of this constraint for cynghanedd sain is below:

(277) **RHYME!CYNGHANEDD$_{SAIN}$** = For any pair of adjacent triolets T_1, T_2 in a line, there is a substring (=RD) in T_1 that has a correspondent in T_2 and these stand in a one-to-one relation.

Rewording the definition to reference triolets rather than hemistichs is a superficial change, as triolets are a sub-type of hemistichs. Adding a requirement that the RDs stand in a one-to-one relation is important, however, to rule out the possibility of three consecutive rhyme domains appearing in the line, one in each triolet, all correspondent with each other. This addendum ensures that the winning candidate is one containing two pairs of rhyme domains in a line of cynghanedd sain.

The constraints on the rhyme domains that hold between these triolets are introduced in the following sections. Those on the interval rhyme are discussed in §5.6.2 and those on the consonant rhyme follow in §5.6.3. §5.6.4 looks at their interaction with each other and how they make up a line of cynghanedd sain. §5.6.5 discusses acceptable differences within the rhyme domains.

To distinguish the two pairs of rhyme domains which occur in cynghanedd sain, I refer to the rhyme domain which consists of an interval as "interval rhyme" and the rhyme domain where only consonants are required to be identical as "consonant rhyme".

5.6.2 Analysis of interval rhyme

Unlike the interval rhyme of cynghanedd lusg, in the interval rhyme of cynghanedd sain, there is no asymmetry to motivate constraints that apply only to the first or to the second rhyme domain. In that sense, it functions like the line-end rhyme of this Welsh poetry and of the Irish poetry analyzed in §3. Imperfect rhymes are permitted, but not ones like in cynghanedd lusg where unanswered segments are allowed in one RD, but not the other.

Taking the line in (278) for example, both interval rhyme domains contain at least one interval and align to the right edge of their triolet.

(278) /raɪd urθ ər 'h[aɪl] | ə 'dr[aɪl] | 'dr<u>em</u>/ <Raid wrth yr haul a draul drem> (111:32)
dr dr

We can describe this using constraints that are familiar from cynghanedd lusg, but here the constraints are indexed only as cynghanedd sain interval rhyme (RD_I) and do not reference either the first or second rhyme domains. The interval rhyme will always align to the right edge of its triolet, which is explained by a high ranking for the constraint in (279).

(279) **ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$** = The right edge of an interval rhyme domain aligns to the right edge of a triolet. Assign one violation per segment that intervenes.

Although the size of consonantal cynghanedd rhyme domains is determined by the align constraints and some shifting of these boundaries to make sure the content of the RDs matches, for cynghanedd sain, the size of the interval rhyme is always at least one interval, so the constraint below will be undominated.

(280) **$RD_I{\geq}I_{SAIN}$** = An interval rhyme contains at least one interval.

These constraints are unviolated in any attested line of cynghanedd sain, so they must rank above the RHYME!CYNGHANEDD$_{SAIN}$ constraint. The highly-ranked markedness constraint against including the final interval of the line in a cynghanedd RD, repeated in (281), is unviolated, and therefore not outranked by constraints on the position of the interval RD for cynghanedd sain.

(281) ***LINE-FINAL-I-IN-RD** = Assign a violation to any candidate which includes (any segment of) the line-final interval in a cynghanedd RD.

This ranking is what confines the interval rhyme to the first and second triolets of a line. In this position, the rhyme domains are able to occupy adjacent triolets (partially satisfying RHYME!CYNGHANEDD$_{SAIN}$), contain at least one interval (satisfying $RD_{I}{\geq}I_{SAIN}$), and be aligned to the right edge of both triolets (satisfying ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$).

In the tableaux in (282) - (285), consonant rhyme is indicated by a subscript <i> to satisfy the other requirements of RHYME!CYNGHANEDD$_{SAIN}$. Correspondent interval rhyme domains are indicated by square brackets with subscript <j>.

The winning candidate (282a) is the attested pattern, which satisfies the constraints by having interval rhyme between the first two triolets. (282b) does not contain cynghanedd sain.

(282) σ σ CVC | σ CVC | CVCVC	*LINE-FINAL -I-IN-RD	ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$	RHYME!CYNG.$_{SAIN}$
☞ a. σ σ C[VC]$_j$ | σ C$_i$[VC]$_j$ | C$_i$VCVC			
b. σ σ CVC | σ CVC | CVCVC			*!

In (283), candidate (283b) violates *LINE-FINAL-I-IN-RD by having right-aligned rhyme domains in the second and third triolets. There are no such lines in the corpus.

(283) σ σ CVC | σ CVC | CVCVC	*LINE-FINAL -I-IN-RD	ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$	RHYME!CYNG.$_{SAIN}$
☞ a. σ σ CVC | σ CVC | CVCVC			*
b. σ σ C$_i$VC | σ C$_i$[VC]$_j$ | CVC[VC]$_j$	*!		

(284b) moves the rhyme domain in the third triolet off of the final interval, for a pair of rhyme domains that could stand in correspondence as cynghanedd lusg, but this is not permissible by the grammar for cynghanedd sain rhyme domains, and it is ruled out.

(284) σ σ CVC | σ CVC | CVCVC	*LINE-FINAL -I-IN-RD	ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$	RHYME! CYNG.$_{SAIN}$
☞ a. σ σ CVC | σ CVC | CVCVC			*
b. σ σ C$_i$VC | σ C$_i$[VC]$_j$ | C[VC]$_j$VC		*!*	

Candidate (285b) also violates RHYME!CYNGHANEDD$_{SAIN}$ by placing the rhyme domains in two non-adjacent triolets.

(285)

σ σ CVC | σ CVC | CVCVC	*LINE-FINAL -I-IN-RD	ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$	RHYME!CYNG.$_{SAIN}$
☞ a. σ σ CVC | σ CVC | CVCVC			*
b. σ σ C[VC]$_j$ | σ C$_i$VC | C$_i$[VC]$_j$VC		*!*	*

These constraints determine the location of the interval rhyme domain in the first two triolets of the line. §5.6.2.1 discusses how an interval is defined for these rhymes.

5.6.2.1 The size of an interval rhyme domain for sain

As described in §5.4.3.4, for the purposes of interval rhyme in cynghanedd lusg, glides count as consonants, so any diphthong or triphthong that begins with a glide-like vowel will only be required to match the sonority peak of that diphthong. An example of this is in (286), where the /j/ that begins the second RD is unanswered and outside that RD.

(286) /a:r vɔɪs h[on] | breɪðʊʌdj[on] | braʊ/ <Â'r foes hon, breuddwydion braw> (137:38)
br br

There are also questions about where the interval for this type of rhyme ends: at the word boundary, or at the following vowel of the next word. As in the example above, where both rhyme domains are followed by /br/, making the largest possible rhyme domain here <onbr>, the consonants following the RD may continue to match into the next word, up to the following vowel.

