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Syllabification in Khalkha Mongolian and output-output correspondence

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Underlying forms of Khalkha Mongolian may contain consonant clusters with two or more consonants, into which the default schwa vowels are epenthesized in order to create well-formed syllables. This property has been analyzed by Svantesson (1995) in one of the derivational frameworks, in which the process is governed by the sonority law, maximality, directionality, and a cycle-sensitive restriction on epentheses. The purpose of this article is to recapitulate the properties of optimal syllabification of Khalkha Mongolian in the framework of Optimality Theory (Prince and Smolensky 1993). I will show, above all, that a seemingly cyclic property in syllabification of morphologically complex words in the language is attributable to an effect of an output-output correspondence constraint, namely Base-Affixed form identity (B/A-identity) as proposed in Benua (1995), and its interaction with other constraints in the grammar.

All the data in the following are from Svantesson 1995, and I will use his symbol set and abbreviations in the examples. I will also follow his position that the vowel harmony facts of the language (Steriade 1979; Svantesson 1985 among others) are irrelevant to syllabification and vowel epenthesis, and hence, are negligible.

In section one, I will describe the basic properties of vowel epenthesis and optimal syllabification, summarizing the account of Svantesson (1995). In section two, I will show an OT account of syllabification of simplex words. In section three, I will show an analysis of morphologically complex words and the fact that cyclic property of syllabification is accounted for by an interaction of an output-output constrain and other constraints in the grammar.

1 Coda sonority grade of Khalkha Mongolian

One of the most strict and unviolable restrictions of Khalkha Mongolian syllabification is that the coda consonant clusters must follow the law of decreasing sonority.

(1) Decreasing-sonority law: A string of (zero or more) consonants is a possible coda if and only if it has strictly decreasing sonority. (=*Coda constraint* of Svantesson 1995:(6))

Thus, while the underlying forms in (2) are syllabified without vowel epenthesis, the underlying forms in (3) are subject to vowel epenthesis in order to break up the illegitimate coda consonant clusters. The abbreviated letters show types of clusters: *A* for affricate/stop, *F* for fricative, *N* for nasal, *L* for liquid, *G* for glide, and *S* covers *N*, *L*, and

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G as one sonorant group.[1]

(2) SO (sonorant-obstruent) combination

a.	NF	/zims/	[zims]	'fruit'	/cONx/	[cONx]	Window
	NA	/limb/	[limb]	'flute'	/dond/	[dond]	Middle
b.	LF	/ols/	[ols]	'state'	/ar'x'/	[ar'x']	Liquor
	LA	/ard/	[ard]	'people'	/aɫrc/	[aɫrc]	Curds
c.	GF	/uj-s/	[uj-s]	'time-PL'	/sawx/	[sawx]	Chopsticks
	GA	/sowd/	[sowd]	'pearl'	/GOjd/	[GOjd]	Elegant-DAT

(3)

a.	NL	/xamr/	[xa.mEr]	'nose'
b.	NN	/unN/	[u.nEN]	'truth'
c.	AA	/x'atd/	[x'a.tEd]	'china'

What constitutes the decreasing grade of sonority is a matter of empirical investigation. The overall sonority scale is determined by the universal principle, generally accepted in the literature such as Sonority Sequence Principle (Clements 1990), and at the same time, it is determined by idiosyncratic characteristics of the language. As we will see, the sonority scale of Khalkha Mongolian looks like (Vowel)>Sonorant>Fricative>Affricate/Stop. Glides, liquids, and nasals act as one group, i.e. sonorant, as having the same sonority value in syllabification, so that LN, GN, and GL are never allowed.

A fricative-affricate/stop combination is generally allowed, provided it does not contravene against either of the restrictions in (4). (4a) bans FA coda clusters beginning with S, (4b) bans those ending with *c*[ts], and (4c) disallows those in which each consonant has different voicing specification. All of these induce vowel epenthesis. Examples are in (5).

