A Preliminary Analysis of the Interaction of Stress Shift and Stem Adjustment in English Derivational Morphology: *-ify* verbs

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1. Introduction

In English we find the following contrast in derivational morphology:

(1) a. líquid+ify→líquify, *liquídify, *líquidify
    b. húmid+ify→*húmify, humídify, *húmidify

Liquid undergoes truncation of the coda of its stem final syllable; on the contrary, *humid* accepts no such process, with its main stress on the initial syllable having shifted to the next one. This is in sharp contrast to the behavior of *liquid*, which retains its main stress in the same position even after the attachment of *-ify*. Among the *liquid* type bases are *dulcet*, *lignin*, *petrol*, *stratum*, etc., and the *humid* type includes *acid*, *object*, *person*, *rigid*, *solid*, etc.

The purpose of this paper is to analyze the above-mentioned contrast and similar alternations that emerge in connection to suffixation, within the framework of Correspondence Theory in Optimality Theory (OT). This study will bring the verb-forming suffix *-ify* into focus, as it addresses some interesting mutation patterns of accentuation in the bases of affixation.

2. Disyllabic bases in *-ify* suffixation

It is widely acknowledged that English presents two types of suffixes in terms of prosodic effects: "stress-shifting/stress-determining" and "stress-neutral" (Siegel 1974: 111f, Giegerich 1992: 191). The verb-forming suffix *-ify* belongs to the former class: its intrinsically stressed final syllable, as illustrated in (2), often gives rise to prosodic structures that need to be fixed somehow. In other words, when such a disfavored structure is anticipated for a given input, we expect certain prosodic and/or segmental mutation processes to take place.

(2) *-ify*[σ̆σ̀][1]

In (3) are given some examples of monosyllabic as well as iambic disyllabic bases.

(3) a. símple+ifỳ → símplifỳ [σ́]+[σ̆σ̀] → [σ́σ̆σ̀]
b. núll+ifỳ → núllifỳ [σ]+[σ̆σ̀]→ [σ́σ̆σ̀]
c. Japán+ifỳ → Japánifỳ [σ̆σ́σ̆σ̀] + [σ̆σ́] → [σ̆σ̀]
d. adúlt+ifỳ → adúltifỳ [σ̆σ́]+[σ̆σσ̀]→ [σ̆σ́σ̆σ̀]

The rhythmic structures of the output forms remain the same as those of the input forms. In this sense, they are completely faithful to their inputs prosodically as well as segmentally. This fact can be captured by the constraints in (4).

(4) MAX-IO: "Every input segment has a correspondent segment in the output." (="no deletion") (McCarthy and Prince, 1995)
IDENT-STRESS: "If α is stressed, then *f*(α) must be stressed." (Pater, 2000: 16)

Let us also assume the constraints Pater (1995, 2000) proposes on foot structure:

(5) English Stress (Pater, 1995)
FOOT BINARITY (FT-BIN): "Feet are binary at some level of analysis (mora, syllable)."
TROCHEE (TROCH): "Feet are trocaic."
NONFINALITY (NONFIN): "The head foot of the prosodic word must not be final."
ALIGN(PRWD, R, HEAD(PRWD), R) (R-ALIGN-HEAD): "Align the right edge of the prosodic word with the right edge of the head of the prosodic word."

He proposes that the constraints in (5) are ranked in such a way that R-ALIGN-HEAD is placed below the other three constraints, which are unranked one another. This means that the following hierarchy holds:

(6) FT-BIN, TROCH, NONFIN >> R-ALIGN-HEAD

With the ranking of MAX-IO and IDENT-STRESS being set aside, Tableau (7) indicates how the proposed constraint set evaluates the output candidates for the input /adúlt+ifỳ/ and selects the desired output (7a):

(7) FT-BIN, TROCH, NONFIN >> R-ALIGN-HEAD, MAX-IO, IDENT-STRESS (to be revised)

/adúlt+ifỳ/	FTBIN	TROCH	NONFIN	R-ALIGN-HEAD	MAX-IO	IDENT-STRESS
⇒a. a(dúlti)(fỳ)				**		
b. (ádul)ti(fỳ)				***		*
c. (ádul)(tìfy)				***		**

