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The distribution and properties of Babole prenasalized segments

Myles Leitch
SIL-UND

The Distribution and Properties of Babole Prenasalized Segments

Myles Leitch[1]

Babole, a Bantu language of Congo, has both voiced and voiceless prenasalized consonants. While the consonants of the voiced series have free distribution as segments, those of the voiceless series occur only stem-initially following a prefix. In the case of unprefixed imperatives, stem-initial voiceless prenasals drop the prenasalization. Adopting the ranked-constraint approach of Optimality Theory (Prince and Smolensky 1993), the paper shows that both the skewed distribution of voiced and voiceless prenasals, and the phenomenon of nasal-dropping follow from the interaction of three constraints. One constraint, ClusterVoi, reflects the grammar's preference for voiced prenasals. A second, ALIGN, insists that prefixes be immediately followed by a syllable, effectively prohibiting underparsed material stem-initially. The third constraint, PARSE, penalizes the underparsing of segments or features (nasality in this case). I propose a ranking for the constraints and show that the quirky behavior of prenasals can be accounted for succinctly by the constraint interaction. The paper thus solves an interesting descriptive problem and provides support for Optimality Theory.

Babole, a Bantu language of Congo, has on the surface both a voiced and voiceless series of so-called prenasalized segments, listed in (1).[2]

(1) *voiced series:* mb nd ndz ng
voiceless series: mp nt ns nts nk

However, the distribution of these complex segments is highly asymmetrical, and calls for an account. The purpose of this article is to suggest a solution to the puzzle within the emerging framework of Optimality Theory (henceforth OT).[3] In section 1 I lay out the data and a few general assumptions about the syllable and moraic structures involved. In section 2 I proceed to an account of the data by introducing and arguing for several constraints which interact in the way prescribed in OT. I show how these constraints, when ranked in a particular way, can account for the data straightforwardly, thus providing confirmation of OT.

[1]I wish to thank Susan Blake, Laura Downing, Mark Hewitt, Ping Jiang-King, Ola Nike, Doug Pulleyblank, Kimary Shahin, Pat Shaw, and Aki Uechi, all from the Linguistics Department at the University of British Columbia, for stimulating discussion of this material and other aspects of Babole phonology. I also thank Andy Black, Steve Marlett, and Chuck Speck of SIL, University of North Dakota, for helpful comments and discussion of the analysis.

[2] Babole has been classified as C-10, Guthrie's classification, in Leitch 1989. All Babole data are from my own field work, conducted in the period 1988-1992.

[3] McCarthy and Prince 1993, Prince and Smolensky 1993.

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1. Distribution of Prenasalized Segments[4]

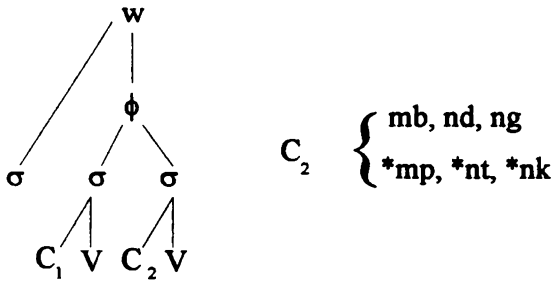
1.1. Prenasalized Segments in Nominals

A few comments about Babole morphological structure are in order to start the discussion. Nominal forms are most generally of the shapes exemplified by the forms in (2), consisting of a CV, V, or N (placeless nasal) prefix and a disyllabic stem.

(2)		*Singular*	*Plural*	*Noun Class*	*Gloss*
	a.	di-sóngó	ma-sóngó	5/6[5]	*toilet, outhouse*
	b.	bo-tɛ́bú	ma-tɛ́bú	14/6	*traditional razor*
	c.	e-kɛ́tɛ́	bi-kɛ́tɛ́	7/8	*skin*
	d.	N-bímb-í	ma-mbímb-í[6]	9/6	*satiety*

If the nominal is derived from a verb root, as in (2d), the stem may have internal morphological constituency. For underived nouns, the stem may be considered a single morpheme. It is useful to schematize the structure of nouns as [PRE-[STEM]], where STEM=C_1VC_2V. This permits the two consonant positions in the stem to be referred to independently. I propose that the morphological structures in (2) be assigned the prosodic structure represented in (3).[7]

(3)



The distribution of prenasalized segments with respect to this prosodic structure is as follows: the onset of the *foot-internal* syllable (i.e. C_2) may be of the voiced series but never of the voiceless series.[8] There is no other relevant restriction on C_2. Thus a word

[4] I use the word *segment* freely when referring to the prenaslized objects above; however, they are ambiguous between segments and clusters, the most accurate term being perhaps complex segments.

