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Item Type	Article
Authors	Sprouse, Ronald
Download date	2026-03-14 09:59:32
Link to Item	https://hdl.handle.net/20.500.14394/36847

Vowels that borrow moras: Geminate and weight in OT¹

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This paper discusses the representation of geminate consonants within Moraic Theory (Hyman 1985, Hayes 1989, Zec 1988) in Hindi, Selkup and Pacific Yupik and the consequences of this representation for a typology of syllable weight. Versions of Moraic Theory that distinguish geminate consonants from regular consonants by mora count in UR have been claimed to lead to incorrect predictions of syllable weight (Tranel 1991). I argue that this apparent problem is an artifact of serial derivational approaches to phonology, however, and is not a necessary result of a constraint-based theory such as Optimality Theory (OT) (Prince & Smolensky (P&S) 1993, McCarthy & Prince (M&P) 1993). In particular the cross-linguistic pattern of contribution or non-contribution of geminates to syllable weight emerges from the variable ranking of licensing and faithfulness constraints.

1. Background: Moraic Theory and assumptions

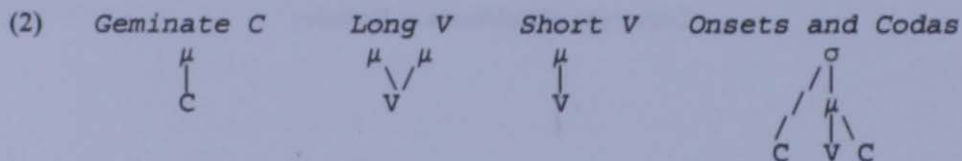
Moraic Theory assumes a basic two-way distinction between light and heavy syllables, with light syllables consisting of a single mora while heavy syllables consist of two. Hayes (1989) proposes the Weight-by-Position rule (WBP), shown in (1), which assigns moraic status to a coda consonant. This language-particular rule results in bimoraic, heavy syllables. In languages without WBP, CVC is light by definition.

(1) Weight-by-Position

$$C \rightarrow \overset{\mu}{C} / \overset{\mu}{V} C]_o$$

¹ I am grateful to Sharon Inkelas for advice and encouragement in the preparation of this paper. I would also like to thank the members of the Fall 1995 Phonology Reading Group at UC Berkeley for comments on earlier versions of this paper and Mark Hewitt for discussion of Pacific Yupik. Any errors are my own.

Geminates are distinguished from singleton consonants by mora count in UR (Hyman 1985, Hayes 1989, M&P 1993, Inkelas and Cho 1993). I will assume the general moraic model introduced in Hayes (1989): 1) underlying geminates are linked to one mora in UR; 2) long vowels are linked to two moras in UR while short vowels are linked to one; 3) onsets link directly to the syllable node and codas to a moraic node. These assumptions are illustrated in (2).

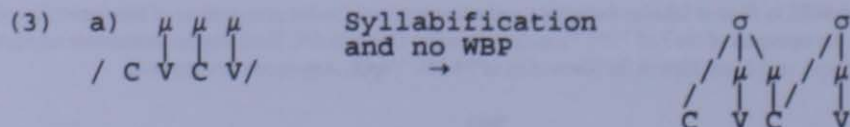


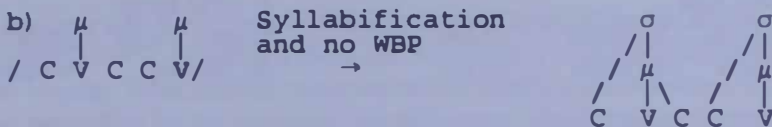
The decision to use this particular moraic model is based on the necessity of using a single model. Other moraic models, with geminates prelinked to two moras in UR (Inkelas and Cho 1993), or with onsets linked to a moraic node (Hyman 1985), should work equally well, although they may require fine-tuning of constraints. In particular the assumption that onsets link to the syllable node instead of a moraic node simplifies the analysis. A model with moraic onsets would require a slightly more elaborate analysis.

