

A Constraint-based Approach to Rhyme

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0. Introduction

In this paper I shall be concerned with the phonological structure of poetic rhyme.¹ I shall try to show that a suitable framework for the analysis of rhyme may be found in the recently developed principles of Optimality Theory as initiated by Prince and Smolensky (1993). My point of departure is the fact that rhyme shows some striking resemblances to the phenomenon of reduplication. Reduplication has been thoroughly studied in the past decade and it has also been the focus of attention of McCarthy and Prince in their recent manuscript *Prosodic Morphology I*.

1. Rhyme and reduplication

To start with, we have to establish what exactly the similarities and differences between rhyme and reduplication are. Although both are 'copying processes' in a broad sense, rhyme and reduplication are clearly not identical in function. Reduplication is a process with a morphological function, rhyme a non-morphological copying process used for aesthetic effect in poetry. However, there are two areas in which we find similarities between the two.

First of all, the results of the copying process for reduplication and rhyme show clear surface similarities. In both reduplication and rhyme, segments from one element are copied in another. Consider, for example, the Luiseño reduplicative form in (1) below and compare that to the Dutch rhyme in (2):

(1) *tiki-ḍiki* (from *tiki* 'light, set fire')²

(2) *traditie* x *positie*
 'tradition' 'position'

In both (1) and (2), from the nucleus of the penultimate syllable onwards, the two elements in the pairs are identical: *-iki* in (1) and *-itie* in (2).

¹ I would like to thank Jan Don, René Kager, Alan Prince, Mieke Trommelen, Wim Zonneveld and an anonymous LIN-reviewer for useful comments on an earlier version of this paper.

² Data from A. Marantz (1982).

Secondly, in both reduplication and rhyme we find a variety of types. Compare the Dutch rhyme forms in (3a) to the reduplicative forms in (3b).³

- (3) a *boot* x *beker* (alliteration)
 /bo:t/ /be:kəɾ/ 'boat' 'cup'
 boot x *doof* (assonance)
 /bo:t/ /do:f/ 'boat' 'deaf'
 boot x *laat* (consonance)
 /bo:t/ /la:t/ 'boat' 'late'
 boot x *boom* (reverse rhyme)
 /bo:t/ /bo:m/ 'boat' 'tree'
 boot x *goot* (monosyllabic end-rhyme)
 /bo:t/ /xo:t/ 'boat' 'gutter'
 boter x *groter* (polysyllabic end-rhyme)
 /bo:təɾ/ /xro:təɾ/ 'butter' 'bigger'
- b *bu-bulud* (partial prefixal reduplication; 1 syllable)
 'ridge' (Timugon)
 nala-la-ng (partial infixal reduplication; 1 syllable)
 'very hungry' (Chamorro)
 buníta-ta (partial suffixal reduplication; 1 syllable)
 'very pretty' (Chamorro)
 apo-apot (partial prefixal reduplication; 2 syllables)
 'I jump repeatedly' (Kamaiurá)
 ohuka-huka (partial suffixal reduplication; 2 syllables)
 'he kept laughing' (Kamaiurá)
 kawosi-kawosi (total reduplication)
 'bathe more and more' (Axininca Campa)

In the poetic sound devices given in (3a), which we may consider members of the Rhyme Family, we can distinguish types such as alliteration, consonance, assonance, through to full end-rhyme. They range from the copying of only one or a few segments through to the copying of a longer string. In the examples of reduplication in (3b), we find a similar variety, from the reduplication of only part of the original string, in varying degrees, through to total reduplication.

³ Data from McCarthy and Prince (1993) and handout Prince (January 1994).