[5] Bantu nominal forms are conventionally cited in singular/plural pairs corresponding to the singular / plural prefix pair that the nominal takes. The traditional numbering system is from Meinhof.

[6] Class 9/6 is different from the other singular/plural pairs in that the plural prefix takes the singular as stem, incorporating the singular prefix /N/ as part of the stem onset and then adding the ma- plural prefix. The verbal root here is -bímb- *be full.* Class 9 nominals are outside the scope of this paper.

[7] In this version of the prosodic hierarchy we have Prosodic Word (W), Prosodic Foot (ϕ), and Syllable (σ). Note the assumption of *weak layering*: the prosodic word may dominate the prefix syllable directly without an intervening foot layer. For a discussion of weak layering see Ito and Mester 1992.

[8] These facts are reminiscent of the cases of restricted foot-internal C_2 cited in Hyman 1990.

such as disóngó, *toilet, outhouse*, is perfect in Babole, but *disónkó would be an impossible word.

Consider now the forms in (4), where C_1 (underlined) can be from either the voiced or voiceless series of prenasalized segments.

(4)	*Singular*	*Plural*	*Noun Class*	*Gloss*
a.	mu-mpómbɔ	mi-mbàká	3/4	*message drum, talking drum*
c.	di-ntùmù	mi-mpómbɔ̀	3/4	*agressive arboreal ant species*
b.	mu-mbàká	ma-ntùmù	5/6	*succulent wild fruit*
d.	di-ndúndù	ma-ndúndù	5/6	*air bubble in water*
e.	di-nkɔ̀tì	ma-nkɔ̀tì	5/6	*horn of an animal*
f.	di-ngàsé	ma-ngàsé	5/6	*little cola nut*
g.	e-nsùè	bi-nsùè	7/8	*finger- / toenails*

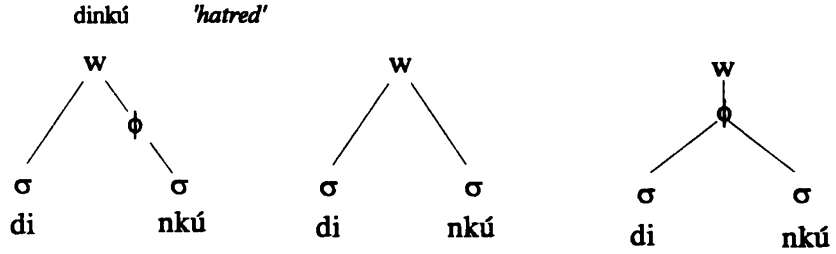
The stem-initial prenasals underlined in (4) cannot easily be argued to be derived by prefixation with N- historically. In other words, they appear to be underlyingly part of the root. What licenses their presence here but not stem-internally? This is the first asymmetry that requires an explanation.

But there is another word shape where the stem consists of a single syllable instead of two. Examples are provided in (5).

(5)	*Singular*	*Plural*	*Noun Class*	*Gloss*
a.	di-hɔ́	ma-hɔ́	5/6	*affair, matter*
b.	mo-bú	mi-bú	3/4	*famine*
c.	di-ngwè	ma-ngwè	5/6	*ritual pendant, jewelry*
d.	di-nkú	ϕ	5/	*hatred*

Words like these are less common in the Babole lexicon, but can hardly be called rare. As seen from the examples in (5), a stem-initial segment may either be from the voiced series, (5c), or voiceless series, (5d). Corresponding to (3), then, consider the choice of prosodic representations provided in (6) for these 'short' words.[9]

(6)



The leftmost representation, although involving a non-binary (i.e., degenerate) foot, has the advantage of allowing us to maintain the generalization from (3) on the distribution of /mp/, /nt/, /nk/: they cannot be foot-internal. This generalization would be lost if either the second or third representation were accepted. While such a generalization about the data