This suggests it is possible for the rhyme domain to contain an entire interval, even across the caesura. Because the caesura represents the end of a phonological phrase, we might expect to see a strong break here in terms of the interval boundaries. However, rhyme domains are able to cross the caesura on rare occasions in other types of cynghanedd to match a consonant that needs to be answered and to display the poet's skill.

This whole-interval rhyme effect may be facilitated by the fact that there will be some consonants immediately following the second interval rhyme RD which are answered in the second triolet, and it is not uncommon for their correspondents to be immediately following the first interval rhyme RD, as they do in (286). If this tendency to have both sets of correspondent consonants immediately following the interval rhyme were due to a desire to maximize the size of the interval, or to create a minimal VC interval for the RD, we might expect to see this effect more strongly in RDs which consist of a single vowel, such as in the line below.

(287) /ɬe ɬeɪnʊ hɛl[i] | dʌw[i] | daɪr/ <Lle lleinw heli Dywi daer> (1:12)
d d

However, we see the opposite effect. In lines where the interval RD includes at least one consonant, there is a significantly (p<0.01) greater chance that the consonants following the caesura will match as well.

(288)

	Whole interval is kept	Interval is split
RD=V	186 (40%)	267 (60%)
RD=VC+	1,311 (52.7%)	1,177 (47.3%)

It could be that instead of trying to create a minimal VC interval to rhyme, the poet was reacting to the stronger assimilatory influence that a following consonant would have on a preceding one. For example, in the line in (286), the /n/ at the end of the marked rhyme domain may have been somewhat assimilated to the following /b/ across the caesura. By having a /b/ follow both interval rhyme domains, the poet created a closer match between the rhymes.

It is difficult to draw conclusions from these facts alone. It is possible that the poet was attempting to rhyme a full interval, across word boundaries and caesuras, and was using the consonant rhyme to make this possible. It may also be an accidental pattern, with the additional consonants lining up at no greater than chance frequency.

5.6.2.2 Summary and interim constraint rankings

The constraints in (289) describe the location and size of the RD for the interval rhyme of cynghanedd sain. The first three constraints are undominated, and their ranking above RHYME!CYNGHANEDD$_{SAIN}$ means that a winning candidate will contain interval rhyme between the first two triolets, which consists of at least one interval, and aligns to the right edge of its triolet.

(289) *LINE-FINAL-I-IN-RD ≫ RHYME!CYNGHANEDD$_{SAIN}$
ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$
RD$_I$≥I$_{SAIN}$

5.6.3 Analysis of consonantal rhyme

While the constraints in §5.6.2 limit interval rhyme to the first two triolets, the consonant rhyme is free to fit around the final interval of the line, and can easily occupy the third triolet. There is nothing preventing consonantal sain rhyme from appearing between the first two triolets, but because of the needs of the interval rhyme, a winning candidate for a line of cynghanedd sain will always be one where the interval rhyme appears in the first two triolets and the consonant rhyme appears in the second two.

The question of this section is to determine what counts as a consonant for this consonant rhyme, and which consonants must be answered. As an example of the basic case, the line from (276) is repeated below in (290). Here, every consonant from the beginning of the third triolet up to the final interval is answered in the second triolet, which contains an unanswered /l/. Consonant rhyme domains are indicated in these examples with curly brackets to disambiguate them from the square brackets of interval rhyme. Correspondent consonants appear below the line.

(290) /raɪd urθ ər 'h[aɪl] | {ə 'dr[aɪ}l] | {dr}em/ <Raid wrth yr haul a draul drem> (111:32)
dr dr

We know from (275), repeated below in (291), that a segment is not blocked from participating in a second rhyme domain just because it is already a part of another. Here, the /ð/ of the second triolet has correspondents in both the first and the third triolets, in separate rhyming pairs.

(291) /guir pɔb 'gr[að] | mad {'n[að]} | {'nɛð}ɪv/ <Gŵyr pob gradd, mad nadd neddyf> (1:83)
n ð n ð

These two examples above also show us that the unanswered consonants in the second triolet may appear either on the right or the left side of the answered segments. The example in (292) shows that unanswered segments may also be on both the right and left sides.

(292) /'g^{w}neɪθ[ir] | ni b{i 'se}g[ir] | {'s}ɛrx/ <Gwneuthur, ni bu segur serch> (73:21)
s s

These examples show that the align constraints for the right and left edges of the first rhyme domain (in the second triolet) are low-ranked, and that it is the second rhyme domain which map exhaustively into the first. These examples also show that in the third triolet, every consonant must be answered from the beginning of the triolet up to the final interval, even when this domain would include more than a single onset, as in (293).

(293) /ar 'ɬ[aɬ] | ðin {'valxg}[aɬ] | {'vʌlxg}aɪr/ <A'r llall, ddyn falchgall fylchgaer> (111:19)
v lxg v lxg

These observations can be captured in constraints through the use of some variations on the constraints used in the analysis of cynghanedd groes and cynghanedd draws. The constraint aligning the left edge of the second RD to the left edge of a triolet is unviolated, and ranks above RHYME!CYNGHANEDD$_{SAIN}$. These constraints are indexed for RDc2, the second consonantal rhyme domain for sain.

(294) **ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$** = The left edge of the RD aligns to the left edge of a triolet. Assign one violation per segment intervening between these.

The constraint governing the right edge of the second rhyme domain ranks below RHYME!CYNGHANEDD$_{SAIN}$ because it is violated in every line of cynghanedd sain in order to satisfy *LINE-FINAL-I-IN-RD. This ranking ensures that the second RD will extend from the left edge of the third triolet up to the final interval.

(295) **ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$** = The right edge of the RD aligns to the right edge of a triolet. Assign one violation per segment intervening between these.

The position of the second consonant rhyme domain is demonstrated in the tableaux in (296) - (299), where the first RD is invariant and spans its entire triolet.

The attested pattern is shown in the candidate in (296a), which aligns the left edge of the second RD to the left edge of the third triolet, and the right edge of it appears right before the final interval. This violates the low-ranked ALIGN-R constraint, but is the optimal candidate.

(296)

$\sigma\ \sigma\ CVC \mid \sigma\ CVC \mid CVC\underline{VC}$	*LINE-FINAL-I-IN-RD	ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$	RHYME! CYNG.$_{SAIN}$	ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$
☞ a. $\sigma\ \sigma\ CVC \mid \{\sigma\ C_iVC_j\} \mid \{C_iVC_j\}\underline{VC}$				**
b. $\sigma\ \sigma\ CVC \mid \sigma\ CVC \mid CVC\underline{VC_j}$			*!	

In (297b), the second RD extends to the right edge of the third triolet, violating the high-ranked *LINE-FINAL-I-IN-RD constraint.