Since this analysis will be couched in the theoretical machinery of OT, WBP must be restated in non-derivational terms. For purposes of this paper I will assume that a constraint, **SyllBin**, requires syllables to be bimoraic and that this accounts for heavy CVC syllables in [+WBP] languages. [-WBP] languages and monomoraic syllables within [+WBP] languages exist because language-specific restrictions on the types of segments that license moras will interact with **SyllBin** (for instance, sonority restrictions; see §4). Although I will propose a sonority-based constraint on moras in the form of licensing for these languages, the precise characterization of **SyllBin** and its interaction with licensing is a question that will not be addressed in this paper.

2. Tranel's problem: Selkup stress

Tranel (1991) notes that the representation of geminates as underlyingly moraic predicts that any syllable closed by a geminate should be heavy, and that this is a problematic result since geminates usually pattern together with other consonants with respect to syllable weight. The underlying representation in (3a) derives a bimoraic first syllable despite the absence of WBP. This is in contrast to (3b), in which the absence of WBP yields a monomoraic syllable.





Selkup (discussed in Tranel 1991, Davis 1994; data from Kuznecova, et. al. (1980) via H&C 1983:189) supports Tranel's claim by treating both CVC and CVG syllables as light. (CVG refers to a syllable closed by a geminate.) The data in (4) illustrates Selkup stress: the rightmost heavy syllable receives stress (b), with default initial stress in the event there is no heavy syllable (a). CVC syllables fail to attract stress. (c) is crucial in demonstrating that CVG syllables also fail to attract stress.

- (4) a) *default initial stress – CVC light*
 á.mí.r.ná 'eats'
 qú.mí.ník 'human being' (dat.)
 úŋ.ŋín.tí 'wolverine'
 qól'.cím.pa.tí 'found'
- b) *rightmost heavy syllable*
 qu.mooq.li.líŋ 'your two friends'
 qu.móo.qí 'two human beings'
- c) *rightmost heavy syllable – CVG light*
 úu.cík.kak 'I am working'

Tranel (1991) proposes the Principle of Equal Weight for Codas to account for Selkup-type languages:

- (5) **Principle of Equal Weight for Codas:** *ceteris paribus*, coda portions of geminate consonants behave in the same way as other coda consonants with respect to syllable weight

As a statistical tendency the observation that languages always assign equal weight to singleton and geminate coda consonants is correct. However, as a universal principle it is falsified by the stress facts of the Hindi dialect analyzed in Davis (1994).

3. Davis' counterexample: Hindi stress

Davis (1994) argues that some languages treat CVC and CVG syllables differently. A stress pattern Davis discusses is from the Hindi dialect described in Gupta (1987). The examples in (6) demonstrate this dialect's stress pattern. Stress falls on the leftmost heavy syllable (b), with default initial stress (a). As in Selkup, CVC syllables are transparent to the stress rule and are therefore light (c). Unlike Selkup, CVG syllables do attract stress and are therefore heavy (d). The numbers in parentheses refer to page numbers in Gupta (1987).

- (6) a) *default initial stress*
 á.nu.ma.tí 'permission' (136)
 kú.ma.tí 'evil thinking' (137)
 á.nu.mo.dan 'approbation' (137)
 sú.ru.či 'good taste' (136)
- b) *leftmost heavy syllable*
 áa.vaa.raa 'vagabond' (139)
 da.káa.rē 'belches' (139)
 ni.šáa.nii 'clue' (139)

c) *CVC light*

bah.láa.ne 'to entice' (139)

sil.váa.ne 'to stitch' (139)

d) *CVG heavy*

át.taa.li.kaa.yē 'attics' (139)

sát.taa.ruur^h 'in power' (135)

Thus the typology of closed syllable weight is more complex than Tranel allowed for. In this paper I present a theory that generates all attested cells of the typology in (7), especially the ones that Tranel (1991) claims Moraic Theory does not predict. Cells (a) and (b), in which CVC syllables are light but the weight of CVG varies, are instantiated by Selkup and Hindi. As I will show, the Chugach dialect of Pacific Yupik fits into cells (b) and (c) of the typology. Cell (d), in which CVC syllables are heavy and CVG syllables are light, is to my knowledge unattested, and the analysis I offer predicts its absence.