[9] This raises the question of word minimality effects in Babole. There is clear evidence that the minimal word in Babole is [σσ]. However, since minimality effects play no role in the phenomena discussed in this paper, I will not attempt to motivate prosodic word minimality in this context.

expressed in terms of the prosodic hierarchy is desirable, it falls short of explaining why this should be the case.[10]

1.2. Distribution of Prenasalized Segments in Verb Roots

Before turning to the OT characterization of this puzzle, we will consider the distribution of prenasalized segments in verb roots. Verb roots have a wide variety of shapes in Babole, but 'pure' roots, that is, ones not incorporating varying degrees of historically suffixal material, are either CVC or CV. Not unexpectedly, the same restriction observed in nominal stems applies in verb roots: C_2 may not be *mp, nt,* or *nk,*[11] whereas examples with the voiced series, as in (7), are extremely common.

(7) *Examples of Roots with C_2= mb, nd, ng*

-hámb-	*curse*
-hànd-	*start again*
-hàng-	*become mean*

Perhaps more surprising is the fact that *all* of the prenasalized segments (with the exception of /ng/) are quite rare in C_1 position in verb stems. In (8), I provide examples of verb roots with prenasals in initial position. In each case I have indicated the number of such examples in my lexicon of more than 1000 verb roots in order to give a clear picture of the statistical rarity of these forms.

(8) *Examples of Prenasal C_1 In Verb roots (lexical database of >1000 verbal roots):*

C_1= mb 3/		*mp 11/*	
-mbíkikad-	*become thick, thicken*	-mpèt-	*become stuck*
-mbwàk-	*make bubbles*	-mpéngum-	*limp*
-mbwàmbwat-	*shake, shiver, tremble*	-mpílo-	*jump*
nd 4/		*nt 7/*	
-ndàmbim-	*jump up, bounce up*	-ntémb-	*become erect*
-ndànd-	*check out, feel out*	-ntèng-	*writhe*
-ndùm-	*stuff the mouth with...*	-ntùmod-	*whip, chasten*
-ndúnde-	*give a large portion*	-ntùntum-	*tremble*
ng 30/		*nk 2/*	
-ngòndze-	*kneel down*	-nkìn-	*underestimate*
-ngɔ̀nd-	*bend*	-nkònyod-	*crunch with teeth*
-ngékod-	*decapitate*		

The meaning of, or reason for, this distributional asymmetry with respect to the C_1 position in nominal and verbal stems is not clear. What interests us, in the context of this

[10] Alternatively, it would be possible to express the restriction on C_2 as a morpheme structure constraint to the effect that: prenasals in C_2 of *roots* may only be of the voiced series. This option would have the same lack of explanation as a generalization stated on foot structure.

[11] In a lexicon with over 1000 verbal roots there is only the form -hɔ̀nkɔt- *attach firmly* that violates the generalization.

paper, however, is simply that such roots exist and that they show peculiar behavior in a certain context. I turn next to examine the unusual behavior of prenasals in C_1 position in verb roots.

1.3. Nasal-Dropping in Imperatives

The 'unusual' behavior referred to is that, in the imperative singular of the verbs with a voiceless prenasal root-initial C, the nasal 'part' of the prenasal 'drops out' (i.e., is simply not pronounced). To make the contrast clear, consider, first, prefixed examples with a voiced stem-initial prenasal, (9a), and a voiceless one, (9b). Prenasalization is preserved in both series when a prefix is present. (9c), an example with a non-prenasalized initial, is included to show that the nasality is not related to the prefix *à*, third person singular subject.

(9) *Prefixed verbs maintain both classes of Stem-Initial Prenasals*

a.	[à.ndù.mí]	/à-ndùm-í/	*he stuffed his mouth...*
b.	[à.ntù.mɔ́.dí]	/à-ntùmod-í/	*he whipped*
c.	[à.kì.dí]	/à-kìd-í/	*he renounced...*

However, when the need for a prefix is removed by using the imperative singular, voiced prenasal initials maintain the nasal articulation, while the voiceless ones 'drop' the nasal. This is illustrated in (10) below.