2.1 Trochaic bases

On the contrary to iambic disyllabic bases, suffixation of *-ify* to trochaic bases is not that straightforward. Suppose we have an input structure of this type. Then, simply combining the base and the suffix, as is expected from the set of constraints above, would yield the following result:

(8) Input: /σ́σ̆+σ̆σ́/
Unconstrained output: [σ́σ̆σ̆σ́]

Notice that there are two unstressed syllables intervening between the first and final syllables. It is the constraint *LAPSE that checks for this type of structure in a given representation. Reffelsiefen (1996) defines this constraint as follows:

(9) *LAPSE: "Two adjacent stressless syllables are prohibited."

Steriade (1997: 41) points out that "[i]n the formation of *-ify* verbs, the potential strings violating *LAPSE are medial, flanked on one side by the secondary stress on *-ify* and on the other by the rightmost stem stress. It appears that these medial lapses are strongly avoided." Also, Pater (2000: 18) remarks that "[i]n the vast majority of situations in which IDENT-STRESS conflicts with FTBIN, FTBIN triumphs. This can be seen both in the complete absence of lexical stress, and in the consistent failure of stem stress to be preserved, in certain environments." Thus, to secure the effect of truncation, we need to rank *LAPSE higher than IDENTSTRESS. This results in the following hierarchy:

(10) FTBIN, TROCH, NON-FIN, *LAPSE >> IDENTSTRESS, R-ALIGN-HEAD, MAX-IO

Now, let us consider three possibilities of raking IDENT-STRESS and MAX-IO, as the relative ranking between them has not been clear yet and it seems to be crucial for the subsequent analysis. The first possibility, as is illustrated in Tableau (11), holds IDENT-STRESS and MAX-IO to be in a free ranking relation. In this case, candidates (11a) and (11b) are both evaluated as equal.

(11) Free ranking between IDENTSTRESS and MAX-IO

Input: /όσ+σὸ/	FTBIN	TROCH	NON-FIN	*LAPSE	IDENT STRESS	MAX-IO	R-ALIGN-HEAD
a. ⇒[(όσ)(ὸ)]						*	**
b. ⇒[σ(όσ)(ὸ)]					*		**

Tableau (12) shows that IDENT-STRESS is ranked higher than MAX-IO. This ranking favors (12a) over (12b).

(12) IDENTSTRESS >> MAX-IO

Input: /όσ+σὸ/	FTBIN	TROCH	NON-FIN	*LAPSE	IDENT STRESS	MAX-IO	R-ALIGN-HEAD
a. ⇨[(όσ)(ὸ)]						*	**
b. [σ(όσ)(ὸ)]					*!		**

The third possibility suggests that the constraints in question are reversely ordered, resulting in the following tableau, with candidate (13b) selected as the output.

(13) MAX-IO >> IDENTSTRESS

Input: /όσ+σὸ/	FTBIN	TROCH	NON-FIN	*LAPSE	MAX-IO	IDENT STRESS	R-ALIGN-HEAD
a. [(όσ)(ὸ)]					*!		**
b. ⇨[σ(όσ)(ὸ)]						*	**

However, we see that none of the above methods accounts for the data in (1); *liquid* type adjectives and *humid* type adjectives seem to be in complementary distribution. In fact, we find additional data supporting this conjecture.

(14) Type One: [σ́σσ̀]------Truncation of the base-final syllable with no stress shift

Input: /σ́σ+σσ̀/ | Violation of *LAPSE

Type Two: [σσ́σσ̀]-----No Truncation of the base-final syllable with stress shift

Type One includes items which undergo truncation of their base-final material while keeping their main stress on the initial syllable intact.