(7) **Geminate/Weight Typology**

	CVC light	CVC heavy
CVG heavy	a) Hindi (Gupta 1987, Davis 1994)	c) Pacific Yupik (Leer 1985, Hewitt 1991, 1995, Hayes 1995)
CVG light	b) Selkup (Tranel 1991, Davis 1994) Pacific Yupik (Leer 1985, Hewitt 1991, 1995, Hayes 1995)	d) * not predicted

4. **An OT approach**

A fundamental insight of OT (P&S 1993) is that grammars may contain sets of ranked phonological constraints that can be violated, and the ability of grammars to differentially rank these constraints is the key to understanding linguistic typology, including the minor typology in (7).

The claim of the present paper is that grammars may favor Selkup-type languages by favoring constraints that demand well-formed outputs, specifically, constraints that prohibit moraic consonants. Hindi-type languages, on the other hand, result when output well-formedness is secondary to constraints that demand that an output string be faithful to the structure found in the input string.

Constraints on faithfulness are discussed in P&S (1993), M&P (1993, 1994, 1995) and Orgun (1995). The present paper will use the **Corr** family of faithfulness constraints described in Orgun (1995). (The **Corr** family is essentially identical to M&P's (1995) **Dep** and **Max** families of constraints collapsed into a single family.) The relevant constraint for Hindi and Selkup is **Corr**(μ), shown in (8), which demands that moras present in UR not be deleted. The related **CorrSeg** constraint (9) is important for the discussion of Pacific Yupik:

(8) **Corr**(μ): For every input μ , there is an output μ .

(9) **CorrSeg**: For every input root node, there is an output root node.

Moraic structure well-formedness will be expressed in terms of moraic licensing in the sense of Zec (1988, 1995), in which a mora can exist only if it dominates a segment of some minimum sonority. These sonority requirements are usually more restrictive for the leftmost, or strong, mora than for the rightmost, or weak, mora. The licensing constraint I assume is an elaboration of **License(Φ)** as developed in Itô, Mester and Padgett (1995):

(10) **License(Φ)**: The phonological feature Φ must be licensed.

License(μ), shown in (11), elaborates on **License(Φ)** by targeting prosodic structure rather than subsegmental features.²

(11) **License(μ)**: μ must be licensed (i.e., must be linked to a segment of given sonority).

Moraic licensing must be specific to individual languages. The interpretation offered by Zec for the language-particular application of a rule such as WBP is that in languages with WBP any segment is sufficiently sonorous to license a mora, while in languages without WBP only [-cons] segments license a mora. For Hindi and Selkup, then, I assume that [-cons] segments license moras but [+cons] segments do not.

Ranking of Corr(μ) and License(μ): Languages ranking **Corr(μ)** above **License(μ)** will have heavy CVG syllables regardless of the moraic status of singleton consonants because **Corr(μ)** demands that a geminate's mora in UR must be in the output string. The effects of this ranking are visible in (12), an example from Hindi. The optimal candidate in (12) is (a), which preserves underlying moraic structure. Although the underlying μ_b is not properly licensed in (a), this candidate still outperforms (b), which violates the higher-ranked **Corr(μ)** by omitting μ_a . Underlining highlights the relevant syllables for evaluation.

(12) **Hindi: Corr(μ) >> License(μ) = CVG heavy**

	$\mu_a \mu_b \quad \mu_c \mu_d \quad \mu_e \quad \mu_f \quad \mu_g$ a t a l i k a y ê	Corr(μ)	License(μ)
a)			*
b)		*!	

A reasonable alternative candidate to the winner in (12a) is one in which both moras

²The idea of moraic licensing also differs from feature licensing in that it is bottom-up, that is to say, moras are licensed by the segments they dominate. Feature licensing in Itô, Mester and Padgett (1995) proceeds in a top-down manner, with features licensed by the structure that dominates them.

(μ_a and μ_b) are preserved and the initial vowel (/a/) links to both, generating [a:] in the first syllable. To eliminate this candidate I introduce ***ShareWeak μ** , which prohibits multiple linking to the second mora of a syllable:

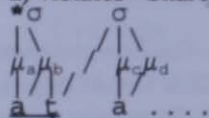
- (13) ***ShareWeak μ** : No multiple linking to the weak μ of a syllable.