(4) a. *[-son] over C C]cd, with the first C linked to S

b. *[-son] over C C]cd, with the second C linked to c

c. *[-son] over C C]cd, with the first C linked to [αvoiced] and the second to [-αvoiced]

(5)

a.	/xoSt/	[xo.SIt]	'a kind ot tree'
b.	/x¹x-c/	[x¹.xEc]	'indigo' (x¹x 'blue')
c.	/xuɫxd/	[xuɫ.xEd]	'child'

Another idiocyncratic property is an irregular behavior of the voiced velar and uvular stops *g*, *g'*,and G, abbreviated here as a group Γ. The Γ consonants in (6a) induce vowel epenthesis, which suggests that a Γ has the same sonority value with sonorants, and the Γ consonants in (6b,c) form complex codas with other obstruents, which suggests they are more sonorous than the other obstruents. These facts led Svantesson to conclude that the Γ consonants are regarded as sonorants for syllabification purposes, and I will follow his conclusion.[2] Other clusters inovolving Γ's are in (7). They all induce epenthesis.

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[1] IPA symbols are used exept the following: S[S], c[ts], z[dz], C[tS], z[dZ], l[lZ], l'[lZɫ]. The character ' indicates palatalization. Following abbreviations are used in the glosses: ABL: ablative, ADJ: adjective-forming suffix, CAUS: causative, DAT: dative, GEN: genitive, IRR: irreal mood, PL: plural, PROG: progressive, REFL: reflexive, TERM: terminal.

[2] Svantesson points out that regarding Γ's as sonorants might cause problem for explainig the existance of the clusters *Ng*, *Ng'*, *NG*. If Γ's are sonorants, there is no decrease in sonority in NΓ clusters, becasue both are considered to be in the same sonority group, and then vowel epentheses must take place. Svantesson attribute the resistance of these clusters againt vowel epentheses to a partial geminate structure created by the rule which assimilate the place of articulation of *N* to that of the following Γ consonant. Some examples

(6)	a.	SΓ	/ajG/	[a.jEG]	'cup'			
			/bilg/	[bi.lEg]	'gift'			
	b.	ΓA	/bOGd/	[bOGd]	'holy'			
	c.	ΓF	/sags/	[sags]	'basket'			
(7)	a.	OΓ	/usg/	[u.sEg]	'script'	/otG/	[o.tEG]	'meaning'
	b.	ΓS	/aGr/	[a.GEr]	'aloe'	/bOg'n/	[bO.g'In][3]	'short'
	c.	ΓΓ	/saGg/	[sa.GEg]	'buckwheat'	/ilgg/	[il.gEg]	'sieve'

All occurring three-consonant codas consist of a premissible fricative-affricate/stop combination preceded by one sonorant. Examples are in (8).

(8)	a.	LFA	/nuÉrs-C/	[nuÉrs-C]	'coal-miner'('coal-ACTOR')
	b.	LFA	/Sarx-C/	[Sarx-C]	'coroner'('wound-ACTOR')
	c.	NFA	/zims-t/	[zims-t]	Having fruit'('fruit-ADJ')
	d.	GFA	/daws-t/	[daws-t]	'salty'('salt-ADJ')
	e.	ΓFA	/zigs-C/	[zigs-C]	'warbler'

2 OT analysis of simplex words

In the previous section, I summarized the properties of coda consonant clusters. In particular, the coda consonant clusters must conform with the decreasing-sonority law with some language particular restrictions. In optimality-theoretic terms, these properties can be stated as a markedness constraint, which is unviolated in Khalkha Mongolian.

(9) SON-SEQ Complex codas fall in sonority.[4]

As has also been summarized in the previous section, there are some language particular properties in the determination of sonority grade as in (10), which I assume is subsumed under the constraint SON-SEQ.

(10) i. Sonority scale for Khalkha Mongolian
(Vowel)>Sonorant>Fricative>Affricate/Stop (Sonorant includes G, L, N, Γ)
ii. Restrictions on F-A cluster (4)

Along with the restriction on coda sonority, there are a few other unviolated restrictions relevant to syllabification. Those are in (11).

