THE RHYMING GRAMMAR OF MODERN ENGLISH

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The current study analyzes findings from a corpus of 11 American musicals comprising of 1753 sets of rhymes, finding that 48% (842/1753) form **imperfect rhymes**, namely containing at least one form of *phonological mismatch*. In English, the stereotypical phonological definition of a rhyme is a set of at least two prosodic words in which all segments beginning with the stressed vowel **correspond** in maximal identity (Zwicky 1976; Katz 2008, 2015). A closer inspection of rhyming material in literary and sung/spoken-word traditions reveals that imperfect rhymes are far more abundant than commonly perceived and largely conform to restrictions on dissimilarity, also observed in the rhyming traditions of multiple languages (Kawahara 2007; Steriade 2003; Kern 2015). The current study shows that positions of **lower salience** may license greater though usually minimal featural difference and also license misscorrespondence (i.e. corresponding with zero). **Stress** is shown to play a crucial role in rhyme construction and in interfacing with musical structures, providing cues for the listener to identify rhyming units. Stressed vowels show high faithfulness in correspondence and vowels specified for primary or secondary stress virtually always form the beginning of a rhyme boundary. Segments within the rhyming boundary are then evaluated for similarity. The encoded threshold of similarity forms the **RHYMING GRAMMAR**, providing concrete evidence for the thesis that speakers display grammatically encoded knowledge of similarity scales not independently inferable from orthography (Steriade 2001), e.g. the feature [nasal] differing in the rhyme 'animals' [ˈ**ænəˌməlz]** ~ 'cannibals' ˈk[**ænəˌbəlz**].[1]

The musico-phonological interface is facilitated by the shared notion of **salience**: the three major acoustic cues of stress – **duration**, **pitch** and **intensity** – are also the possible acoustic cues that identify the *focal point* of a musical phrase. In other terms, many musical traditions that rely on *phrasing* also exhibit the same traits of contour and stress as in natural speech. In Western musical traditions, *musical-phrase* edges overwhelmingly coincide with the *lyrical-line* edge and therefore are natural loci for rhyming. The cognitive similarity between linguistic and musical phrases allow the expansion of the concept of **Rhyme Domains** (Steriade 2003, 2009, 2011) to align with phrasal edges as opposed to orthographic line edges. The current theory may only construct the Rhyme Domain (RD) via musico-phonological cues since listeners cannot rely on orthographic cues. In English, the left edge of the RD stereotypically aligns to the left of a stressed vowel until the edge of the prosodic word.[2] The current theory explicitly defines a rhyme as a set composed of at least 2 RDs which are then successfully evaluated for a threshold of grammatically-encoded similarity.

The phonological mechanism used to determine the similarity of a given set of RDs is Correspondence Theory (McCarthy & Prince 1995) set within the framework of Optimality Theory (Prince & Smolensky 1993/2004). Each segment is evaluated for correspondence to any segment in the same prosodic position, including corresponding with zero. Within this framework, a **perfect identity rhyme** is one where all RDs are *maximally identical*, e.g. the pair 'respect' ~ 'erect', both yielding the RD [ˈ**ɛkt**]. Any violations results in an imperfect rhyme; e.g., in the set 'luck' ~ 'judge' ~ 'tux', the set of RDs is {[ˈ**ʌk**], [ˈ**ʌd͡ʒ**], [ˈ**ʌks**]}, where the segment /k/ is in correspondence once with an identical segment and once with /dʒ/, whereas the segment /s/ corresponds twice with zero. The relation between the members can be captured illustratively in the form of a **Correspondence Map** (CM) with asterisks marking violations as in CM (1).

CM (1)

l	ʌ	k	
dʒ	ʌ	dʒ	
t	ʌ	k	s
		*	*

In this instructive case, the segment /s/ violates the constraint **MAX$_{SEG}$** prohibiting misscorrespondence while the correspondence *(/k/ ~ /dʒ/) violates the constraint **IDENT(F)**, prohibiting misidentity of specified features. While some analyses have attempted to account for the relative commonality of misscorresponding segments by positing that the RD may sometimes not be aligned with the rightmost (line) edge in order to produce a perfect rhyme (Kern 2015), e.g. 'luck' → l[ʌk] rhyming with 'tux' → t[ʌk]s; however, the current theory posits the contrary since misscorrespondence may occur in any prosodic position including **onsets**, e.g. "picture" ˈp[**ɪkt͡ʃɝ̩**] ~ "liquor" ˈl[**ɪkɝ̩**] and 'shamelessly' ˈʃ[**e̞ɪ̯mlɛsˌlɪ**] ~ 'famously' ˈf[**e̞ɪ̯məsˌlɪ**]. It must therefore be the case that the grammar tolerates some extent of misscorrespondence since otherwise pathological under-similarity is predicted, e.g. *(/t͡ʃ/ ~ /ɜ/). Moreover, this provides us with a fixed ranking of IDENT ›› MAX$_{SEG}$, capturing the system's preference for maximal identity *and*

a correlation between tolerance of a violation and its minimality. Thus the grammar generates possible CMs and selects for the most harmonious candidate. This accounts for similarity even when IDENT is violated; consider the pair 'rags' r[**ægz**] ~ 'fast' f[**æst**] illustrated in Tableau (1) where the second, *contiguous* candidate is correctly predicted to be perceived as less similar.