***Share** prohibits vowels from supporting weak, otherwise unlicensed moras. In (14a) the potential alternative to the winner in (12) violates ***Share** and is ruled out. ***Share** is undominated in Hindi.

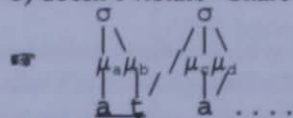
át.taa.li.kaa.yē

- (14) **Hindi: *Share** /attaalikaayē/ → [át.taa.li.kaa.yē] (*[áat.taa.li.kaa.yē])

a) violates ***Share**



b) doesn't violate ***Share**



Zec (1988, 1995) argues that the leftmost mora is stronger than the first because it dominates a segment that is both syllabic and moraic. The prominence of the strong mora is thus enhanced by having more stringent sonority restrictions than the weak mora. The weak mora only needs to dominate a moraic segment. ***ShareWeak μ** builds on the idea that the weak mora is less prominent by also restricting the quantity of segments that it may dominate.

We turn next to the type of grammar that, Tranel observes, Moraic Theory does not predict under a derivational approach. I account for cell (b) (Selkup) of the typology in (7) by ranking **License(μ)** above **Corr(μ)**. In such a language all moraic consonants are out, regardless of whether they belong to CVC or CVG. (15) illustrates this for Selkup.

- (15) **Selkup: License(μ) >> Corr(μ) = CVG light**

		License(μ)	Corr(μ)
a)		*! (μ_d)	
b)			* (μ_c)

In (15) the relevant syllable is the second one. Winning candidate (b) has a well-formed moraic structure since all of its moras are properly licensed. It violates correspondence since the underlying μ_c is absent. The competing candidate (a) does not violate correspondence since all the input moras are present in the output. (a) is out because

the geminate's mora (μ_d) violates moraic licensing. A monomoraic, light syllable is therefore the optimal one.

Another way to satisfy **License(μ)** by violating **Corr(μ)** would be to delete the mora corresponding to the geminate instead of the one corresponding to the vowel. This would result in degemination, not the desired result. In order to distinguish such a candidate from (13b), **Corr(μ)** must be split into two constraints that require correspondence of the vowel's underlying mora versus the consonant's underlying mora.

(16) **Corr(V- μ)**: A μ coindexed with a V in input must be present in the output.

(17) **Corr(C- μ)**: A μ coindexed with a C in input must be present in the output.

In Selkup **Corr(C- μ)** must outrank **Corr(V- μ)**. A hypothetical language with the opposite ranking is illustrated in (18).

(18) **Hypothetical: License(μ) >> Corr(V- μ) >> Corr(C- μ) = no gemination**

	μ_a/μ_b μ_c/μ_d μ_e u c † k a k	License (μ)	Corr (V- μ)	Corr (C- μ)
a)		*! (μ_d)		
b)			*! (μ_c)	
c)				* (μ_d)

This ranking proves to be uninteresting, however, since it will always prevent the expression of an underlying geminate on the surface; therefore, the language learner has no reason ever to posit a moraic consonant in UR. The ranking **Corr(V- μ) >> Corr(C- μ)** can only describe languages that lack underlying geminates. Since the languages under discussion in this paper do have underlying geminates, I will not consider any candidate that favors a **Corr** violation of a consonant's underlying mora over a vowel's underlying mora.

Now that we have seen how reranking of **License(μ)** and **Corr(C- μ)** generates a typology in which CVG syllables may be either heavy or light, we will examine the Chugach dialect of Pacific Yupik, with its more complex licensing requirements and stress patterns.

5. Pacific Yupik (Chugach dialect)

Pacific Yupik (PY) prosody is unusual in that a CVC syllable is light by default but bimoraic in two environments: 1) in the initial syllable; 2) when stress happens to fall on it. The crucial observation for the present discussion is that when CVC is heavy, CVG is also heavy, as predicted in (7). However, in unstressed syllables, where CVC is light, CVC and CVG behave differently -- CVC is allowed but CVG is not and in fact degemination occurs, a pattern which is also consistent with the typology. I will argue that the differential treatment of CVC and CVG results from the moraic representation of geminates, in which degemination and segment deletion do not invoke the same *Corr* violation.