(11) i. No deletion of a segment.
ii. Complex onsets are prohibited.
iii. No vowel epenthesis in the final position.
iv. Onsets are required except in the initial syllable.

(11i) says that, in order to resolve unfavorable coda clusters, the language adopts a strategy of epenthesis instead of deletion. Ranking MAX-IO over DEP-IO accounts for this. The two constraints are stated below and the following tableau shows this fact. Since deletion occurs in no circumstance of syllabification, I assume that MAX-IO is undominated as well as SON-SEQ.

are: /m^{1}Ng/ [m^{1}Ng] 'silver,' /ang'/ [ang'] 'class,' /m'aNG/ [m'aNG] 'thousand.'

[3] The inserted vowel is fronted to [I] after palatalized consonants and alveopalatals.

[4] SON-SEQ is also relevant for onset sonority: complex onsets rise in sonority. Since no complex onset is allowed in Khalkha Mongolian, I disregard the onset part of the constraint.

(12) MAX-IO Input segments must have output correspondents.("No deletion")
(13) DEP-IO Output segments must have input correspondents. ("No epenthesis")

(14)

/xamr/ 'nose'	SON-SEQ	MAX-IO	DEP-IO
a. .xamr.	*!		
b. .xam.		*!	
c. Λ .xa.mEr.			*

The relevant constrains for restrictions (11ii, iii, iv) are the following.

(15) *COMPLEX^ONS *[$_\sigma$CC ("Onsets are simple")
(16) ANCHOR-R The right edge of grammatical word coincides with the right edge of a syllable.
(17) ONS A syllable has an onset.
(18) ANCHOR-L The left edge of grammatical word coincides with the left edge of a syllable.

Another constraint involved in syllabification is NOCODA. Since Khalkha Mongolian extensively allows single-consonant codas rather than avoiding them as much as possible, I assume it is ranked in a lower position. We will see in the course of argument that there is an interaction of NO-CODA with DEP-IO, and that the language tolerates codas while suppressing epenthesis to be minimal.

(19) NO-CODA *C]$_\sigma$ Syllables are open.

The following tableau illustrates an overall picture of optimal syllabification in Khalkha Mongolian.

(20)

/Sastr/ 'chronicle'	SON-SEQ	MAX-IO	ANCHOR-R	*COMPLEX^ONS	ANCHOR-L	ONS	DEP-IO	NO-CODA
a. Λ .Sas.tEr.							*	**
b. .Sastr.	*!							*
c. .Sast.		*!						*
d. .Sas.trE.			*!	*			*	*
e. .Sa.stEr				*!			*	*
f. .Sast.Er.						*!	*	*
g. .Sa.sE.tEr.							**	*
h. .Sa.sE.tE.rE.			*!				***	

As has already been assumed, SON-SEQ and MAX-IO are undominated in the highest position. Comparing candidates (a) and (b), we must conclude that both DEP-IO and NO-CODA must be ranked lower than SON-SEQ. Comparing candidates (a), (g), and (h), we will notice that the language prefers minimal epentheses rather than minimal creation of codas, which establishes DEP-IO >> NOCODA.

Comparison of candidates (a) and (c) shows that deletion is not used to resolve an unfavorable cluster. Note that [-*st*] in candidate (c) has a decreasing sonority, and it is not against the sonority law *per se*. Candidate (c) is penalized significantly by MAX-IO because of its loss of the final consonant.

The above observation establishes a partial ranking of constraints as in SON-SEQ, MaxIO >> Dep-IO >> No-Coda.

Failure of candidate (d) corresponds to the restriction stated in (11iii), namely, no epenthesis in final positions. The constraint militating against this is Anchor –R, (16), and it must be ranked above NoCoda: Anchor–R >> NoCoda. Since this constraint is never violated, I assume it is undominated in the highest position.