(15) Type One *-ify* verbs ([σ́σ+σσ̀] →[σ́σσ̀])

Input	Faithful to input	Stem truncation	Stress shift
chróndrin+ifỳ	*chróndrinifỳ	chróndrifỳ	*chrondrínifỳ
chýlous+ifỳ	*chýlousifỳ	chýlifỳ	*chylóusifỳ
dúlcet+ifỳ	*dúlcetifỳ	dúlcifỳ	*dulcétifỳ
lígnin+ifỳ	*lígninifỳ	lígnifỳ	*lignínifỳ
líquid+ifỳ	*líquidifỳ	líquifỳ	*liqúidifỳ
pétrol+ifỳ	*pétrolifỳ	pétrifỳ	*petrórifỳ
strátum+ifỳ	*strátumifỳ	strátifỳ	*stratúmifỳ
téchnic+ifỳ	*téchnicifỳ	téchnifỳ	*technícifỳ
térror+ifỳ	*térrorifỳ	térrifỳ	*terrórifỳ
tórpor+ifỳ	*tórporifỳ	tórpifỳ	*torpórifỳ
tórrid+ifỳ	*tórridifỳ	tórrefỳ	*torrídifỳ
vívid+ifỳ	*vívidifỳ	vívifỳ	*vivídifỳ

Type Two, on the other hand, includes items that keep their segmental material intact but allow their main stress to shift from the initial syllable to the second syllable.

(16) Type Two *-ify* words ([σ́σ+σσ̀]→[σσ́σσ̀])

Input	Faithful to input	Stem truncation	Stress shift
ácid+ifỳ	*ácidifỳ	*ácifỳ	acídifỳ
húmid+ifỳ	*húmidifỳ	*húmifỳ	humídifỳ
óbject+ifỳ	*óbjectifỳ	*óbjifỳ	objéctifỳ
pérson+ifỳ	*pérsonifỳ	*pérsifỳ	persónifỳ
rígid+ifỳ	*rígidifỳ	*rígifỳ	rigídifỳ
sólid+ifỳ	*sólidifỳ	*sólifỳ	solídifỳ
súbject+ifỳ	*súbjectifỳ	*súbjifỳ	subjéctifỳ
tórpid+ifỳ	*tórpidifỳ	*tórpifỳ	torpídifỳ

As was suggested above, the prosodic structures of the items in each of these two types never mix up and stand in complementary distribution, thereby rejecting possibility (11).

Next, let us consider the other two possibilities:

(17) a. FTBIN, TROCH, NON-FIN, *LAPSE >> <u>IDENTSTRESS >>MAX-IO</u>, R-ALIGN-HEAD

b. FTBIN, TROCH, NON-FIN, *LAPSE >> <u>MAX-IO >> IDENTSTRESS</u>, R-ALIGN-HEAD

Neither of these seems decisive, as they will inevitably select a wrong candidate as optimal. Tableaux (18)-(21) show how the output candidates for the inputs /líquid+ifỳ/ and /húmid+ifỳ/ are evaluated on each hierarchy.

(18) FTBIN, TROCH, NON-FIN, *LAPSE >> IDENTSTRESS >>MAX-IO, R-ALIGN-HEAD

/líquid+ifỳ/	FTBIN	TROCH	NON-FIN	*LAPSE	IDENT STRESS	MAX-IO	R-ALIGN-HEAD
a. (líqui)di(fỳ)				*!			***
b. li(quídi)(fỳ)					*!		**
⇒c. (líqui)(fỳ)						*	**

(19) FTBIN, TROCH, NON-FIN, *LAPSE >> IDENTSTRESS >>MAX-IO, R-ALIGN-HEAD

/húmid+ifỳ/	FTBIN	TROCH	NON-FIN	*LAPSE	IDENT STRESS	MAX-IO	R-ALIGN-HEAD
a. (húmi)di(fỳ)				*!			***
b. hu(mídi)(fỳ)					*!		**
⇒c. (húmi)(fỳ)						*	**

(20) FTBIN, TROCH, NON-FIN, *LAPSE >> MAX-IO >> IDENTSTRESS, R-ALIGN-HEAD

/húmid+ifỳ/	FTBIN	TROCH	NON-FIN	*LAPSE	MAX-IO	IDENT STRESS	R-ALIGN-HEAD
a. (húmi)di(fỳ)				*!			***
⇒b. hu(mídi)(fỳ)						*	**
c. (húmi)(fỳ)					*!		**

(21) FtBin, Troch, Non-Fin, *Lapse >> Max-IO >> IdentStress, R-Align-Head

/líquid+ifỳ/	FtBin	Troch	Non-Fin	*Lapse	Max-IO	Ident Stress	R-Align-Head
a. (líqui)di(fỳ)				*!			***
⇒b. li(quídi)(fỳ)						*	**
c. (líqui)(fỳ)					*!		**

The following observation made by Plag (1999: 162f) is worth reviewing, as it provides important clues to the issue at stake. He states:

> ... the truncation of the base in some derivatives would lead to a derived form whose base is no longer recognizable, which may be an important general factor constraining the deletion of base-final segments in complex words.