Leer (1985a,b) analyses the PY prosodic system in great detail, and Hewitt (1991, 1994) and Hayes (1995) propose alternative analyses based on this description. The present analysis focuses on the Chugach dialect and follows Hayes (1995) in the basic details of stress. Portions of the analysis are also similar to Hewitt (1994), which offers an insightful account of the closely-related Koniag dialect based on somewhat different assumptions. The present paper will not motivate the stress patterns themselves. Instead the focus is on the behavior of CVC and CVG depending on their position in the word and with regard to stress.

5.1 Basic stress facts

The basic ternary, iambic stress pattern is in (19). (a-b) show the basic iambic pattern, and (c-d) show ternarity.³ Numbers in parentheses refer to pages numbers in Leer (1985a).

- | | | | |
|------|---------------------------------|----------------------------------|-------|
| (19) | a) <u>a.táa</u> ka | 'my father' | (116) |
| | b) <u>a.kúu</u> .ta.mə'k | '(a food)' abl. sg. | (84) |
| | c) a.túu.q <u>u.ni.ki</u> | 'if he (refl.) uses them' | (113) |
| | d) pi.súu.q <u>u.ta.qúu</u> .ni | 'if he (refl.) is going to hunt' | (113) |

Stress is quantity-sensitive: underlying long vowels always attracts stress, as in (20).

- | | | | |
|------|---------------------|-------------|------|
| (20) | a) <u>táa.ta.qá</u> | 'my father' | (86) |
| | b) <u>cáa.uq</u> | 'tea' | (98) |

Non-initial CVC is light, as it does not attract stress (21a,b). Initial CVC, however, does attract stress (21a,c).

³ For Hayes (1995) ternarity results from weak local parsing, which skips a single light syllable between foot assignments wherever possible. Hewitt (1991) has an alternative view of ternarity in PY in which ternarity is derived by adjoining a monomoraic syllable to a bimoraic Foot under the Prosodic Word.

- (21) a) án.ku.tax.túu.tə̀n 'you're going to backpack' (116)
 b) pi.lii.wa.kax.túq 'he's making too much' (101)
 c) kús.ka.qá 'my cat' (86)

The evidence from stress indicates that only [-cons] segments license a mora since CVC and CVG are both light; the exception to this generalization is the first syllable, in which any root node may license a mora.

Further evidence for the exceptional licensing of moras in the first syllable comes from Pre-Long Strengthening (PLS). PLS attracts stress to the syllable before an underlying long vowel or diphthong. When PLS targets a non-initial open syllable a long vowel results due to Iambic Lengthening, as in the second syllable of (22a); (22b) shows that when PLS targets an open initial syllable, gemination results. (In (22a) the triggering environment is rendered opaque by closed syllable shortening.)

- | | PLS | Closed σ shortening | | |
|---------|--|----------------------------|---------------------------|------|
| (22) a) | /muluku <u>u</u> t/ → mu. <u>lúu</u> .kúut | → [mu.lúu. <u>ku</u>] | 'if you take a long time' | (87) |
| b) | /qaya <u>a</u> kun/ → qá.yáa.kun | | 'by his boat' | (88) |

The PLS facts follow the same pattern as the stress facts: when PLS targets non-initial syllables, vowel lengthening results since the onset of the following syllable cannot license the second mora of the target syllable; in initial syllables PLS results in gemination because the onset of the following syllable may license a mora in the initial syllable. To capture the special behavior of initial CVC, a disjunctive licensing statement is needed:

- (23) **License(μ)** (Pacific Yupik): To be properly licensed, μ must be linked to a member of the set { [-cons]; [_w[_o... RtNode...] }.