(297)

$\sigma\ \sigma\ CVC \mid \sigma\ CVC \mid CVC\underline{VC}$	*LINE-FINAL-I-IN-RD	ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$	RHYME! CYNG.$_{SAIN}$	ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$
☞ a. $\sigma\ \sigma\ CVC \mid \sigma\ CVC \mid CVC\underline{VC_j}$			*	
b. $\sigma\ \sigma\ CVC \mid \{\sigma\ C_iVC_j\} \mid \{C_iVC_j\underline{VC_j}\}$	*!			

(298b) is ruled out for violating the ALIGN-L constraint, and leaving a consonant of the third hemistich out of the rhyme domain.

(298)

$\sigma\ \sigma\ CVC \mid \sigma\ CVC \mid CVC\underline{VC}$	*LINE-FINAL-I-IN-RD	ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$	RHYME! CYNG.$_{SAIN}$	ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$
☞ a. $\sigma\ \sigma\ CVC \mid \sigma\ CVC \mid CVC\underline{VC_j}$			*	
b. $\sigma\ \sigma\ CVC \mid \{\sigma\ C_iVC_i\} \mid C\{VC_i\}\underline{VC}$		*!		

(299b) violates RHYME!CYNGHANEDD$_{SAIN}$ by placing the two correspondent RDs in non-adjacent triolets, so they cannot stand in correspondence.

(299) σ σ CVC | σ CVC | CVC<u>VC</u>	*LINE-FINAL-I-IN-RD	ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$	RHYME! CYNG.$_{SAIN}$	ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$
a. σ σ CVC | σ CVC | CVC<u>VC$_j$</u>			*	
b. {σ σ C$_i$VC$_j$} | σ C$_i$VC | {C$_i$VC$_j$}<u>VC</u>			*	

The align constraints on the first RD will also rank below RHYME!CYNGHANEDD$_{SAIN}$, and will be violated in order to satisfy MAX/DEP constraints.

(300) **ALIGN$_{RDc1}$(RD-L, TRIOLET-L)$_{SAIN}$** = The left edge of the RD aligns to the left edge of a triolet. Assign one violation per segment intervening between these.

(301) **ALIGN$_{RDc1}$(RD-R, TRIOLET-R)$_{SAIN}$** = The right edge of the RD aligns to the right edge of a triolet. Assign one violation per segment intervening between these.

These are demonstrated in the tableau in (303), using the line below, which shows violations of both RDc1 align constraints.

(302) /'gʷneɪθ[ir] | ni b{i 'se}g[ir] | {'s}<u>ɛrx</u>/ <Gwneuthur, ni bu segur serch> (73:21)
s s

Here, only the second two triolets are included in each candidate, because any candidate with a RD in the first triolet will violate RHYME!CYNGHANEDD$_{SAIN}$. In candidate (303a), the winner, each align constraint has been violated three times to avoid violating DEP(C) and MAX(C). (Although the rhyme domains occur in the second and third triolets, the MAX/DEP constraints still reference the first and second rhyme domains, not the triolets in which they occur.) Candidate (303b) fully satisfies both align constraints, but at the cost of four violations of DEP(C). The candidate in (303c) has an empty RD in the second triolet, which violates MAX(C). For comparison, (303d) does not rhyme.

(303) /gʷneɪθir | ni bi segir | s<u>ɛrx</u>/	DEP(C)$_{RD}$ 2>1	MAX(C)$_{RD}$ 2>1	RHYME! C.$_{SAIN}$	ALIGN$_{RDc1}$ (RD-L, TRI-L)$_{SAIN}$	ALIGN$_{RDc1}$ (RD-R, TRI-R)$_{SAIN}$
☞ a. ni b{i se}gir | [s]<u>ɛrx</u> <s><s>				***	***
b. {ni bi segir} | {s}<u>ɛrx</u> <nbsgr><s>	*!*** (nbgr)				
c. ni bi segir{} | {s}<u>ɛrx</u> <><s>		*! (s)		*********	
d. ni bi segir | s<u>ɛrx</u>			*!		

Because the unindexed constraints that apply to all types of cynghanedd have a fixed ranking relative each other, we know that DEP(C) outranks MAX(C) from their behavior in cynghanedd lusg, even though there is no evidence for a ranking between them here.

A complete ranking for the constraints on the consonantal rhyme in sain follows.

5.6.3.1 Constraints and interim ranking

The constraint *LINE-FINAL-I-IN-RD is undominated here, as is the align constraint favoring the second RD have its left edge aligned to the left edge of a hemistich. DEP(C) and MAX(C) are also ranked above RHYME!CYNGHANEDD$_{SAIN}$, and, crucially, above the two align constraints that govern the first rhyme domain, which adjusts to avoid DEP/MAX violations. The align constraint for the right edge of the second rhyme domain is also ranked below RHYME! because it will move to avoid violating *LINE-FINAL.

(304)

*LINE-FINAL-I-IN-RD	≫	RHYME!CYNGHANEDD$_{SAIN}$	≫	ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$
DEP(C)$_{RD}$2>1				ALIGN$_{RDc1}$(RD-L, TRI-L)$_{SAIN}$
MAX(C)$_{RD}$2>1				ALIGN$_{RDc1}$(RD-R, TRI-R)$_{SAIN}$
ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$				

5.6.3.2 A minimal consonant rhyme for cynghanedd sain?

In some cases, there will be no consonants to match in this defined portion of the third triolet between the caesura and the final interval. As described above, the first rhyme domain will shift, within limits, to find consonants to match. In some cases, it appears the second rhyme domain may do the same. In cynghanedd sain, rather than give up on a consonant rhyme and allow an empty rhyme domain to stand, the domain for matching consonants in the third triolet can extend over the caesura or into the final interval.

This empty rhyme usually happens when the final triolet contains a monosyllabic word that is vowel-initial. This means that once the final interval has been excluded, there is nothing available to rhyme. There are 44 such lines in my corpus. There are three solutions to this, which I introduce in this section.

The first is to allow empty rhyme domains to stand in correspondence, as can be done in cynghanedd groes or traws. An example of this is in (305). No consonants stand in correspondence between the last two triolets. 19 of the lines take this approach.

(305) /ɪ 'ox[el] | {'aw[e}l] | {'aɪ}av/ <I ochel awel aeaf> (35:39)

The second method is to allow the second RD to extend into the final interval to find a consonant to match. An example of this is in (306). There are 19 lines which show this method.

(306) /ən arɔs 'gʷ[ɛn] | {'ɛl[ɛ}n] | {'aɪl}/ <Yn aros gwen, Elen ail> (63:2)
l l

The third approach is to extend the second rhyme domain across the caesura to use the final consonant(s) of the second triolet in the rhyme domain, as in the example in (307). This occurs in 6 lines.

(307) /r̥ɔdj[aɪs] | ni hɪr {sʌ}nj[aɪ{s] | }i̲/ <Rhodiais, ni hir syniais i> (68:47)
s s

It is surprising to see the strategies of violating previously unviolated constraints in order to find a consonant for the consonantal rhyme, when cynghanedd groes and traws, as well as 19 examples of cynghanedd sain are willing to rhyme empty RDs. These examples could be explained by a variably-ranked constraint requiring that the consonantal RD contain at least one C:

(308) **CONSRD≥C$_{SAIN}$** = The RD for consonantal rhyme in sain must contain at least one consonant.