2. Theorizing on Rhyme

If we want to develop a theory of rhyme, we should work out the underlying principles of rhyme capable of explaining all forms of rhyme we encounter. This would include all the forms given in (3a). In addition, it should give a principled account of so-called irregular or imperfect rhymes. Examples of such imperfect end-rhymes rhymes are given in (4).⁴

(4)	<i>wreekt</i>	x	<i>poëet</i>	(Gilliams)
	/vre:kt/		/powe:t/	'revenges' 'poet'
	<i>verhalen</i>	x	<i>vervaalde</i>	(Vestdijk)
	/vɔrha:lɔn/		/vɔrva:ldɔ/	'stories' 'faded'
	<i>aangenaam</i>	x	<i>maan</i>	(Breemer)
	/a:nxɔna:m/		/ma:n/	'pleasant' 'moon'
	<i>kwam</i>	x	<i>Abraham</i>	(Staring)
	/kwam/		/a:bra:ham/	'came' 'Abraham'
	<i>veldkonijn</i>	x	<i>zijn</i>	(Van de Linde)
	/vɛltko:nɛin/		/zɛin/	'field rabbit' 'to be'

In these rhymes there are several dissimilarities which we do not normally expect, such as dissimilar final consonants or consonant clusters, dissimilar internal clusters, differences in stress patterns, and so on.

Taking all these different kinds of rhyme into account, a theory of rhyme must be able to do two things. First, it should be able to point out which rhymes are absolutely impossible, i.e. ungrammatical. Secondly, it should be able to indicate whether a grammatical rhyme is simple or complex.

This latter feature is something we do not find in a theory of reduplication. For reduplication we should be able to come up with one correct grammatical output. Different degrees of correctness are not possible. For rhyme, however, more than one output may be grammatical (and usually is). Furthermore, some grammatical rhyme outputs may be more complex than others, given the acceptability of the end-rhymes in (4). This crucial difference between rhyme and reduplication should not be ignored. I shall return to the problem of complexity in section 4.4 below.

3. Optimality Theory and reduplication

Let us now first consider briefly how reduplication is accounted for within the framework of Optimality Theory and then see if rhyme phenomena can be dealt

⁴ Data in (4) and (9) from Komrij (1992).

with in a similar way. Optimality Theory works with constraint tableaux in which constraints are ranked. In the evaluation of certain candidate outputs, this hierarchy of constraints determines which form is the optimal one. This optimal form is then the actual output in a particular language. A crucial aspect of Optimality Theory is that constraints are, in principle, violable. In other words, the optimal form is not the one obeying all constraints, but rather the one which takes the language-particular ranking into account. It may violate certain constraints, as long as this violation is necessary in order to satisfy a higher-ranked constraint.

McCarthy and Prince give a detailed analysis of reduplication in Axininca Campa (a language spoken in Peru). They show that the framework of Optimality Theory is able to deal with seemingly contradictory forms of reduplication we find in this language. For reduplication they assume that two types of constraints are at work. First, there are constraints which refer to the copying mechanism in general. Second, there are constraints which determine the form of the output of the reduplicative process. The latter will not be discussed here, since they are not directly relevant to rhyme. Below we shall first consider the constraints on copying in reduplication (section 3.1). In section 4 their relevance for rhyme will be discussed and an analysis of a number of rhyme pairs in the Optimality framework will be given.

3.1. Copying constraints in reduplication. The constraints on copying in reduplication are CONTIGUITY, ANCHORING, TOTALITY and MAX(IMIZATION). They are defined in (5) to (8) below. In the definitions, B stands for 'Base', the phonological material to which a reduplicative affix is attached, and R for 'Reduplicant', the phonological projection of the reduplicative morpheme (which is phonologically unspecified).

- (5) **CONTIGUITY**
All elements of R that lie between elements with phonologically identical correspondents in B must themselves have phonologically identical correspondents in B.
- (6) **ANCHORING**
R and B must share an edge element, initial in prefixing reduplication, final in suffixing reduplication.
- (7) **TOTALITY**
Every element in R must have a corresponding element in B
- (8) **MAX**
Reduplication is total ($R=B$).