5.2 CVC and CVG

We will now examine the behavior of CVC and CVG in different environments, beginning with the initial syllable. Since CVG is normally light, as in Selkup, **License(μ)** must dominate **Corr(μ)**, a ranking which always yields monomoraic CVC and CVG in Selkup. PY initial syllable licensing renders **License(μ)** irrelevant in that syllable, however, a fact that allows initial CVC to be heavy but does not explain why it must be heavy. To this end Hewitt (1994) proposes an **Initial Stress** constraint that attracts stress to the initial syllable. **Initial Stress** cannot be allowed to lengthen the vowel of an initial CV syllable, however. For Hewitt **Initial Stress** motivates the addition of a non-nuclear mora to the first syllable, and vowels are restricted from linking to non-nuclear moras. My analysis also assumes **Initial Stress**, but my moraic model does not include a nuclear/non-nuclear distinction, and so I assume that **NoLongVowel** (Sherer 1994; P&S 1993), which prohibits vowels from linking to multiple moras, dominates **Initial Stress**. The end result is that CVC and CVG are both heavy in the initial syllable.

In non-initial position, CVC is ordinarily light and doesn't attract stress; however, in

some cases it may be stressed because of its position with respect to the iambic stress pattern. Hewitt (1994) observes that closed syllables can be interpreted as either heavy or light in OT, depending on whichever representation yields the better output. This fact is a conundrum for derivational theories because WBP is assumed to either apply or not, so closed syllables should always have the same moraic representation. (For Hayes (1995) WBP in PY applies only in the first syllable.) In terms of the present discussion, **License(μ)** prohibits bimoraic non-initial closed syllables. However, other prosodic needs may override **License(μ)**. A stressed syllable will be bimoraic even though it violates moraic licensing because of the higher-ranked **Iambic Length (IL)** constraint:

(24) **Iambic Length:** Stressed syllables are bimoraic.

The ranking in (25) shows the effect **IL** has in favoring bimoraic stressed CVC. Although winning candidate (a) fails to properly license μ_x , (b) is worse since it fails to have a bimoraic stressed syllable, as demanded by **IL**. I assume that ***Share** is also highly-ranked in PY and do not regard any candidate that violates that constraint.

(25) /pənaq/ → [pə.náq] (104)

	μ_a μ_b p ə n a q	IL	License(μ)
a)	<p>[pə.náq]</p>		* (μ_x)
b)	<p>[pə.náq]</p>	*	

In addition to allowing the existence of underlying CVG in stressed syllables, **IL** favors candidates with non-underlying geminates under certain circumstances. Schwa can never be long in PY, and when **IL** demands that an open syllable containing schwa have a second mora, gemination of the following onset occurs. I propose **NoLongə**, a more specific form of **NoLongVowel**, to handle that fact that schwa can never be long:

(26) **NoLongə:** Don't have long ə.

NoLongə doesn't allow schwa to spread to the second mora demanded by **IL**. In this case, gemination of the following onset occurs rather than the vowel lengthening that **IL** normally

motivates.⁴ The second mora of this syllable incurs a licensing violation, as does the second mora of a stressed CVC syllable. Again, this violation results from the ranking of **IL** >> **License(μ)**, along with the high ranking of **NoLongθ**.

(27) /tuməma/ → [tu mə́ m ma] (Leer 1985b:137)

	$\begin{matrix} \mu_a & \mu_b & \mu_c \\ & & \\ t & u & m \end{matrix} \quad \begin{matrix} \mu_b & \mu_c \\ & \\ \emptyset & m \end{matrix} \quad \begin{matrix} \mu_c \\ \\ a \end{matrix}$	IL	NoLongθ	License(μ)
a)	$\begin{matrix} \sigma & & \sigma & & \sigma \\ / \backslash & / \backslash & / \backslash & / \backslash & / \backslash \\ \mu_a & \mu_b & \mu_c & \mu_b & \mu_c \\ & & & & \\ t & u & m & \emptyset & m & a \end{matrix}$			* (μ _v)
b)	$\begin{matrix} \sigma & & \sigma & & \sigma \\ / \backslash & / \backslash & / \backslash & / \backslash & / \backslash \\ \mu_a & \mu_b & \mu_x & \mu_c & \mu_c \\ & & & & \\ t & u & m & \emptyset & m & a \end{matrix}$		*!	
c)	$\begin{matrix} \sigma & & \sigma & & \sigma \\ / \backslash & / \backslash & / \backslash & / \backslash & / \backslash \\ \mu_a & \mu_b & \mu_c & \mu_c & \mu_c \\ & & & & \\ t & u & m & \emptyset & m & a \end{matrix}$	*!		