When there is a possibility of different partitioning of a medial consonant cluster as shown by candidates (a), (e), and (f), the one which has a simplex onset is preferred; a syllable prefers to have an onset, but it must consists of no more than one consonant: (11ii, iv). Observation of the violation marks for (a), (e), and (f) tells that if either of *Complex^{ONS} or Ons were ranked lower than NoCoda, the intended candidate (a) would loose against its respective competitor. Thus, both *Complex^{ONS} and Ons must be ranked higher than NoCoda. Now, we have {*Complex^{ONS} >> NoCoda} AND {Ons >> NoCoda}.

Among these constraints, *Complex^{ONS} is never violated; therefore, it must be undominated, but Ons may be violated, because initial syllables may lack onsets: (11iv). As in the following tableau, ranking Anchor-L over Ons yields the right result. Since epenthesis in initial onsets never occurs, I assume Anchor-L is undominated.

(21)

/ard/ 'people'	Son-Seq	Max-IO	Anchor-R	*Complex^{ONS}	Anchor-L	Ons	Dep-IO	No-Coda
a. Λ .ard.						*		*
b. .tard.					*!		*	*

No interaction of Ons and Dep-IO is observed in the data; I will put them in the same place. The following is the summary of the constraint ranking so far established.

(22) Son-Seq, Max-IO, Anchor-R, *Complex^{ONS}, Anchor-L >> Ons, Dep-IO >>No-Coda

With all the relevant constraints at hand, I will show again, how the constraint ranking chooses the right candidate for simple (C)VCC forms.

(23)

/xamr/ 'nose'	Son-Seq	Max-IO	Anchor-R	*Complex^{ONS}	Anchor-L	Ons	Dep-IO	No-Coda
a. .xamr.	*!							*
b. Λ .xa.mEr.							*	*
c. .xam.rE			*!				*	*
d. .xa.mrE.			*!	*!			*	
e. .xam.		*!	*					*

(24)

/ard/ 'people'	Son-Seq	Max-IO	Anchor-R	*Complex^{ONS}	Anchor-L	Ons	Dep-IO	No-Coda
a. Λ .ard.						*		*
b. .tard.					*!		*	*
c. .a.rEd.						*	*!	*
d. .ar.Ed.						**!	*	**
e. .ar.dE.			*!			*	*	*

The winning candidates never violate Max-IO, Anchor-R, *Complex^{ONS}, Anchor-L or Son-Seq, and these constraints do not interact with each other in any way relevant to our issue. In the following argument, I will focus on the candidates which observe these constraints, and highlight the interaction of other relevant constraints. I will also exclude the candidate which violates the single onset requirements (11ii). The tableaux hereafter will be simplified accordingly.

Next, I will consider the forms with final three-consonant clusters in a little more detail. The list below are taken from Svantesson (1995: (8)).

(25)	a.	SSS	[S.SES]	tarwG	[tar.wEG]	'marmot'
	b.	ASS	[A.SES]	xidmN	[xid.mEN]	'pear'
	c.	SAS	[S.AES]	aldr	[al.dEr]	'fame'
	d.	FAS	[F.AES]	Sastr	[Sas.tEr]	'chronicle'
	e.	SAF	[S.AEF]	xowcs	[xow.cEs]	'clothes'
	f.	FAF	[F.AEF]	Sax-ds	[Sax.dEs]	'residue'
	g.	SSF	[.SESF]	sar'ms	[sa.r'Ims]	'garlic'
	h.	ASA	[.AESA]	Godmz	[Go.dEmz]	'street'

In examples from (25a) through (25f), each of the final CCC's is divided in the same way. Between the two possibilities of syllabifying the final clusters into [CV.CECC] or [CVC.CEC], the latter is chosen, because final CC of the former violates the sonority law and the grammar is forced to choose the latter. The following tableaux show this fact.