Notice that the forms in (22), each of which shows the string which subtraction of *-ify* has created for a given input, are in sharp contrast to those in (23), as the former group holds only one member of (22a-j), whereas the latter group shows multiple candidates for each of (23a-g). In (22), each set is made up of a single member, whereas each of the sets in (23) may accept strings that are phonologically identical but morphologically distinct. In other words, the morphemes in (22) neatly show one-to-one correspondence, but those in (23) look totally chaotic despite that fact that the size of each morpheme is more or less the same.[2]

(22) Attested forms

a. *chondr-*∈ {*chondr* 'cartilage'}
b. *chyl-* ∈ {*chyl* 'juice' }
c. *dulc-* ∈ {*dulc* 'sweet'}
d. *lign-* ∈ {*lign* 'wood' }
e. *petr-* ∈ {*peter* 'stone/rock'}
f. *strat-* ∈ {*strat* 'layer' }
g. *techn-* ∈ {*techn* 'art/craft'}
h. *torp-* ∈ {*torp* 'numb'}
i. *torr-* ∈ {*torr* 'scorch'}
j. *viv-* ∈ {*viv* 'live'}

(23) Unattested forms

a. *hum-* ∈ {*human*, *humate* 'a kind of ester', *humid* 'moist', *humil* ' lowly', etc.}

b. *pers-* ∈ {*perse*, *purse*, etc.}

c. *rig-* ∈ {*ridge*, *rigid*, etc}

d. *sol-* ∈ {*salt*, *sol* 'one', etc.}

e. *obj-* ∈ {*ob+ject* [*ject* 'throw'], *ob+jur+gate* [*jurg* 'quarrel']}

f. *ac-* ∈ {*ace* 'sour', *ass*, *astro* 'star'}

g. *subj-* ∈ {*sub+jacent* [*jacent* 'to lie'], *sub+ject*, *sub+jug+ate* [*jug* 'yoke']}

The contrast in membership between the attested and unattested forms above reminds us of Siegel's (1974) discussion of stem morphemes in her morphological theory, which provided the foundation of the theory of Lexical Morphology and Phonology. She proposed that "stems be represented in the lexicon surrounded by brackets labeled S" (p. 105). The sampling of English stems that she presented in her study is as follows:[3]

(24) $[\text{graph}]_S$, $[\text{dur}]_S$, $[\text{quire}]_S$, $[\text{cite}]_S$, $[\text{cede}]_S$, $[\text{mit}]_S$, $[\text{ject}]_S$, $[\text{tend}]_S$, $[\text{clude}]_S$, $[\text{leg}]_S$, $[\text{lit}]_S$, $[\text{loo}]_S$, $[\text{nume}]_S$, $[\text{test}]_S$, $[\text{tract}]_S$, $[\text{duce}]_S$, $[\text{sorb}]_S$ (Siegel, 1974: 105)

In what follows, we demonstrate that Siegel's treatment of stem morphemes proves to be of great help in capturing mapping relations between a set of certain morphemes and output candidates from GEN for a given morphological input. Let us suppose that the lexicon contains some lists of morphemes, with an eye on the list of stem morphemes (25) in particular.

(25) The list of stem morphemes

{*cede, cite, chondr, chyl, clude, duce, dulc, dur, graph, humid, humili, ject, lign, loo, mit, tend, leg, lit, nume, test, tract, peter, quire,* sol_1 *'one',* sol_2 *'sun', sorb, strat, techn, torp, torr, viv,* etc.}

It should be kept in mind that the members of the list form a closed set and therefore are numerically finite. This is a crucial point for the present investigation and allows us to propose the following constraint *DOUBLEEXPOSURE, which forbids a given input to undertake an excessive truncation process to the extent that there arise multiple correspondences.[4]

(26) *DOUBLEEXPOSURE (*DE): "The base of the output candidate must not have more than one corresponding member of the pertinent morpheme list."