In reduplication, the constraint of CONTIGUITY makes sure that a contiguous substring of the Base is copied in the Reduplicant. In other words, elements cannot be skipped in the copying process. McCarthy and Prince claim that in Axininca Campa this constraint may not be violated in reduplication, i.e. it is 'undominated'.

ANCHORING requires that if reduplication is a suffixing process, the final elements of the Base must correspond to the final elements in the Reduplicant. If reduplication is a prefixing process, the initial elements of both the Base and the Reduplicant should be identical. ANCHORING is also said to be undominated.

TOTALITY forbids the Reduplicant to contain elements that are not found in the Base.

MAX requires reduplication to be total, which means that Base and Reduplicant should be identical. However, in many, if not most, languages which have reduplication, including Axininca Campa, we find partial reduplication alongside total reduplication. In terms of the principles of Optimality Theory, then, MAX can be said to be frequently violated, and it is therefore ranked low in the constraint hierarchy.

4. Optimality Theory and Rhyme

I suggest that for rhyme we can make a similar division into constraints on copying and constraints on form. I shall try to show here that the copying constraints we have seen for reduplication can in fact be used for rhyme, albeit in a somewhat modified version.

In our formulation of the copying constraints for rhyme we can take over the abbreviations B and R as above, except that R will now stand for Rhyme. The definition of Base is slightly problematic for rhyme, because it has to take into account the post-lexical nature of rhyme. Rhyming elements are not always single words. We also find rhymes like those in (9):

- (9) *Shakespeare te* x *kier, te* (Philippus)
 /ʃe:kspi:r#tə/ /ki:r#tə/
 'Shakespeare to' 'chink, to'
reiner x *zijn er* (Van 't Lindenhout)
 /reɪnə/ /zeɪn#ə/
 'cleaner' 'be there'

In the rhyme pair /*Shakespeare te* x *kier, te*/, for example, it is not sufficient to consider only the final word of the line of verse: it will be clear that at least part of *Shakespeare* has to be included in the Base. A definition of the Base for rhyme is given in (10) below.

(10) **Definition of Base in rhyme**

The left edge of the Base is defined as the left edge of the rightmost syllable in a line of verse which bears lexical stress, i.e. stress assigned in the lexicon.

Put simply, I assume that the Base starts at the syllable which bears the rightmost lexical stress in a line of verse (including the onset!). At the moment, I have not yet looked into the question of exactly how the Base can best be formulated in terms of prosodic domains, although this would seem to be desirable.

4.1. Copying constraints for rhyme. Given the definition of the Base in (10), the copying constraints for rhyme can be defined as in (11) below.

(11) **Definitions of copying constraints for rhyme****CONTIGUITY**

All elements of R that lie between elements with phonologically identical correspondents in B must themselves have phonologically identical correspondents in B.

ANCHORING

In poetic rhyme, R and B must share an edge element. Two kinds of Anchoring may play a role:

- (i) **ANCHORING-RIGHT:** The final element of R should be identical to the final element in B;
- (ii) **ANCHORING-LEFT:** The initial element of R should be identical to the initial element in B.

TOTALITY

Every element in R must have a phonologically identical correspondent in B.

MAX

All elements in the B should have correspondents in R.

CONTIGUITY has the same function in rhyme as in reduplication. It ensures that elements in the Base and the Rhyme are phonologically identical and that no elements are skipped. Notice, however, that elements on the edges are ignored by CONTIGUITY.⁵

ANCHORING needs to be adapted for rhyme, because rhyme is not a prefixing or suffixing process. It may, however, prove useful in explaining the distinction between end-rhyme and phenomena such as alliteration in the sense that end-

⁵ A peripheral element in B may not be present in R. This does not, however, violate CONTIGUITY, because CONTIGUITY only considers the elements in between the two peripheral elements in R.

rhyme requires final elements of B and R to be shared, whereas alliteration requires initial elements to be shared. This can be expressed by assuming two kinds of ANCHORING for poetic rhyme devices, i.e. ANCHORING-LEFT and ANCHORING-RIGHT. For end-rhyme the constraint ANCHORING-RIGHT will be shown to play an important role.