(26) SSS [S.SES](a)

/tarwG/ 'marmot'	SON-SEQ	DEP-IO	NO-CODA
a. .tarwG.	*!		*
b. Λ .tar.wEG.		*	**
c. .ta.rEwG.	*!	*	*

(27) SAS [S.OES](c)

/aldr / 'fame'	SON-SEQ	ONS	DEP-IO	NO-CODA
a. .aldr.	*!	*		
b. Λ .al.dEr.		*	*	**
c. .ald.Er.		**!	*	**
d. .a.lEdr.	*!	*	*	*

(28) SAF [S.OEO] (e)

/xowcs/'clothes'	SON-SEQ	ONS	DEP-IO	NO-CODA
a. .xowcs.	*!			*
b. Λ .xow.cEs.			*	**
c. .xowc.Es.		*!	*	**
d. .xo.wEcs.	*!		*	*

In examples (25g) and (25h), things are somehow different, because [CV.CECC] and [CVC.CEC] are both possible with respect to the sonority law; the final CC, namely SF([ms]) in (g), and SA([mz]) in (h) conforms with the sonority law and both are permissible codas *per se*. This situation led Svantesson's derivational analysis to postulate that syllabification must be subject to directionality and maximality. That is, in derivational terms, preference of [CV.CECC] over [CVC.CEC] is captured by scanning the maximally possible cluster from right to left. In Optimality Theory, neither directionality nor procedural mechanism of maximality is available. Such characteristics must result from interactions of ranked constraints.

If we compare [CV.CECC] and [CVC.CEC], we will notice that preserving a maximal CC sequence in the right has an effect of reducing the number of codas in the entire syllable parse. The latter parse candidate gets more violation marks than the former with respect to NO-CODA. The constraint ranking so far established successfully chooses the right candidate as in the following tableaux.

(29) SSF [.SESF](g)

	/sar"ms/ 'garlic'	SON-SEQ	DEP-IO	NO-CODA
a.	.sar"ms.	*!		
b.	.sar".mEs.		*	**!
c. Λ	.sa.r"Ims.		*	*
d.	.sa.r"I.mEs.		**!	*

(30) ASA [.AESA](h)

	/Godmz/ 'street'	SON-SEQ	DEP-IO	NO-CODA
a.	.Godmz.	*!		*
b.	.God.mEz.		*	**!
c. Λ	.Go.dEmz.		*	*
d.	.Go.dE.mEz.		**!	

Now we look at complex clusters with more than 3 consonants. Examples are shown below. (Svantesson 1995:(9))

(31)
a. /j¹rtnc/ j¹r.tEnc 'world'
b. /sorwlz/ Sor.wElz 'root'
c. /xuEnlde/ XuE.xEl.de 'doll'
d. /b0lzmr/ Bolz.mEr 'lark'
e. /naimlzrGn/ Nai.mEl.zEr.GEn 'louse'
f. /GorGldai/ Gor.GEl.dai 'nightingale'

While Svantesson's derivational account with right-to-left directionality and maximality correctly parses all the forms in (31), the OT account proposed so far fails in two cases, namely (31a) and (31e).

(32) =(31b)

	/sorwlz/ 'root'	SON-SEQ	DEP-IO	NOCODA
a.	.sorwlz.	*!		*
b.	.sorw.lEz.	*!	*	**
c. Λ	.sor.wElz.		*	**
d.	.so.rEwlz.	*!	*	*

(33) =(31c)

	/xuEnlde/ 'doll'	SON-SEQ	DEP-IO	NOCODA
a.	.xuExl.de.	*!		*
b. Λ	.xuE.xEl.de		*	*
c.	.xuE.xElE.de		**!	