Not that this constraint is distinct from other familiar faithfulness constraints like MAX-IO or DEP-IO in that it evaluates a substring of the base form by scanning the list of morphemes in the lexicon. Then, *DE is assumed to lie between *LAPSE and IDENTSTRESS.

(27) FTBIN, TROCH, NON-FIN, *LAPSE >> *DE >> IDENTSTRESS >>MAX-IO, R-ALIGN-HEAD

Let us consider /liquid+ify/ and /humid+ify/, for example. The desired results can be correctly obtained, as Tableaux (29) and (30) below illustrate:

(28)

/liquid+ify/	FTBIN	TROCH	NON-FIN	*LAPSE	*DE	IDENT STRESS	MAX-IO	R-ALIGN-HEAD
a. (líqui)di(fý)				*!				
b. li(quídi)(fý)						*!		
⇒c.(líqui)(fý)							*	

The worst output candidate is (28a), as it violates *LAPSE, although it is most faithful to its input. The next constraint *DE does not play any role regarding the competition between (28b) and (28c); it is IDENTSTRESS that determines (28c) to make a better evaluation and be selected as the optimal output. On the contrary, *DE plays a crucial role in penalizing the truncated candidate. Notice that the string /húm/ in (29c) violates *DE because it cannot maintain one-to-one correspondence with an item on the stem morpheme list, as we have seen in (23a).[5]

(29)

/húmid+ifý/	FTBIN	TROCH	NON-FIN	*LAPSE	*DE	IDENT STRESS	MAX-IO	R-ALIGN-HEAD
a. (húmi)di(fý)				*!				
⇒b. hu(mídi)(fý)						*		
c. (húmi)(fý)					*!		*	

3. Concluding Remarks

In this short article we have been concerned with the mapping of morphological inputs to their output candidates, within the framework of Optimality Theory; in particular, we have explored the input representations composed of a disyllabic base followed by the verb-forming suffix *-ify*, focusing on how stress lapse is resolved in terms of the choice between stress shift and truncation of base-end material. In explaining the phonological shapes of the optimal candidates, the present analysis proposed a constraint set that governs prosodic structure and the correspondence between input and output. We have demonstrated that truncation of some segmental material at the end of a given base as a means of resolving stress lapse is applicable as far as the remaining part shows no duplication with more than a single members of the list of stem morphemes; otherwise, a shift in the primary stress takes place as an alternative means. It appears that the former procedure, which guarantees the saving of prosodic information at the cost of segmental information, is employed first, and latter procedure applies only if the former does not work. Crucially, this task is undertaken by the constraint *DOUBLEEXPOSURE, which checks whether or not truncation is applicable. It is necessary, we admit, that the effect of this constraint needs to be further tested against data sets of more complex cases.

Notes

1. Note that $\acute{\sigma}$ stands for a syllable with a primary stress, $\grave{\sigma}$ for a syllable with a secondary stress, and $\breve{\sigma}$ for an unstressed syllable.

2. It must be admitted that *terr-* ∈ {*terrace*, *terror*, *terrain*, etc.}, which belongs to Type One, may need to be treated as an exceptional case to the present analysis, as it fails to show a one-to-one relation.

3. Siegel (1974: 104) says, "The word *formative* refers to the category which includes the minimal word-building elements of English. The formatives of English fall into four principal classes: 1) formatives which happen to be words, 2) stems, 3) suffixes, and 4) prefixes. In the present paper we stick to the use of the term 'morpheme' instead of 'formative'.

4. Issues on avoidance of homonyms can be traced back to Kisseberth and Abasheikh's (1974) work on the phonology of the so-called "applied" stem in Chi-Mwi:ni, a Bantu language spoken in the city of Brava (-Mwi:ni) in Somalia.