(10) *Imperatives 'drop' nasal in the voiceless class*

Voiced Class			
/ndùm-á/	[ndù.má]	*[dù.má]	*stuff your mouth!*
/ndàmbim-á/	[ndà.mbí.ma]	*[dà.mbí.má]	*jump up!*
Voiceless Class			
/ntùmod-á/	[tù.mɔ́.lá]	*[ntù.mɔ́.lá]	*whip!*
/ntùntum-á/	[tù.ntú.má]	*[ntù.ntú.má]	*tremble!*

This is something that requires an explanation. Moreover, it should be required of an adequate analysis that the impossibility of having the voiceless prenasals in initial position in imperatives be related to the impossibility of having them root/stem internally (sections 1.1 and 1.2). After outlining a few pertinent facts about Babole syllable structure in section 1.4, I proceed directly in section 2 to an analysis in terms of OT.

1.4. Babole Syllable Structure

My assumptions about Babole syllable structure for the purposes of the article are as given in (10) and (11).

(10) a. The only moraic consonant is the nasal glide prefix /N/.
b. Only vowels can be nucleus of a syllable.[12]

[12] The Class 9 morpheme ends up being realized as [i] with some degree of nasalization, in both voiced and voiceless prenasals; for example, ngɔ́mɔ̀ *drum* is [ĩ.ŋgɔ́.mɔ̀], while nkìlò *renunciation* is [ĩ.ŋkì.lò]. In other words, Class 9 nominals always have a syllable that corresponds to the noun-class prefix /N/. This might be taken as evidence that the /N/ had

(11) Babole Syllable Structure = $\Sigma^{(c)}V$ (Prince and Smolensky 1993:94)

(11) means two things. First, the language has optional onsets. There is no gratuitous epenthesis to satisfy the onset requirement. Example (12) illustrates the extent to which Babole allows onsetless syllables.[13]

(12) à.ɔ́.í ngɔ́mɔ̀

à	-ɔ́	-í	ngɔ́mɔ̀
3s	-beat	-CMPL	CL:9-drum

he beat the drum

Second, (11) means that codas are not allowed. In fact, for the purpose of this paper, I will maintain that Babole *strictly* forbids codas.[14]

2. Optimality Theory Account

2.1. The Constraints

OT conceives of grammar as a set of competing constraints, each of which, in itself, is violable. Constraints, unlike rules, do not apply serially or derivationally but in parallel. Candidate forms which fare best in the overall constraint interaction emerge as optimal. I see three constraints operating in the fragment of phonological grammar under consideration here:

Constraint 1= ClusterVoi

One constraint needs to capture the fact that, for prenasals, the voiced series is stable, free in distribution, and somehow to be preferred over the voiceless series. Presumably [nas], because of its inherent sonorant voicing can only form a satisfactory complex segment with voiced segments. Clearly this constraint is violable since there are voiceless prenasals in some contexts. I call this constraint "ClusterVoi". ClusterVoi simply insists that the consonant member of NC clusters be voiced.[15]

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underlying moraic status. Moreover if syllable nuclei must be vowels, as suggested here, and exhaustive syllabification holds, then we can understand how a vowel gets inserted in these forms.

[13] There are also morpheme-internal onsetless syllables, as in the verb -sáo- *be insipid.* Although such forms may be historically derived from -sá- plus some suffix, such an analysis is not supported synchronically at all. Thus, I conclude that they exemplify morpheme internal onsetless syllables

[14] It might be possible to analyze the nasal as a Coda. For example, nkìlò *renunciation* would, on this view, be syllabified [ĩŋ.kì.lò]. I thank Pat Shaw (personal communication) for bringing this to my attention. Nevertheless, I will not pursue this possibility here since the weight of evidence appears to rest with the alternative interpretation given in footnote 12. Furthermore, the non-existence of forms like *di-sónkò would be hard to account for if [di.sóŋ.kò.] were an acceptable syllabification. Recall the generalization that [nt], [nk], [mp], were acceptable as onsets only following a noun-class prefix. Under the coda analysis, attested words like di-nkú *hatred,* would have to be analyzed as diŋ.kú. It would then be necessary to explain why [diŋ.kú] is fine but *[di.sóŋ.kò.] is an impossible word.

[15]This constraint is not analogous to the NasVoi constraint of Ito, Mester and Padgett 1993.