(34) =(31d)

	/b0lzmr/ 'lark'	SON-SEQ	DEP-IO	NOCODA
a. Λ	.b0l**z.m**Er.		*	**
b.	.b0l.zE.mEr.		**!	**
c.	.b0l.zEmr.	*!	*	**

(35) =(31f)

	/GorGldai/ 'nightingale'	SON-SEQ	DEP-IO	NOCODA
a.	.GorGl.dai.	*!		*
b.	.GorG.lE.dai.	*!	*	*
c. Λ	.Gor.GEl.dai.		*	**
d.	.Go.rEGl.dai.	*!	*	*
e.	.Go.rE.GEl.dai.		**!	*

(36) =(31a)

	/j¹rtnc/ 'world'	SON-SEQ	DEP-IO	NOCODA
a.	.j¹rtnc.	*!		*
b. K	.j¹rt.nEc.		*	**
c. ;	.j¹r.tEnc.		*	**
d.	.j¹.rEtnc.	*!	*	*

(37) =(31e)

	/naimIzrGn/ 'louse'	SON-SEQ	DEP-IO	NOCODA
a. ;	.nai.mEI.zEr.GEn.		***	***
b. K	.naim.IEz.rE.GEn.		***	***
c. K	.nai.mEIz.rE.GEn.		***	**
d.	.nai.mEIz.rEGn	*!		
e.	.naim.IEzr.GEn.	*!		
f.	.naim.IEz.rEGn.	*!		

Focusing our attention on candidates (b) and (c) in Tableau (36), we will notice that the sonority grade of the medial syllable boundaries are different between *t.n* and *r.t*. In the former, the sonority rises, but in the latter, the sonority falls. It is widely observed that boundaries of rising sonority are dispreferred, and they are often those cites where metatheses are expected (Murray 1988) such as *katra* |*karta*, but not vice versa.

Following the spirit of the Syllable Contact Law (Murray 1988:116), I propose a constraint which militates against coda-onset boundaries of rising sonority. [5]

(38) C.O-SEQ Coda-Onset sequence does not rise in sonority.

Other than the purpose of Khalkha Mongolian syllabification, this constraint has an effect of dispensing with the directionality of syllabification proposed in the derivational framework. For example the Core Syllabification Principle[6] (Clements 1990:299) adjoins segments to a syllable structure maximally from right to left as far as a segment to be adjoined has a lower sonority. Only after this is done, left-to-right adjunction may proceed.

When there is a sequence of segments with relative sonorities indicated by inequality signs such as ...V>C>C<C<V..., unmarked and universally preferred syllabification is ...VC.CCV... with syllable boundary placed between the first and the second C's from the left. The Core Syllabification Principle captures this generalization by postulating the precedence of the right-to-left direction over the left-to-right direction. With C.O-SEQ constraint, we are able to despense with the directionality proviso. Under C.O-SEQ, VC.>CCV is better than VCC.<CV, because the sonority rise across the syllable boundary in the latter induces C.O-SEQ violation.

Likewise, in Khalkha Mongolian syllabification, C.O-SEQ plays a role of recapitulating a characteristic which has been captured by directionality. The following

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[5] The Syllable Contact Law calculate the evaluation integer according to the sonority values of the segments. Less sonorous segments, e.g. stops, are priorly given greater numbers than more sonorous ones are, and the numbers are subtracted between the segments across the syllable boundary. Rising sonority gives a minus value, which reduced the value of the entire evaluation integer.

[6] The Core Syllabification Principle (CSP) (Clements 1990)

a. Associate each [+syllabic] segment to a syllable node.
b. Given P (an unsyllabified segment) preceding Q (a syllabified segment), adjoin P to the syllable Containing Q iff P has a lower sonority rank than Q (iterative).
c. Given Q (a syllabified segment) followed by R (an unsyllabified segment), adjoin R to the syllable containing Q iff R has a lower sonority rank than Q (iterative).

tableaux illustrate how C.O-SEQ penalizes the offending candidates. The boldfaced types indicate the boundaries with rising sonority.