In (25) and (27) **License(μ)** is not trivially satisfied as it was in initial syllables. Despite this fact both CVC and CVG emerge as bimoraic syllables when stressed because a higher ranked constraints compels the syllable to be bimoraic.

The one environment in which CVC and CVG behave differently is in unstressed position. CVC syllables are allowed and are monomoraic. CVG syllables are not allowed, and underlying geminates degeminate:

(28) /iqʌnnixtuq/ → [iq ʌ.niX tʌq] 'he stopped lying' (87)

Degemination results from the constraint **Minimize Unstressed σ**, which serves as a counterpart to **IL** by making unstressed syllables less prominent:

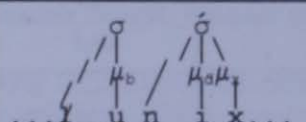
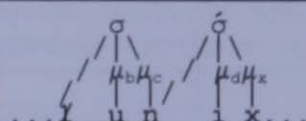
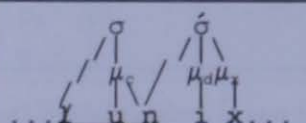
(29) **Minimize Unstressed σ**: Minimize segmental content in an unstressed syllable (i.e., σ dominates as few root nodes as possible).

Hewitt (1994) observes that degemination incurs only a faithfulness violation of a mora but

⁴ Hewitt (1994) regards schwa as an empty mora that doesn't have any featural material to spread to the second mora. Regardless of the particular mechanism used to account for the absence of long schwas, the crucial observation remains the same -- moraic positions normally filled by vowels link to a following onset when no vowel is available to link to the mora.

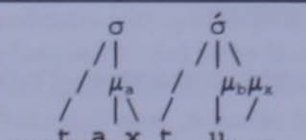
leaves the segmental melody intact.⁵ I capture this generalization in my account through the differential ranking of **Corr** constraints for moras and segments with respect to **Min**, which yields the differential behavior of CVC and CVG unstressed syllables. Since degemination involves loss of a mora and not a segment the ranking **CorrSeg** >> **Min** >> **Corr(μ)** results in degemination. In (30) the winning candidate is decided by the second-ranked **Min** constraint. (a) has only two **Min** violations, whereas (b) and (c) have three each.

(30) /iq $\dot{\text{h}}$ unnixtuq/ → [iq $\dot{\text{h}}$ u nix $\dot{\text{t}}$ uq]

	$\mu_a \mu_b \mu_c \mu_d \mu_e$ /iq $\dot{\text{h}}$ un ixtuq/	CorrSeg	Min	License(μ)	Corr(μ)
a)			** (Yun)	* (μ_x)	* (μ_c)
b)			*** (Yun)	** (μ_c, μ_x)	
c)			*** (Yun)	* (μ_x)	* (μ_b)

In (31) the content of the underlined CVC syllable is unaffected by the unstressed position because **CorrSeg** demands that all segments in the input be present in the output. The winner (a) has no **CorrSeg** violation. It is favored despite incurring one more **Min** violation than (b).

(31) /ankutax $\dot{\text{t}}$ ut $\dot{\text{e}}$ n/ → [an.ku.tax $\dot{\text{t}}$ u.t $\dot{\text{e}}$ n]

	$\mu_a \mu_b \mu_c \mu_d \mu_e$ /ankutax $\dot{\text{t}}$ ut $\dot{\text{e}}$ n/	CorrSeg	Min
a)			*** (tax)

⁵ In Hewitt (1994) **PeakProminence** motivates degemination by forcing unstressed syllables to be monomoraic. This constraint is not sufficient on its own to motivate degemination in my model, however, since my model allows monomoraic CVG syllables in PY as in Selkup, creating the additional need for **Min**.

b)		*! (x)	** (ta)
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(31) and (32) demonstrate that CVC and CVG behave differently in unstressed syllables; CVG degeminates and CVC is unaffected. This differential behavior is a result of high-ranked **CorrSeg** and low-ranked **Corr(μ)**.

6. Conclusions:

When geminates and singleton consonants behave differently, as they do in Hindi and in PY unstressed syllables, it is a result of the high ranking of a **Corr** faithfulness constraint, though in PY **Min** also plays a role. This was seen in the case of Hindi, in which **Corr(μ)** is ranked high, and in PY unstressed syllables, in which **CorrSeg** is ranked high. When **Corr** is low, geminates and other consonants behave the same, as in Selkup.