Tableau (1)

'rags' [rægz] ~ 'fast'[fæst]	IDENT	MAX_{SEG}
☞ r æ g z f æ s t * * *	*(g ~ t)	*(s ~ Ø) *(z ~ Ø)
r æ g z f æ s t * *	*!(g ~ s) *(z ~ t)	

The emergent typology shows that larger the unit the less likely it is to misscorrespond: misscorrespondence of **intervals**[3] (Steriade 2009, 2011) e.g. 'revel' ˈr[**ɛvəl**] ~ 'malevolence' məˈl[**ɛvəˌləns**] and **syllables**, e.g. 'prefer' priˈf[**ɜr**] ~ 'Merlin' ˈm[**ɜrlən**] is far less common than of segments while the least common is that of entire prosodic words. The prosodic position in relation to stress – reflecting salience – is also a factor in licensing misscorrespondence, as is adjacency to other segments, e.g. 'girl' g[**ɜrl**] ~ 'world' w[**ɜrld**].

A similar pattern is observed for violations of IDENT and their prosodic position. While positions of high salience such post-tonal onsets typically tolerate only minimal violation, e.g. "forever" fɜˈr[**ɛvɜr**] ~ "together" təˈg[**ɛðɜr**] differing in the commonly violated feature [place], whereas positions of lower salience may license greater though still minimal difference, e.g. "myself" ˌmaɪˈs[**ɛlf**] ~ "help" h[**ɛlp**], differing in less common [±cont]. The most common natural class to differ in [place] is not surprisingly nasals, e.g. 'done' [d**ʌn**] ~ 'young' [j**ʌŋ**], followed by stops and spirants. Notably, specified yet unstressed vowels correspond relatively easily with schwa.[4]

Another common prosodic violation occurs when corresponding vowels differ in their stress specification, most commonly in primary stress corresponding to secondary stress, e.g. 'lost' ˈl[**ɑst**] ~ 'Holocaust' ˈhɑləˌk[**ɑst**]. In fact, the abundance of this phenomenon lends credence to the hypothesis that the left edge of the RD prefers to align with stressed vowels as only a handful of stressless RDs are found, e.g. 'pocket' ˈpɑk[**ət**] ~'moment' ˈmoʊ̯m[**ənt**].

Perhaps the most telling evidence that speakers discreetly compute for the possibility of imperfect identity is **Inferred Rhyming**, where one of the rhyming units is (often comically) silenced yet still **inferable from context** as in the lines "*I'll weed out any w**ussy** / I'm a pretty little kitty but I ain't no {p**ussy**}*". In another instance of this phenomenon, given the lines "*I'm… You're not my t**ype** / I can tell. So, you're into {g**uys**}*" the last word is silenced due to the taboo on homosexuality, the audience clearly inferring the intended rhyme despite the dissimilarity of t[**aɪ̯p**] ~ g[**aɪ̯z**].

In conclusion, while speakers often equate rhyming with maximal identity, their phonologies *must* equip them with richly encoded scales of similarity in order to account for identification rhyming units. Moreover, the musico-phonological interface enables and licenses a proliferation of many of these phenomena, suggesting that the orthographic bias in written mediums is responsible for stricter prescriptive definitions of rhyming. The current research is of interest to theories of grammar that rely on *perfect* rhyming as a core lexical function (Bybee 2001) since accounting for *imperfect* rhyming may more correctly predict perceptions of lexical similarity and also of interest to investigation of the acoustic and phonological similarity of cognitive units and their computation.

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SELECTED LIST OF SOURCES

- **Firebringer** - https://www.youtube.com/watch?v=ZmVuNlu0LCk
- **Holy Musical B@tman!** - https://www.youtube.com/playlist?list=PL96B8289ADF77A8C4
- **Spies Are Forever** - https://www.youtube.com/playlist?list=PLlF0gFzOX4tD1KJ5ZEnvhD55Qhnz-K0X2
- **Starship** - https://www.youtube.com/playlist?list=PLC6A915952D67F112
- **The Trail To Oregon** - https://www.youtube.com/watch?v=BxKCX-UvPrI

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[1] **-** All examples are taken from the corpus and are thus independently verifiable online *gratis*; see List of Sources.
- In IPA transcriptions, brackets are placed only around the Rhyme Domain (RD).
- Segments violating MAX are marked red; violations of IDENT are marked pink.

[2] Omitted here for brevity is a *very* common phenomenon where the RD includes more than one prosodic boundary, e.g. 'antennae' ʌnˈt[**ɛnaɪ̯**] ~ 'then I' ð[**ɛn#aɪ̯**]; 'be the man' ˈb[**i#ðə#**ˈ**mæn**] ~ 'beat the man' ˈb[**it#ðə#**ˈ**mæn**] etc.

[3] An *interval* is a unit of division where each unit begins with the *nucleus*, e.g. the word *interval* would be *int.erv.al*.

[4] The marginal phenomenon of $\text{IDENT}_{\dot{V}}$ violations has been omitted for brevity.