TOTALITY ensures that an element in the Rhyme actually has a correspondent in the Base. So it limits the amount of 'new' material that can be added in the Rhyme.

MAX requires the Rhyme to copy all elements that are in the Base.

4.2. Rankings. McCarthy and Prince assume that the universal ranking of copying constraints for reduplication is ANCHORING, CONTIGUITY » MAX. In reduplication MAX can be found to be frequently violated because it is dominated by constraints on prosodic well-formedness. For poetic end-rhyme, I suggest that this basic ranking of copying constraints is the same. Consider, for example, the rhyme *veldkonijn* x *zijn* in (5). Here MAX is clearly violated, given the definition of Base in (10). The Rhyme only considers the final syllable of the Base, whereas the Base in fact consists of three syllables. The syllable that is copied, however, satisfies both ANCHORING-RIGHT (final /n/ is faithfully copied) and CONTIGUITY (the substring /ein/ in Rhyme does not contain elements which cannot be found in the Base).

McCarthy and Prince also assume a ranking TOTALITY » MAX for reduplication in most languages. For rhyme, this dominance relation is less clear. TOTALITY is clearly less dominant in rhyme than in reduplication, because a very important aspect of rhyme is the fact that Base and Rhyme should not be completely identical. For end-rhyme, for example, we do not accept homophones as rhymes but require the onsets to be dissimilar. Clearly, then, there are constraints on the *form* of the rhyme which conflict with TOTALITY.

4.3. Constraints on form. Besides the copying constraints for rhyme, additional constraints determine the actual form a Rhyme may have. I propose that for rhyme there are two families of constraints which have a crucial role to play in this respect. The first family is that of ECHO-constraints (cf. Yip 1993), which require a certain non-identity of Base and Rhyme:⁶

(12) **ECHO-constraints**

⁶ In a talk at OSU (Linguistic Institute 1993), Moira Yip proposed the ECHO constraint for reduplication in Chaoyang. This constraint prohibits the juxtaposition of two identical syllables and is thus responsible for the insertion of new phonological material in some Chaoyang reduplicative forms (e.g. *pa-R* = *pala*).

Base and Rhyme should not be completely identical.

For end-rhyme, the ECHO-constraint ONSETDIS will turn out to play an important role. The definition of this constraint is given in (13); it says that the onset of the first syllable in the Base should not be the same as the onset of the first syllable in the Rhyme.

- (13) **ONSETDIS**
The onsets (of the initial syllable) in R and B should be dissimilar.

Notice that ONSETDIS is necessarily in conflict with TOTALITY. On the basis of this conflict we can establish that the dominance relation for end-rhyme is ONSETDIS » TOTALITY. How this works can be seen in the constraint tableau in (14), which shows the evaluation of rhymes on Dutch *boom* ('tree').

- (14) **ONSETDIS » TOTALITY**
Input /bo:m x R/

Candidates	ONSETDIS	TOTALITY
bo:m x bo:m	*!	
bo:m x lo:m		*

The rhyme pair *boom* x *loom* (/bo:m/ x /lo:m/) violates TOTALITY but satisfies ONSETDIS and is therefore preferred over the pair of homophones /bo:m x bo:m/, which satisfies TOTALITY, but violates ONSETDIS.

The second family of constraints on form is that of IDENTITY-constraints, which require the Base and the Rhyme to have certain elements in common:

- (15) **IDENTITY-constraints**
Base and Rhyme should have particular elements in common.