(32) Geminate/weight typology

	CVC light	CVC heavy
CVG heavy	a) Hindi Corr(C-μ) >> License(μ)	c) Pacific Yupik (initial & stressed σ) License(μ) irrelevant
CVG light	b) Selkup Pacific Yupik (unstressed σ: degemination) License(μ) >> Corr(C-μ)	d) * not predicted

It is now possible to see why cell (d) in the typology in (33) is not predicted by this analysis. In a language where CVC is uniformly heavy, **License(μ)** is trivially satisfied by being linked to any segment. Its ranking with respect to **Corr(μ)** is therefore irrelevant, and the faithfulness constraint will demand that both the vowel's and the consonant's underlying moras be in the output. CVG will therefore always be heavy.

6.1 Implications

6.1.1 Representation of geminates

The differential behavior of geminates and singleton consonants supports the claim that geminates are associated with a mora in UR rather than argues against it. A theory which supposes that underlying geminates consist of consecutive root nodes is not capable of separating the behavior of geminates and singleton consonants in the same way (Selkirk 1990). It would be difficult to incorporate the facts of Hindi stress or PY degemination into

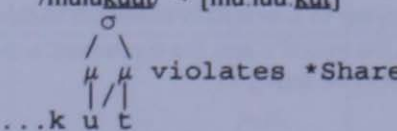
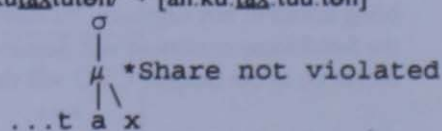
such a theory.

This theory also makes it possible to distinguish true moraic geminates from heteromorphemic geminates that result from the concatenation of two morphemes with identical segments at their shared edges (see McCarthy 1986:257-58). In PY the differential rankings of **CorrSeg** and **Corr(μ)** predict that the heteromorphemic geminates will be allowed in unstressed position. Unfortunately, Leer doesn't include data to resolve this question, and this issue will have to await further research. If moraic and heteromorphemic geminates are treated identically, a more elaborate theory will be necessary, perhaps one that converts heteromorphemic geminates into moraic geminates to avoid violations of the Obligatory Contour Principle. Again, this is a question that awaits further research.

6.1.2 *Share

The ***Share** constraint introduced here may be useful for evaluating other moraic representations, in particular, the representation of superheavy syllables. Mora-sharing is a possible repair in OT for trimoraic syllables in languages with moraic consonants and will have to be allowed or excluded on the basis of a constraint like ***Share** in combination with **SyllBin**. Languages with heavy CVC tend to forbid CVVC; exceptions include Latin, Seminole/Creek, General Central Yupik, Klamath, Estonian, which as noted in Hayes (1995) must allow trimoraic syllables or special crowding of segments onto moras.

***Share** also makes a prediction that is otherwise difficult to make in Moraic Theory: some languages with light CVC will disallow CVVC syllables. That is, mora sharing is allowed on the first but not the second syllable. Two possible representations for CVVC are in (34b,c). PY is one such language; St. Lawrence Island Yupik is another (Hayes 1995). In (35a) the long vowel and coda consonant share the weak mora and violate ***Share**. This results in vowel shortening in PY because of ***Share**'s high ranking. In (30b), however, a regular closed syllable does not violate ***Share** because the shared μ is not the weak one.

- (33) a) closed σ shortening: $/mulukuut/ \rightarrow [mu.luu.kút]$

 violates ***Share**
 ...k u t
- b) closed unstressed σ : $/ankutaxtutən/ \rightarrow [án.ku.tax.túu.tən]$

***Share** not violated
 ...t a x

Finally, it is likely that ***Share** is a family of constraints that also includes ***ShareStrong μ** and the more general ***Share μ** . This family, along with the sonority-based **License(μ)**, has the potential to describe structural well-formedness of syllables in a precise way and may provide the explicit grounding for other constraints that assume but do not explicitly encode syllabic positions, such as **NoCoda**.

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