If this outranks both ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$ and *FINAL-I-IN-RD, then the second RD will be extend into the final interval or across the caesura to find a consonant to rhyme. However, the fact that nearly half of the lines which fit the criteria for this do have an empty RD suggests that this constraint, despite being occasionally high-ranked, is not a priority for the poet.

5.6.4 Interlocking rhyme domains

The above sections show how interval rhyme and consonantal rhyme work independently of each other, but do not specify how to require that both be present in a single line. The constraint rankings for the interval rhyme will ensure that their RDs occupy the first two triolets, and the consonant rhyme will occur between the second and third triolets because this is what remains and each triolet needs to have a RD.

However, there is nothing to stop a line of cynghanedd sain from containing two pairs of consonantal rhyme domains. This would look like the example in (309), where the second triolet of each pair maps fully into the triolet that precedes it. Here, numbers and curly brackets mark the second pair of RDs, and letters and square brackets mark the first.

(309) $[C_AV\ C_BVC_CVC_D]C_E \mid [C_AV\{C_{B1}C_{C2}VC_{D3}\}] \mid \{C_1VC_2C_3\}\underline{VC}$

This could could be ruled out by the constraint in (310), or one similar to it. The line in (309) seems difficult to parse, difficult to create, and not as pleasant to listen to or easy to recognize as a rhyme as a mixture of interval and consonantal rhymes in a line would be. However, it is not clear exactly what principles dictate this requirement.

(310) ***OVERLAPPINGCONS** = A RD containing consonantal cynghanedd may not overlap with another non-correspondent RD containing consonantal cynghanedd.

Overlapping rhyme domains, we know from the example in (311), repeated from (275), are permitted. It is also possible to have multiple rhyme domains of the same type in a line: cynghanedd lusg and sain have two non-correspondent interval rhymes in the line, counting the line-end rhyme.

(311) /guir pɔb 'gr[að] | mad {'n[að]} | {'nɛð}<u>IV</u>/ <Gŵyr pob gradd, mad nadd neddyf> (1:83)
n ð n ð

A complete list and ranking of all constraints required for the grammar that evaluates cynghanedd sain is in (312).

(312) *LINE-FINAL-I-IN-RD ≫ RHYME!CYNGHANEDD$_{SAIN}$ ≫ ALIGN$_{RDc2}$(RD-R, TRIOLET-R)$_{SAIN}$
DEP(C)$_{RD}$2>1
MAX(C)$_{RD}$2>1
ALIGN$_{RDI}$(RD-R, TRIOLET-R)$_{SAIN}$
RD$_{I}$≥I$_{SAIN}$
ALIGN$_{RDc2}$(RD-L, TRIOLET-L)$_{SAIN}$
ALIGN$_{RDc1}$(RD-L, TRI-L)$_{SAIN}$
ALIGN$_{RDc1}$(RD-R, TRI-R)$_{SAIN}$

5.6.5 Acceptable imperfect rhymes

As in the other types of cynghanedd, certain types of imperfect rhymes are permitted in cynghanedd sain. The kinds of imperfect matches that occur in the interval rhyme of cynghanedd sain are generally the same as occur in cynghanedd lusg, and the consonantal rhyme of cynghanedd sain allows the same imperfect matches as does cynghanedd groes and traws.

5.6.5.1 Interval rhyme

In interval rhymes, vowel length and stress can be mismatched in a RD, as in the example below, where a stressed /e:/ rhymes with an unstressed /e/:

(313) /gʷɛdi 'd[e:l] | priv 'rʌv[el] | 'praf/ <Gwedy dêl, prif ryfel praff,> (111:33)
pr pr

This suggests a low ranking of the following constraints:

(314) **IDENT(LONG)$_{RD}$** = Any pair of correspondent vowels in a rhyme domain must match for length.

(315) **IDENT(STRESS)$_{RD}$** = Two correspondent vowels in a RD must match for stress.

5.6.5.2 Consonant rhyme

Similar to the consonant rhyme in cynghanedd groes and traws, the consonant(s) appearing immediately before the stressed vowel of the third triolet must be answered, but otherwise it is only the obstruents, laterals, and /ŋ/ which must have a match. The example in (316) shows an /m/ in the third triolet which has no pair in the second, meaning the /k/ is the only part of the consonant rhyme which is answered. The line in (317) shows an unanswered /n/.

(316) /ɪ 'vʌn[i] | {'kʌ}mr[i] | {am 'k}<u>a:r</u>/ <I fyny, Cymry a'm câr> (73:50)
k _ k

(317) /nɪd an:'hɛb[ɪg] | {'ð[ɪg]} | {'ðɔgn}<u>i</u>/ <Nid annhebig, ddig ddogni> (111:45)
ð g ð g_

As mentioned in §5.6.2.1, in interval rhyme, glides count as consonants, at least in that they can be left out of a rhyme domain which begins on a vowel, for the consonant rhyme part of cynghanedd sain, they are treated as vowels, and are generally not answered in the rhymes. The only exception to this is in lines where a monosyllabic vowel-initial word makes up the third triolet. If that word contains a glide, it may find a correspondent in the second triolet rather than resorting to one of the methods discussed in §5.6.3.2. Examples of this are in (318a-b).

(318) a. /kʌ'waɪθ[ɔg] | ag 'en{w[ɔ}g] | '{ʊ̯}<u>iv</u>/ <Cywaethog ac enwog wyf> (16:28)
w w

b. /mʌnɛd om 'gʷl[ad] | 'dʌv{j[a}d] | {'j}<u>o:r</u>/ <Myned o'm gwlad, dyfiad iôr> (13:5)
j j

Having correspondence between a segment that does not usually correspond is another way to satisfy CONSRD≥C_{SAIN}.

5.6.6 Summary

Cynghanedd sain has complex requirements due to its metrical structure of three triolets. Because each of these must contain a RD and RDs can only exist in pairs, each line of cynghanedd sain involves two separate rhyme patterns: one consonantal and one interval-based. However, these both use constraints that are familiar from the other types of consonantal and interval cynghanedd.

In interval rhyme, the size of the RD is fixed and it aligns to the edge of a hemistich. In consonant rhyme, the RD is defined by the aligning of its edges to the edges of a hemistich, and must find a correspondent for each relevant segment it contains. The relevant segments are obstruents, laterals, and /ŋ/, but other consonantal segments may be answered as well.

5.7 Towards unification of cynghanedd analyses

Because the poetic grammars for the three different types of cynghanedd draw on a similar set of constraints and share some constraint rankings between them, the analysis seems open to a unification of all three grammars. Consonantal cynghanedd already relies on a variable ranking between the RHYME!CYNGHANEDD constraint and the $\text{ALIGN}_{\text{RD2}}$(RD-L, HEMISTICH-L) constraint in order to derive the difference between cynghanedd groes and cynghanedd draws, so capturing every type of cynghanedd by treating it as a slight variation on the others, with a few constraint re-rankings seems like an achievable goal.