At first sight, given TOTALITY, a family of IDENTITY constraints might seem superfluous. However, TOTALITY is unable to express partial identity, something we must be able to do. This becomes clear if we consider a potential candidate rhyme pair *boom* x *roem* (/bo:m/ x /ru:m/). ONSETDIS is obeyed, and TOTALITY is violated, just as in the correct rhyme-pair /bo:m/ x /lo:m/ in (14). Still, we do not accept *boom* x *roem* as a grammatical rhyme. What is wrong here is that the nuclei of Base and Rhyme are dissimilar. This is not acceptable in rhyme. Apparently, we need an additional constraint for this. I suggest that this constraint is a member of the IDENTITY-constraints family. The constraint in question requires the nuclei (possibly more than one) of Base and Rhyme to be phonologi-

cally identical. A definition of this constraint, called NUCLEUSID, is given in (16).

(16) **NUCLEUSID**

The nuclei of B and R should be phonologically identical.

The constraint tableau in (17) shows how we can rule out rhyme-pairs such as *boom* x *roem*.

(17) **The Role of NUCLEUSID**

Input /bo:m x R/

Candidates	ONSETDIS	NUCLEUSID	TOTALITY
bo:m x bo:m	*!		
bo:m x ru:m		*!	*
bo:m x lo:m			*

Notice that the dominance relation between TOTALITY and NUCLEUSID cannot be established, because they are never in direct conflict with each other. The reverse ordering in (17) would yield the same output. Similarly, there is no conflict situation between ONSETDIS and NUCLEUSID. This is indicated by means of the dotted line in the tableau.

Earlier I pointed out that the ANCHORING constraint relevant for end-rhyme is ANCHORING-RIGHT, the definition of which is repeated in (18).

(18) **ANCHORING-R**

The final element of B should be identical to the final element in R

The role of ANCHORING-R becomes clear when we consider the potential candidate rhyme-pair *boom* x *rood* (/bo:m/ x /ro:t/), the evaluation of which can be seen in the tableau in (19).

(19) **The Role of ANCHORING-R**

Input /boom x R/

Candidates	ONSETDIS	NUCLEUSID	ANCHORING-R	TOTALITY
bo:m x ro:t			*!	*
bo:m x lo:m				*

This rhyme-pair satisfies ONSETDIS and NUCLEUSID and yet is not an acceptable rhyme. ANCHORING-R is crucially violated in this rhyme-pair, because the final consonants of the elements (/m/ and /t/) are not identical.

Now consider the tableau in (20), which has the monosyllabic Base *kam* (/kam/ ‘comb’) as input. Potential rhyme candidates include monosyllables such as *zalm* (/zalm/ ‘salmon’). Using the set of constraints given above, *kam* x *zalm* would be considered just as acceptable as, say, /kam/ x /ram/, since it satisfies ONSETDIS, NUCLEUSID and ANCHORING-R. Clearly, however, the latter rhyme is acceptable, whereas the former is not. In order to exclude rhyme-pairs like *kam* x *zalm*, I shall assume that CONTIGUITY, the no-skipping constraint, is in fact responsible for the rejection of this candidate. The /l/ in *zalm* fatally violates CONTIGUITY as defined in (11).

(20) **The Role of CONTIGUITY**
 Input /kam x R/

Candidates	ONSETDIS	NUCLEUSID	ANCHORING-R	CONTIGUITY
kam x zalm				*!
kam x ram				

The constraint tableaux show how a careful selection of constraints only allows rhymes such as /bo:m/ x /lo:m/ and /kam/ x /ram/ as output. Of course, the constraints as formulated so far would also accept rhymes such as /bo:m/ x /ro:m/, /bo:m/ x /zo:m/, /bo:m/ x /to:m/, and /kam/ x /tam/, /kam/ x /lam/, etc. This is exactly what is desired.

4.4. *Irregular rhymes and the problem of complexity.* Until now, we have only considered monosyllabic perfect rhyme. Ideally, we should also be able to explain different kinds of rhyme, such as polysyllabic rhymes and those irregular cases of which we saw some examples in (4). So far, all these different kinds of rhyme have not yet been worked out in detail. However, in what follows, I shall try to give a tentative analysis of one particular kind of ‘special’ rhyme.