(39)

/j¹rtnc/ 'world'	SON-SEQ	DEP-IO	C.O-SEQ	NOCODA
a. .j¹**rt.n**Ec.		*	*!	**
b. Λ .j¹r.tEnc.		*		**

(40)

/naimlzrGn/ 'louse'	SON-SEQ	DEP-IO	C.O-SEQ	NOCODA
a. Λ .nai.mEl.zEr.GEn.		***		***
b. .nai**m.lEz.r**E.GEn.		***	**!	***
c. .nai.mEl**z.r**E.GEn.		***	*!	**

Comparison of (a) and (c) in tableau (40) establishes the ranking C.O-SEQ >> NOCODA. The relative ranking of DEP-IO and C.O-SEQ is yet to be clear.

3 Morphologically complex words

The following series of derivation shows that syllabification proceeds as if it neglects the morphological structure of the words. Especially, comparison of (b) and (c), and (e) and (f) reveals that the schwas (realized as [I] in both (b) and (e)) inserted in the previous stages of affixation (shown by boldface) are deleted in the next stages.

(41)	a. Root:	/uil/	[uil]	'action'
	b. VERB:	/uil-Cl/	[uil.C**I**l]	'to serve'
	c. CAUS:	/uil-Cl-ul/	[uilC.lul]	'to cause to serve'
	d. AGENT:	/uil-Cl-ul-gC/	[uilC.lu.lEgC]	'customer'
	e. PL:	/uil-Cl-ul-gC-d/	[uilC.lu.lEg.C**I**d]	'customers'
	f. GEN:	/uil-Cl-ul-gC-d-iN/	[uilC.lu.lEgC.diN]	'of the customers'
	g. NOUN:	/uil-Cl-ul-gC-d-iN-x/	[uilC.lu.lEgC.diNx]	'belongings of the customers'

However, it is not always the case. The following pairs of words show that different morphological structures yield different syllable parses. (Svantesson 1995:(11))

(42)	a.	/xoc-t-la/	[xo.cEt.la]	'mounted (like a ram)'('ram-VERB-PAST')
		/xoc-tl-a/	[xoc.tE.la]	'until its barking'('bark-TERM-REFL')
	b.	/alt-d-ml/	[al.tEd.mEl]	'gilded' ('gold-VERB-ADJ')
		/ard-Cl-l/	[ard.Cl.lEl]	'democratization' ('people-VERB-NOUN')
	c.	/z¹wl-l¹/	[z¹.wEl.l¹]	'advised' ('advise-PAST)
		/z¹wl-l-¹/	[z¹w.lE.l¹]	'his advice' ('advise-NOUN-REFL')

The derivational processes proposed by Svantesson proceed as in (43).

(43)	a.0 Root	/z¹wl/	[z¹.wEl]	'to advise'
	1 PAST	-l¹	[z¹.wEl.l¹]	'advised'
	b.0 Root	/z¹wl/	[z¹.w**E**l]	'to advise'
	1 NOUN	-l	[z¹w.lEl]	'advice'
	2 REFLEXIVE	-¹	[z¹w.lE.l¹]	'his advice'
	3		*[z¹.w**E**l.l¹]	

The (a) example is streightforward; it is optimally syllabified in one step. In the (b) example, the first derivation (b1) is optimally syllabified, but the next step (b2) observes the syllabification of the previous step rather than follow the process of optimal syllabification. If it were syllabified optimally, from right to left, maximally scanning the segments, the output would be (b3), which is the same form as (a1). In order to derive (b3), syllabification would reinsert a schwa into the position where there was a schwa in early stage of derivation (b0), but it has been deleted in the later stage (b1).

The above characteristic of syllabificaiton of morphologically complex words led Svantesson to conclude that syllabification may insert no new schwa into an input string from the previous cycle, although it may delete one.

In the optimalty theory, there is no mechanism of referring to derivational cycles in generation of candidate sets. However, in the output-output correspondence approach (Benua 1995), condidates may be evaluated with respect to a particular string which exists in a morphological paradigm of a language. In our example above, the candidate for (43b2) is evaluated against the other forms in the paradigm, which is (43b1) epicifically. In this respect, the virture of (43b2) over (43b3) resides in its resemblence to (43b1). The constraint at effect is stated in (44) as one type of output-output constraints, namely, a Base-Affixed form correspondence constraint.