However, the number of variable constraint rankings involved in this would be considerable, and it is not clear that it would be possible to motivate the required variable rankings any more than the separate grammar account presented here. It appears it is not possible to say, for example, that when constraint α outranks constraint β, then constraint γ also outranks constraint δ. For this reason, I continue to support an analysis of separate grammars indexed to the rhyme domains they create. I do however, leave open the possibility of a unified analysis for future work.

Rather than push for a unified analysis, I consider the shared constraints and similarities between the three grammars to be part of a typology of rhyming grammars. Different rankings produce different grammars and poetic traditions by drawing on the same set of constraints governing the size, location, and identity between the contents of a rhyme domain.

By maintaining three separate grammars which are indexed to the rhyme domains that they govern, we can also more easily explain the presence of multiple types of cynghanedd in one line. In the example in (319), repeated from (107), there is cynghanedd lusg in (319a) and cynghanedd groes in (319b).

(319) a. /dɛglen 'n[ɛ:s] | dʊi glɪn '[ɛs]ɪ<u>θ</u>/ <Degle'n nes, dwy glun esyth> (25:31)

b. /[dɛglen 'nɛ:s] | [dʊi glɪn 'ɛs]ɪ<u>θ</u>/
d gl n n s d gl n s

Represented in a single example, we can mark the two cynghanedd domains as below, with square brackets marked with subscript for the llusg, and curly brackets marked with superscript (for clarity) on the croes RD:

(320) /$\{$dɛglen 'n[ɛ:s]$_{\text{LLUSG}}\}^{\text{CROES}}$ | $\{$dʊi glɪn '[ɛs]$_{\text{LLUSG}}\}^{\text{CROES}}$ɪ<u>θ</u>/ (25:31)

No cynghanedd sain RD was able to be placed in this line, so there is not an index set of rhyme domains for it. Similarly, in lines without cynghanedd, none of the three grammars is able to establish a set of RDs in the line. Instead, they are left unornamented, or, as in the example in (321), they show alliteration. Here, the alliteration includes at least the /d/ of /dɪlaɪs/ and /deɪli/, and could include the /l/ as well. If this is a part of a pattern, and not accidental matching, it would be evidence for more types of cynghanedd filling out the poetic typology.

(321) /{dɪl}aɪs ə {deɪl}i hɛb 'ʌstrɪu/ <Dilaes y deily heb ystryw> (124:29)

However, cynghanedd is said to always involve the main stressed vowels of the line or their surrounding consonants. One of these main stresses must be the penultimate vowel of the line, and there is no recognisable repetition of the consonants surrounding it. If (321) is an example of a previously unnotived type of cynghanedd, it is quite different from the other ones.

5.7.1 Constraint review for cynghanedd lusg

The constraints on the size and position of the rhyme domains for cynghanedd lusg are presented below in Figure 14.

*LINE-FINAL-I-IN-RD

MAX(C/'V_)$_{RD}$2>1

ALIGN$_{RD1}$(RD-R, HEMISTICH-R)

RD$_2$ ≥'I

DEP(C)$_{RD}$

RD$_1$≥I

RHYME!CYNGHANEDD$_{LUSG}$

MAX(C)$_{RD}$2>1

Figure 14: Constraint rankings for cynghanedd lusg

Here, *LINE-FINAL-I-IN-RD is undominated. The fact that it outranks RD2≥'I derives the position of the second RD in the penultimate interval of the line. This is the only way for a main stress bearing, non-final vowel to be included in a rhyme domain for cynghanedd.

Max(C/'V_), ALIGN$_{RD1}$(RD-R, HEMISTICH-R), and RD1≥I are unviolated, and describe facts independently, without interacting with other constraints. The fact that RD2≥'I outranks Max(C)$_{RD}$ means that unanswered segments in the second rhyme domain are permissible.

5.7.2 Constraint review for consonantal cynghanedd

*Line-Final-I-in-RD

Align$_{RD1}$(RD-L, Hemistich-L)

Dep(C)$_{RD}$2>1, Max(C)$_{RD}$2>1

Rhyme!Cynghanedd$_{CONS}$ ≪≫ Align$_{RD2}$(RD-L, Hemistich-L)

Align$_{RD2}$(RD-R, Hemistich-R)

*Hemistich-Final-I-in-RD

Align$_{RD1}$(RD-R, Hemistich-R)

Figure 15: Constraint rankings for consonantal cynghanedd

For consonantal cynghanedd, as for cynghanedd lusg, *Line-Final-I-in-RD is undominated, and its ranking above Align$_{RD2}$(RD-R, Hemistich-R) means that the second rhyme domain excludes the final interval of the line.

Align$_{RD1}$(RD-L, Hemistich-L) is unviolated and means that the first rhyme domain will always align to the left edge of a hemistich, and of a line. The ranking of Max(C)$_{RD}$2>1 over *Hemistich-Final-I-in-RD means that the rhyme domain will extend into the final interval to match a consonant, but will not do so otherwise.

The variable ranking between Rhyme!Cynghanedd$_{CONS}$ and Align$_{RD2}$(RD-L, Hemistich-L) captures the difference between cynghanedd groes and cynghanedd draws.

5.7.3 Constraint review for cynghanedd sain

ConsRD≥C

*Line-Final-I-in-RD

Dep(C)$_{RD}$2>1, Max(C)$_{RD}$2>1

Align$_{RDI}$(RD-R, Hemistich-R)
RD$_{I}$≥I

Rhyme!Cynghanedd$_{SAIN}$

Align$_{RDc2}$(RD-L, Hemistich-L), Align$_{RDc2}$(RD-R, Hemistich-R)

Align$_{RDc1}$(RD-L, Hemistich-L), Align$_{RDc1}$(RD-R, Hemistich-R)

Figure 16: Constraint rankings for cynghanedd sain

The possible or variable ranking of ConsRD≥C over *Line-Final-I-in-RD means that the consonantal rhyme domain for cynghanedd sain may extend into the final interval to find a match – something that no other type of cynghanedd does. The fact that *Line-Final-I-in-RD outranks both of the constraints on the interval-based rhyme domains means that this pair will be restricted to appearing in the first two triolets.

The fact that Dep(C)$_{RD}$2>1 and Max(C)$_{RD}$2>1 outrank all of the align constraints on the first RD for the consonantal rhyme means that this rhyme domain will adjust its edges on both sides to match all and only the consonants appearing in the second rhyme domain.

5.7.4 Poetic typologies

While a unified account of the three main kinds of cynghanedd would not simplify the analysis, the fact that these grammars share constraints in different rankings shows that the attested cynghanedd grammars are a part of a larger typology of rhymes.