Consider, for example, the Dutch rhyme *reiner* x *zijn er* in (9). This is a rather striking rhyme in that the Base consists of only one word, whereas the Rhyme contains a word and a clitic. Apparently, poets may allow themselves to extend their domain of possible rhyme data to include clitics. In terms of the prosodic hierarchy we could say that the Clitic Group in fact seems the relevant domain for the operation of rhyme in these instances. Notice, however, that rhymes of the *reiner* x *zijn er* kind are not allowed by all poets. We should therefore consider them to be more complex than rhymes such as *reiner* x *fijner*, where no clitic is involved.

In order to be able to capture the relative complexity of rhymes involving clitics, I propose that for 'ordinary' end-rhyme there is usually a constraint at work which makes sure that elements playing a role in rhyme are limited to the immediate output of the lexicon, i.e. that the highest prosodic level they can refer to is that of the word (ω). I shall call this constraint LEXICON, a definition of which is given in (21).⁷

(21) **LEXICON**

Rhyme data are limited to the immediate output of the lexicon (ω -level)

I assume that there are poets or poetic styles which strictly obey this constraint. However, there are examples in which the constraint is obviously violated, given *reiner x zijn er* in (9). Apparently, for some poets LEXICON is assigned a lower ranking, allowing it to be violated.

In this respect it is important to notice that poets who allow clitics in their rhymes also produce rhymes which obey LEXICON perfectly. Most of the time a poet's rhymes will in fact conform to LEXICON. These ordinary rhymes are both 'grammatical' and 'non-complex'. If, however, a poet allows a constraint such as (21) to be violated occasionally, these rhymes can be considered 'grammatical', but 'complex'. In this way, the poet in fact expands the range of rhyme pairs he allows.

I propose that ranking of constraints can provide us with the tool we need to indicate the grammaticality and/or complexity of a form. In order to do this we will have to stipulate that a particular constraint can be given such a low ranking that its violation cannot affect the grammaticality of a rhyme pair. It can only say something about its complexity. Expressing this in terms of Optimality Theory, we could say that the relative ranking of constraints such as LEXICON and the lowest ranked categorical constraint determining the grammaticality of a rhyme, e.g. TOTALITY, is crucial. In other words, if a rhyme-specific constraint is ranked below TOTALITY, it may be violated without the grammaticality of the rhyme being affected. This is shown in tableau (22) below.

⁷ It is interesting to observe here that poets allowing clitics to form part of their rhymes apparently move up one step in the prosodic hierarchy for their rhyming domain. It is conceivable that there is a further constraint at work which limits this domain to the Clitic Group, which may in its turn be violated by poets who allow a concatenation of full words to form part of a rhyming element.

(22) **ONSETDIS » TOTALITY » LEXICON**

Input /rein+ðr x R/

	Candidates	ONSETDIS	TOTALITY	LEXICON
✖	re _{in} +ðr x fe _{in} +ðr		*	
✖	re _{in} +ðr x ze _{in} #ðr		*	*

If, however, LEXICON is ranked above TOTALITY, its violation will directly imply the ungrammaticality of the rhyme-pair in question. This is shown in (23).

(23) **ONSETDIS, LEXICON » TOTALITY**

Input /rein+ðr x R/

	Candidates	ONSETDIS	LEXICON	TOTALITY
✖	re _{in} +ðr x fe _{in} +ðr			*
	re _{in} +ðr x ze _{in} #ðr		*!	*

5. Conclusion

To conclude, the model presented here is intended as a tool for the analysis of rhyme and related phenomena in poetry. It is an attempt to capture our intuitions about rhyme: which sound structures do we find acceptable as rhymes, how complex may rhymes become and in what way. It is the proposal of this paper that constraint-ranking will prove a useful mechanism to provide us with the desired insight.

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