Constraint 2= ALIGN (Pre-R, σ-L)

Prince and Smolensky (1993:104), propose a family of constraints which belong to the prosody-morphology interface. This family of constraints is called ALIGN. ALIGN constraints force alignment of one side (right or left) of morphological categories such as root, stem, prefix, etc., with one side of prosodic categories: mora, syllable, foot, prosodic word. ClusterVoi, as it is formulated, will always prohibit *mp, nt,* and *nk* unless some higher constraint comes to the rescue. In the case of the prefixed forms in (4) and (5), I will claim that the prefix comes to the rescue. The alignment constraint captures this.[16] The constraint ALIGN (Pre-R, σ-L) reads: "align the right edge of a prefix with the left edge of a syllable". No unsyllabified material may intervene.

Constraint 3= PARSE

The final constraint needed for the analysis is one of the family of "faithfulness" constraints (P&S, 87), which favor parsing or inclusion of features, segments, etc. into prosodic structure, and favor the filling of structural positions with content. PARSE simply says that there is a penalty for not having features or nodes properly gathered into prosodic structure. So, for example, a penalty must be incurred for underparsing the nasal in the case of initial voiceless prenasals in imperatives.

2.2. Constraint Ranking and Candidate Evaluation in Tableaux

I will simply propose a ranking for the constraints and then justify it by applying it to the crucial cases in our puzzle. The logic of the ranking will show itself to be rather obvious, following simply from the optimal forms. The constraints are ranked as in (13), where ">>" means "is more highly ranked than."

(13) ALIGN>>ClusterVoi>>PARSE

To verify that this ranking is correct and that the constraint interaction yields the desired results, I will discuss each relevant case below in Tableau format.

2.2.1. How to Read a Constraint Tableau

In a Tableau, the candidates[17] to be evaluated are listed, one to a row. The constraints, crucially ranked, are presented from left to right across the top of the Tableau. When a candidate violates a particular constraint, the cell corresponding to the violation receives an asterisk (constraint violation mark). After evaluating each candidate with respect to each constraint and assigning violation marks, the optimal candidate can be computed. The candidate that violates the fewest and least important constraints wins. Note that under this view of grammaticality, many 'grammatical' forms will actually violate one or more constraints, the optimal form being simply the least offensive in parallel evaluation of the whole candidate set. Periods in candidate forms indicate syllable breaks. The constraint violation asterisk that is 'fatal' to a particular candidate is marked with an exclamation mark, "!". The victorious candidate is indicated by a "pointing hand" symbol on the left.

[16] Thanks to Doug Pulleyblank for suggesting the actual formulation of this constraint to me.

[17] The candidate set is produced by a function GEN, which pairs each underlying form with a "large space" of output candidate forms "by freely exercising the basic structural resources of the representational theory" (Prince and Smolensky 1993:4-5). In practice, only the most plausible pertinent candidates are included in a tableau for evaluation.

Elements in angle brackets "<...>" are 'underparsed', that is, not properly included in prosodic structure. The vertical bar "|" indicates a morphological edge where that is relevant to an ALIGN constraint.

2.3. Discussion of Tableaux

Case 1 shows that, with stem internal voiced NC sequences, failing to parse the nasal would always be worse than simply leaving it, since the optimal form violates none of the constraints being considered. In particular it doesn't violate ClusterVoi.

Case 1. Stem Internal voiced

	di-sóngó *outhouse, toilet*	ALIGN >> (Pre-R,σ-L)	ClusterVoi >>	PARSE
☞	di | .so.ngo			
	di | .so <n> .go			*!

Case 2 shows how the constraint interaction analyzes the stem internal restriction on voiceless prenasals. Recall that this applies both to verb roots and noun stems. Since PARSE is ranked below ClusterVoi, any form with the nasal underparsed will be optimal[18]. This explains *why* there are no voiceless prenasals root/stem internally. ALIGN plays no role whatsoever.

Case 2. Stem Internal voiceless

	Babole *nonce form*	ALIGN >> (Pre-R,σ-L)	ClusterVoi >>	PARSE
	di | .so.nko		*	
☞	di | .so<n>.ko			*

Case 3 shows that stem initial voiced prenasals violate no constraints; in particular ALIGN is crucially respected. The vertical line represents the Right edge of the prefix; the dot represents the Left edge of a syllable. Underparsing the nasal would be much worse, involving both an ALIGN and a PARSE violation. ALIGN is violated because the underparsed <n> is now intervening between the Right edge of the prefix and the Left edge of the syllable.