(44) MAX-BA Every element of the Base has a correspondent in the Affixed form.

The following tableaux show the analysis with MAX-BA constraint. The precise ranking of the constraints is yet to be argued for, but at this moment it suffices to show that it plays a determining role in choosing the right winning candidate.

(45)

/z^{1}wl-l^1/ Base[z^1.w**El**]	SON-SEQ	DEP-IO	MAX-BA	C.O-SEQ	NOCODA
a. Λ . z^1.w**El**.l^1.		*			*
b. . z^{1}w.lE.l^1.		*	*!		*

(46)

/z^{1}wl-l-^{1}/ Base[z^{1}w.l**E**l]	SON-SEQ	DEP-IO	MAX-BA	C.O-SEQ	NOCODA
a. . z^1.wEl.l^1.		*	*!		*
b. Λ . z^{1}w.l**E**.l^1.		*			*

In both cases, the losing condidates are penalized by MAX-BA, because the boldfaced vowel in each base lacks its correspondent in them. The winning candidates retain the correspondents, as indicated by the boldfaced letters in each candidate.

We must then try out if the MAX-BA analysis works well with the previous examples in (41), where syllabification proceeds as if it does not observe morphological structure. (41c) and (41f) are reanalyzed in the following tableaux.

(47) =(41c)

/uil-Cl-ul/ Base[uil.C**l**l]	SON-SEQ	DEP-IO	MAX-BA	C.O-SEQ	NOCODA
a. .uil.Cl.lul.		*!			**
b. Λ .uilC.lul.			*	*	**

(48) =(41f)

/uil-Cl-ul-gC-d-iN/ Base[uilC.lu.lEg.C**l**d]	SON-SEQ	DEP-IO	MAX-BA	C.O-SEQ	NOCODA
a. .uilC.lu.lEg.Cl.diN.		**!		*	***
b. Λ .uilC.lu.lEgC.diN.		*	*	*	**

In both cases, the boldfaced vowels in the base are lost in the winning candidates, which incurs MAX-IO violations, but the loss of the vowels eventually have an effect of reducing the number of vowels to be epenthesized in the entire forms. Given the ranking DEP-IO >> MAX-BA, we are able to select the right candidates.

Finally tableau (49) argues for the ranking MAX-BA >> C.O-SEQ.[7]

(49)

/xoc-t-la/ Base[xo.cEt]	SON-SEQ	DEP-IO	MAX-BA	C.O-SEQ	NOCODA
a. Λ .xo.cEt.la.		*		*	*
b. .xoc.tE.la.		*	*!		*

(50)

/xoc-tl-a/ Base[xoc.tEl]	SON-SEQ	DEP-IO	MAX-BA	C.O-SEQ	NOCODA
a. .xo.cEt.la.		*	*!	*	*
b. Λ .xoc.tE.la.		*			*

4 Conclusion

The following is the constraint ranking established in this article for Khalkha Mongolian.

(51) SON-SEQ, MAX-IO, ANCHOR-R, *COMPLEX^{ONS}, ANCHOR-L >> ONS, DEP-IO >> MAX-BA >> C.O-SEQ >> NOCODA

I have shown that the characteristics of syllabification and schwa epenthesis result from the constrain interactions, and that the procedural postulation on directionality and maximality in derivational analysis can be dispensed with. I have also shown that an interaction of MAX-BA constraint and other constrains accounts for the ambivalent sensitivity to the morphological structures in syllabification.

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[7] If the form /xoctla/ were a morphologically simplex word, my OT analysis with the constraint C.O-SEQ makes a different prediction from Svantesson's derivational analysis. The derivational analysis predicts [xo.cEt.la] is a correct syllabification, but the OT analysis predicts [xoc.tE.la] is a correct one.