The interval-based cynghanedd, llusg and sain, share a preference to align to the right edge of a hemistich. The consonantal cynghanedd patterns of croes, traws, and sain, all share a willingness to adjust their edges to avoid Max(C) and Dep(C) violations. They also only require identity between the consonants within these edges.

If every possible ranking of these constraints is a potential poetic grammar, then we expect to see traditions which are very similar to cynghanedd, but differ in some key ranking. For example, we see assonance patterns, such as in Spanish feminine assonance, where a rhyme domain spans across several syllables, but only requires identity in vowels, not consonants.

Future work will create a complete factorial typology of the constraints involved in cynghanedd to test whether we see every possible combination of constraints and rankings in the three or four types of attested cynghanedd, and whether some combinations can be ruled out on independent grounds.

5.8 Towards establishing a head and tail rhyme for cynghanedd

In cynghanedd, as in skaldic rhyme, there are asymmetries between the two rhyme domains standing in correspondence. In rhyming traditions where both rhyme domains occur in a similar, predictable location (e.g. the final interval of the line) and where imperfect rhymes involving an unanswered segment may appear in either order, such as in Irish rhyme, there is no need to treat the two rhyme domains as distinct. However, when analyzing line-interal rhyme, where the location of at least one rhyme domain can vary, and where there are often asymmetries in terms of which RD may contain unanswered consonants, it is essential that the constraints be indexed to the two rhyme domains in order to capture these differences.

In this work, I have labeled the rhyme domains in terms of their linear order: RD1 and RD2. For skaldic rhyme, there is a clear division between the two rhyme domains, such that one can be judged to be more prominent by a number of criteria. This rhyme domain is refered to as the 'head' in Árnason (2007) and Steriade (2011b). The less prominent RD is called the 'tail' in Steriade (2011b) and the 'support' in Árnason (2007).

Drawing on the analysis of skaldic rhyme in the two aforementioned works, I look at the properties which separate skaldic head rhymes from tail rhymes, and how these properties are distributed between the two rhyme domains involved in each type of cynghanedd. Although the distribution is much less clear in cynghanedd, this section works towards determining a head and a tail for Welsh rhymes.

5.8.1 Skaldic heads and tails

In skaldic rhyme, like in cynghanedd, the two rhyme domains occur within a line. One of these is always the penultimate interval, and the other may occur anywhere earlier in the line, as long as there is at least one syllable between the two rhyme domains (Árnason, 2007:98). The penultimate syllable is always stressed and is metrically prominent because it carries the beat of the line. For the most part, the entire interval is answered in the earlier rhyme domain (see Árnason (99-101) for some exceptions, which mostly involve sonority rises and morphological boundaries).

An example of these is in (322). Here, the entire penultimate interval of <adr> is the head rhyme, and the [edr] of the third syllable is the tail rhyme. Following the answered segments of the tail rhyme domain, there is an unanswered /s/.

(322) nauta l*edrs* á n*adr*i (via Árnason, 2007: 98)

Based on the division of head and tail rhymes in Skaldic, we can say that the features of a head rhyme include the following:

(323)
- A regular and predictable location (e.g. penultimate interval in the line)
- A regular and predictable size (e.g. a whole interval)
- Prosodic prominence (stress and metrical prominence)
- Maps exhaustively into the other RD

5.8.2 Welsh is less clear

In Welsh cynghanedd the distribution of these traits between the two rhyme domains in a line is different, with neither rhyme domain having every trait of a head rhyme domain. Moreover, the distribution of these traits is different in each kind of cynghanedd, as I discuss below.

This section looks at each type of cynghanedd, and evaluates the two rhyme domains for the four properties of a head rhyme introduced above in (323).

5.8.2.1 Cynghanedd lusg

Cynghanedd lusg is most similar to skaldic rhyme in that it involves the main-stress bearing penultimate interval rhyming with an interval appearing earlier in the line. Some key differences are that in cynghanedd lusg, the two rhyme domains are not required to be separated by one or more intervals (though Dafydd ap Gwilym does show a preference for doing so). Secondly, while the first/tail rhyme domain in skaldic may appear in the middle of a word, in cynghanedd lusg, it must appear at the end of the word containing a main stress.

5.8.2.1.1 Regular and predictable location

For cynghanedd lusg, the first rhyme domain may occur in any syllable between the first, as in (324a), to the fifth, as in (324b). It may be main-stressed or it may only carry a pitch accent, but it is always the final interval of the main-stressed word of its hemistich. Despite this variability in location, it is consistently the final interval of the first hemistich.

The second rhyme domain occurs in the main-stressed penultimate syllable that occurs just before the end of the line.

(324) a. /'r̥[aɪd] | ɔɪð əm vɛdri 'p[eɪd]jaʊ/ <Rhaid oedd ym fedru peidiaw> (137:37)
b. /ni wisgav 'vɛn[ɪg] | 'n[ɪg]is/ <Ni wisgaf fenig nigus> (15:27)

Both rhyme domains are in a regular, predictable location at the hemistich level, but the second rhyme domain is also in a fixed position at the line level, which gives it a greater degree of regularity in location.

5.8.2.1.2 Regular and predictable size

The first rhyme domain is defined as the final vowel and any following consonants, up to the end of the word, which is also the end of the hemistich. The second rhyme domain is the penultimate vowel and all following consonants up to the next vowel.

(325) /paɪn asgɛɬ[as] | din[ast]aɪ/ <Paun asgellas dinastai> (32:39)

Both rhyme domains have a regular size.

5.8.2.1.3 Prosodic prominence

The first rhyme domain may be stressed and pitch-accented (in a monosyllabic word, as in (326a) above) or only pitch-accented (as the final syllable of a polysyllabic word (as in (326b))). If stressed, it will carry the main stress of the hemistich, but the strongest stress of the line is said to be the final one.

(326) a. /'r̥[aɪd] | ɔɪð əm vɛdri 'p[eɪd]jaʊ/ <Rhaid oedd ym fedru peidiaw> (137:37)
b. /ni wisgav 'vɛn[ɪg] | 'n[ɪg]is/ <Ni wisgaf fenig nigus> (15:27)

The second rhyme domain will always include the main stressed vowel of both its hemistich and the line. However, because cynghanedd lusg can only occur with a polysyllabic word ending the second hemistich, it will only carry the stress, and not the pitch accent.

The second rhyme domain is more likely to be prosodically prominent.

5.8.2.1.4 Maps exhaustively into the other RD

The first rhyme domain maps exhaustively into the second rhyme domain, which may have unanswered consonants. An example of this is in (327) where the /t/ of the second rhyme domain is unanswered.

(327) /paɪn asgɛɬ[as] | din[ast]aɪ/ <Paun asgellas dinastai> (32:39)

The first rhyme domain meets this criterion.

5.8.2.2 Cynghanedd groes/draws

Although there appears to be no significant asymmetry between the two rhyme domains for cynghanedd groes, there is a more obvious difference for cynghanedd draws. I treat them as variations of the same type of rhyme here, as elsewhere, in evaluating which is the head.