[18] Note that this could be interpreted as saying that Babole lost nasals in this root internal C_2 position historically (perhaps through re-ranking ClusterVoi and PARSE). At present I have no evidence bearing on this question.

Case 3. Stem Initial voiced

	di-ngàsé *little cola nut*	ALIGN >> (Pre-R,σ-L)	ClusterVoi >>	PARSE
☞	di| . nga.se			
	di |<n>.ga.se	*!		*

Consider Case 4. There is a ClusterVoi violation, but resolving the problem by failing to parse the nasal creates misalignment. This can be seen from the Tableau below where the unparsed nasal <n> now intervenes between the Right prefix edge and the syllable which starts with /t/. The net result is that living with a single ClusterVoi violation is optimal. Note that this desirable result crucially depends on ranking ALIGN over ClusterVoi, confirming our choice of this ranking.

Case 4. Stem Initial voiceless

	di-ntùmù *wild fruit*	ALIGN >> (Pre-R,σ-L)	ClusterVoi >>	PARSE
☞	di |.ntu.mu		*	
	di|<n>.tu.mu	*!		*

For the imperative cases, below, ALIGN does not enter the picture since no prefixing is involved. In Case 5, unparsing the nasal creates a PARSE violation, showing that the optimal form with no violations clearly wins the contest.

Case 5. Imperative Initial voiced

	-ndùm- *stuff the mouth*	ALIGN >> (Pre-R,σ-L)	ClusterVoi >>	PARSE
☞	ndu.ma			
	< n > du.ma			*

For Case 6 where there a ClusterVoi violation, the crucial ranking of ClusterVoi over PARSE means that simply unparsing the nasal is preferable, incurring a less costly

violation than ClusterVoi. The constraint interaction thus identifies the optimal output form correctly.

Case 6. Imperative Initial voiceless

	-ntùmod- *whip*	ALIGN >> (Pre-R,σ-L)	ClusterVoi >>	PARSE
	ntu.mo.la		*	
☞	< n > tu.mo.la			*

3. Concluding Discussion

In this way a fairly complex set of facts concerning the distribution and properties of NC segments in Babole receives a unified and simple account. The account moreover achieves the goal formulated at the end of section 1, to show the relation between the impossibility of voiceless prenasals internally in stems and initially in imperatives. This was accomplished by recognizing the key importance of the ClusterVoi constraint and ranking it in a particular fashion with respect to ALIGN and PARSE. Voiceless prenasals are rejected by the ClusterVoi constraint, but this can be avoided by underparsing the nasal 'part', incurring only a modest PARSE infraction in stem-internal position and initially in imperatives. Only in the prefixing cases where ALIGN adjudicates by legislating fatal results for underparsing, do the voiceless nasals surface.

The fact that results like these can be achieved through the ranking of a few highly plausible constraints is a strong confirmation of OT's basic correctness and potential. Of course the analysis of a fragment of phonological grammar, such as in this present study, needs to be confirmed by looking at the overall interaction of all relevant constraints in the whole of the phonology.

References

Hyman, L. 1990. Non-exhaustive syllabication: Evidence from Nigeria and Cameroon. *Proceedings of the Chicago Linguistics Society 26, Vol. 2. Parasession on the Syllable and Phonetics and Phonology.*

Ito, Junko and Armin Mester, 1992. Weak layering and word binarity. Ms., University of California at Santa Cruz.

Ito, Junko, Armin Mester, and Jaye Padgett. 1993. Licensing and redundancy: Underspecification in Optimality Theory. LRC-93-07. Linguistics Research Center, Cowell College, University of California at Santa Cruz.

Leitch, Myles. 1989. *Langue et dialecte au sud du district D'Epena.* Ms., S.I.L. Brazzaville, Congo.

McCarthy, John and Alan Prince. 1993. *Prosodic morphology I: Constraint interaction and satisfaction.* Ms., University of Massachusetts, Amherst, and Rutgers University, New Brunswick, NJ.

Prince, Alan and Paul Smolensky. 1993. *Optimality Theory: Constraint interaction in Generative Grammar.* Technical report #2 of the Rutgers Center for Cognitive Sciences, Rutgers University.

2958 West 20th Ave.
Vancouver, B.C. V6L 1H5
Canada

leit@unixg.ubc.ca