5.8.2.2.1 Regular and predictable location and size

The size and location of the rhyme domain in cynghanedd groes and traws are hard to separate, because the size (meaning what corresponds within a RD) is dependent on the location.

The first rhyme domain extends from the left edge of the hemistich to the caesura. The consonant cluster immediately preceding the caesura may count only partially, as in (328), or not at all, as in (329), depending on the consonants in the other rhyme domain.

(328) /[gʷaʊr ə 'bɔb]l/ | /[gʷiʊra 'bɛb]ɪɬ/ <Gwawr y bobl, gwiwra bebyll> (111:9)
g r b b g r b b

(329) /[mʊi no 'd]ɪm/ | /[am ɛnaɪd] 'ɪu/ <Mwy no dim, a'm enaid yw> (111:16)
m n d m n d

The second rhyme domain ends before the final interval of the line, and goes as far left as it is able, provided it does not include any consonants not present in the other rhyme domain. The line in (330) is an example of cynghanedd draws, where the second hemistich includes a sequence of unanswered consonants at its left edge.

(330) /['pl]a | ar hɔɬ vɛrxɛd[ə 'plʊ]iv/ <Pla ar holl ferched y plwyf!> (137:2)
pl pl

Cynghanedd groes and traws present some additional challenges in determining which rhyme domain has the more regular size and location. For cynghanedd groes, the size and location are fairly equal – both extend across the entirety of the hemistich (excluding the final intervals). However, both the first and the second rhyme domains will adjust to some degree to avoid DEP(C) or MAX(C) violations, so it not a completely binary distinction to say which RD is the more regular and predictable. However, since the left edge of the second RD will move farther than the right edge of the first one will, I consider the first RD as more head-like in this respect.

5.8.2.2.2 Prosodic prominence

The first rhyme domain will include at least the consonant appearing immediately before the main stressed vowel of the hemistich, and may include the vowel and following consonants. The second rhyme domain has a similar distribution as the first rhyme domain concerning the main stressed vowel of the second hemistich.

It is not clear that either rhyme domain is more prosodically prominent than the other in this sense. The rightmost stress is said to be strongest (Aled Llion Jones, p.c.), but these stresses are not necessarily in either rhyme domain, though the consonants preceding them will be. The second RD is slightly stronger in this respect, by virtue of containing the rightmost stress.

5.8.2.2.3 Maps exhaustively into the other RD

The first RD must map exhaustively into the other RD, in the sense that the contents of the first RD will determine the size of the second RD, but unanswered consonants are not allowed in either RD, so there is no clear distinction between the two in this regard.

5.8.2.3 Cynghanedd sain

In cynghanedd sain, the interval rhymes do not show any asymmetries and do not have a head or tail rhyme, which I demonstrate in §5.7.2.3.1. However, the consonant rhymes do, and I evaluate their differences in §5.7.2.3.2.

5.8.2.3.1 Interval rhyme for sain

5.8.2.3.1.1 Regular and predictable location

Both interval rhyme domains occur at the right edge of their triolet:

(331) ar 'ɬ[aɬ] | ðin 'valxg[aɬ] | 'vʌlxgaɪr <A'r llall, ddyn falchgall fylchgaer> (111: 19)

5.8.2.3.1.2 Regular and predictable size

Both rhyme domains consist of the final vowel and any following consonants up to the end of the word.

5.8.2.3.1.3 Prosodic prominence

Either rhyme domain may contain a stressed, pitch accented vowel when a monosyllable ends the triolet, or a pitch-accented, unstressed vowel when a polysyllabic word ends the triolet.

5.8.2.3.1.4 Maps exhaustively into the other RD

Unanswered segments are not permitted in either rhyme domain, and neither rhyme domain may adjust its boundaries to accommodate unanswered segments (excluding glide onsets, which, if present, will not be included in the rhyme domain).

5.8.2.3.2 Consonant rhyme for sain

5.8.2.3.2.1 Regular and predictable size and location

As for cynghanedd groes and traws, the size and location of the rhyme domains for this type of consonantal cynghanedd are very closely related, so I treat them together.

The first rhyme domain may be anywhere within the second triolet of the line, for example in (332), where the rhyme domain is in the middle of the second triolet, with unanswered segments on either side. The second rhyme domain extends from the beginning of the triolet up to the left edge of the final interval and includes every consonants within this range.

The size of both rhyme domains depends on how many consonants occur within the defined location of the rightmost rhyme domain. See the examples in (331), which answers four consonants, and (332), which only answers one.

(332) /gʷneɪθ[ir] | ni b{i 'se}g[ir] | '{s}ɛrx/ <Gwneuthur, ni bu segur serch> (73:21)
s s

The second rhyme domain has a more predictable location and size.

5.8.2.3.2.2 Prosodic prominence

The first rhyme domain may or may not include a stressed vowel or the consonant immediately preceding or following it. The line in (332) has an example where both answered consonants precede the stressed vowel. However, in (333), the third triolet includes the consonants before the stressed vowel, but in the second triolet, these answered consonants are not before a stressed vowel.

(333) /a:r vɔɪs h[on] | {br}eɪ'ðʊʌdj[on] | '{br}aʊ/ <Â'r foes hon, breuddwydion braw> (137:38)
br br

The second rhyme domain will generally include at least any consonants which precede the main stressed vowel of the triolet. This, combined with the fact that the final stress of the line is considered slightly stronger, makes the second rhyme domain is more prosodically prominent.

5.8.2.3.2.3 Maps exhaustively into the other RD

As was the case for cynghanedd groes and traws, neither rhyme domain may contain unanswered consonants, because the RD border adjust to avoid MAX(C)/DEP(C) violations. Neither RD can be said to be more prominent in this regard.

5.8.3 Choosing a head rhyme domain

In every type of cynghanedd, the distribution of properties signifying prominence is less clear than in skaldic rhyme, where every criterion favors the head. The facts described above are summarized in the chart in (334). The consonant rhyme of cynghanedd sain has a fairly clear distribution, with no criteria favoring the first RD, but the other two types of rhyme are somewhat mixed. A ✓ marks the favored RD, and an x marks a trait that is inconclusive.

(334)

	Llusg		Croes/Traws		Sain (Cons.)	
	1	2	1	2	1	2
Regular location		✓	✓			✓
Regular size	x	x				
Prosodic prominence		✓		✓		✓
Exhaustive mapping	✓		x	x	x	x
Winner?		✓	(✓)			✓

5.8.3.1 Open issues, problems

By considering all these traits of a head rhyme as discrete and equally important, we are able to assign 'head' to one rhyme domain for each type of rhyme based on which exhibits the most behaviors associated with a head rhyme. However, in the case of the consonantal rhymes, the location and size of the rhyme domains are closely linked, and exhaustive mapping is not a relevant criterion because the RDs adjust to avoid imperfect mappings. Because of this, treating these three behaviors separately may lead them to be over-emphasized in choosing a head rhyme domain.

Although the rightmost stress is said to have the most prosodic prominence, linear precedence may be a factor that is driving these rhymes to treat the leftmost rhyme domain as head in some respects, for example in choosing the first RD as the one to map exhaustively into the other in cynghanedd lusg, or choosing the first RD to determine the size of the second in cynghanedd draws.

The criteria that determined the head rhyme for skaldic may not be the correct criteria in choosing a more prominent RD for cynghanedd. A better set of a criteria is not obvious to me, and I leave this question open for future research.

5.9 Summary

This chapter shows how the principles of phonological analysis of rhyme can be applied to even a system as complex as that of cynghanedd. Though this we see that the rhyme domain boundaries that occur in unexpected places, such as the middle of a line, or the middle of a word, fit into the larger typology of poetry with some adjustments to our expectations. Rhyme domains that end in the middle of the line are aligning to a hemistich boundary, and those that end in the middle of a word contain an interval, and not a syllable rime.

This analysis of cynghanedd shows the difference between interval rhyme, where a vowel plus any following consonants are included in the rhyme domain, and consonant rhyme, where only the consonants must find correspondents. The former of these is similar to the more familiar end-rhyme in that its boundaries are defined by its contents: one interval. Consonant rhyme, on the other hand, is more similar to alliteration, but taken to an extreme. While the domain for alliteration is typically measured from the beginning of a word to a steep rise in sonority, the domain for consonantal cynghanedd spans across an entire hemistich. Because these domains are defined by their position, and not their contents, both will allow correspondence of empty domains.

Many of the other challenging aspects of cynghanedd involve interaction with other aspects of the line or the grammar. For example, there is interaction between non-correspondent rhyme domains to avoid confusion, because the ornamentation of the line is a way of communicating its structure, e.g. by marking line boundaries. (Fabb, 1999) Cynghanedd also interacts with the prosody of the line, in that it is sensitive to a number of main stresses which determine the type of cynghanedd that the line is eligible for.

The line can be evaluated by three separate grammars, each with its own set of constraints and rankings which are indexed to the rhyme domains that they govern. A line which satisfies the constraints ranking above a RHYME! constraint for a particular grammar (or grammars) will be permitted to stand in correspondence. These constraints are ranked relative a set of four constraints which have a fixed ranking across all types of cynghanedd. These constraints, and their rankings are in (335).

(335) *LINE-FINAL-I-IN-RD » DEP$(C)_{RD}$2>1 » MAX$(C)_{RD}$2>1 » *HEMISTICH-FINAL-I-IN-RD

In addition to these, there are some shared low-ranked IDENT(F) constraints between the different types of interval rhyme (llusg and sain) and the consonant rhyme (croes, traws, and sain). Within the same type of rhyme domain, the same differences are tolerated, even though the rhymes might have different requirements in terms of alignment to a hemistich.

Future work will present a factorial typology of the constraint used in cynghanedd to determine whether we should expect other types of cynghanedd to exist, beyond these three separate grammars.

Chapter 6
Conclusion

This dissertation has presented grammars of the rhyming systems of Early Irish, skaldic, and Welsh to show how they relate to a typology of rhyming systems. Analysis of poetic rhymes using the interval rather than the syllable rime has allowed me to unify the definition of the size of a rhyme, whether it occurs at the end of a word or in the middle of one. A syllable-based account is sufficient for line-final rhyme, but such an account would have been unable to explain why the rhyme domain for skaldic rhyme and cynghanedd lusg so frequently answers every consonant up until the following vowel. Investigation into the constituency of the interval across word boundaries for cynghanedd sain allowed me to make the observation in §5.6.2.1 that in about half of all lines, the sequence of answered consonants stretches across a caesura into a following word for a full interval.

I have found that a major difference between rhyme and alliteration is that rhyme domains are defined by their contents: e.g. at least one interval, or at least one stressed interval, while alliterative domains are defined by the space they occupy: e.g. from the beginning of a word to the first rise in sonority, or across an entire hemistich. This is why we see empty alliteration domains, even in domains as large as the ones for Welsh consonantal cynghanedd, but we do not see empty rhyme or assonance domains.

The claim made in Fabb (1999:239) that consonantal cynghanedd could not be alliteration because alliteration domains are never interrupted, i.e. they never appear in an ABAB pattern, like rhyme, while cynghanedd appears to do exactly this, is seen to be unnecessary. Although consonantal cynghanedd can contain many segments repeated in order, it is a single domain, which is uninterrupted, and holds between adjacent constituents, just as Fabb (1999) expects for alliteration.

There are a number of complications that arise in systems which involve multiple forms of mostly obligatory ornamentation. The interaction between the cynghanedd and end-rhyme in Welsh, for example, is to avoid conflicting cues about the location of line-ends. The final interval of the line is not available for cynghanedd to avoid the listener thinking that the end of a hemistich was actually the end of a line. Both involve similar prosodic cues, because a main stress of the line will occur before both. If there is rhyme, or near rhyme, between the end of a hemistich and the end of the line, then the listener may interpret the ambiguous communication incorrectly. Fabb (1999:238) makes similar claims about the interaction of skaldic rhyme and alliteration avoiding sending ambiguous cues about the division of the line into hemistichs.

Like many other rhyme traditions, where a periodic meter plays a role in the size of an end-rhyme domain and whether it contains a stressed interval, in Welsh, too, there is some cooperation in the interaction between stress and the rhyme domain. Cynghanedd and end-rhyme are both organized around the main stresses of their hemistichs, but rather than getting this stress information from a strict meter, it comes from the prosody of the line. Here, then, the sub-line constituent that rhyme is sensitive to is the phonological phrase, rather than the foot.

This dissertation has also looked at a rhyming grammar with multiple options, including not rhyming, available for each line. While the prosody (of two versus three main stresses in a line) means that some types of cynghanedd will not be available for some lines, in general, it is not possible to predict what kind of cynghanedd will appear in a given line. This means that all of the grammars are available to the poet, who must choose between them. Because there are a number of lines which contain more than one type of cynghanedd, it appears that the grammar would favor a candidate which satisfied the requirements for every type of cynghanedd in every line. In many cases, the types of cynghanedd are incompatible with each other, or it is not possible to find words with the right corresponding segments in order to satisfy more than one type of cynghanedd. An acceptable line of cywydd poetry is one that has at least one type of cynghanedd, or alliteration as a last resort, to communicate the line's structure.

While the constraints and rankings provide a system of determining what is the minimal rhyme to meet the requirements for a line to be considered cynghanedd, it seems that a different part of the grammar would push a poet to make as ornate a line as possible. While a single line without any cynghanedd is acceptable, constraints on the stanza or the entire poem would limit the number of lines without cynghanedd, or the number lines of each individual type of cynghanedd, that could appear per poem.

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