5. We might be tempted to assume that there be two types of *-ify*, i.e. *-ify*$_{A}$ and *-ify*$_{B}$ and embark on a framework like that of Benua (1997), which proposes that affixes are subcategorized by one of two OO_1-correspondence or OO_2 correspondence relations and all correlates of affix class membership are obtained from the ranking of the constraints on the two OO-relations. However, such a strategy does not appear to be attractive, as it is equivalent to saying that words that resist truncation are lexically marked. There are cases in which three different types of output realization are available for a single input.

Steriade (1997) propounds an interesting analysis worth exploring in a serious way. She introduces the notions "listed words" and "listed allomorphs". She states:

The notions of listed word and listed allomorph will be essential to the analysis. I borrow these, with some extension, from Halle (1973), who notes that speakers are aware of the difference between potential and actual results of the word formation system of their language. Correspondingly, the term "listed" denotes here a degree of familiarity with a word, sufficient to give a speaker the confidence that the word has been sanctioned by past linguistic usage. A listed word is a non-hapax, a non-nonce form. A listed word, in the sense adopted here, may be a word whose morphological and phonological properties are fully predictable, given knowledge of the grammar and lexicon of the language: thus *happiness, demonstrative, demonstrable, readable* are listed words for most speakers of English. In contrast, I expect that a form like *matchability* is a clear hapax for most speakers. Since listedness is a matter of individual linguistic experience, the listed status of a word may vary from speaker to speaker: thus I expect that words like *nouniness* or *pronounceable* may register as listed with some English speakers but not with others. (p. 1-2)

Steriade (1997) further examines stress shift in *-ify* verbs and argues that the shift of the main stress to the following syllable is predictable by the presence of a listed allomorph with final stress. If such an allomorph exists, stress shift takes place; if not, the stress remains in the same position. Let us consider the examples Steriade presents:

i. a. Bases whose corresponding *-ify* forms differ stress wise:

Base	*-ify* form	Listed allomorphs with final stress
rígid	*rigíd-ify*	*rigíd-ity*
flúid	*fluíd-ify*	*fluíd-ity*
sóllemn	*sllémn-ify*	*sllémn-ity*
cálorie	*calór-ify*	*calór-ic*
hístory	*histór-ify*	*histór-ical*
iamb	*iámb-ify*	*iámb-ic*
vítrol	*vitról-ify*	*vitról-ic*
stáble	*stabíl-ify*	*satabíl-ity*

b. Bases whose corresponding *-ify* forms do not differ stress-wise:

Base	*-ify* form	Listed allomorphs with final stress
résin	*résin-ify*	-----
púmpkin	*púmpkin-ify*	------

The ranking of the constraint she employs is given in (ii), and the results of evaluating output candidates for *-ify* forms with and without a corresponding listed allomorph are cited in (iii) and (iv), respectively.

ii. IDENT STRESS >> *LAPSE >> IDENT(stress, ms) (Sterade 1997: 43)

iii. listed allomorphs: *vítriol, vìtriól-*

vítriol+ifỳ	IDENT STRESS	*LAPSE	IDENT(stress, ms)
vìtriólifỳ			*
⇒vítriolifỳ		*!	

iv. listed allomorphs: résin

résin+ifỳ	IDENT STRESS	*LAPSE	IDENT(stress, ms)
resínifỳ	*!		*
⇒résinifỳ		*	

There are some problems with this analysis, however. First, Steriade does not take into consideration Type One cases, namely, words which allow truncation but keep the main stress intact. As it stands, her theory would force us to choose wrong candidates as to some Type One *-ify* verbs, as the bases given in the column below are likely to have listed words.

v.

Base	*-ify* form	Listed allomorphs with final stress
líquid	**líquid-ify*	*liquídity*
pétrol	**pétrol-ify*	*petrólic*
téchnic	**téchnic-ify*	*techníciann*
tórrid	**tórrid-ify*	*torrídity*

Second, it seems that some of the examples in (v) seem to work against Steriade's theory. Although she states that main stress falls on the first syllable for the *resin-resinify* pair, we actually find two variants for *resinify*'s stress contour, as shown in (vi).

vi. *resin* [réz(ə)n; rézɪn]
resinify [rezínəfàɪ; rézɪn-]

As these cases do accept stress shift independently of any listed allomorph, we see that Steriade's account does not work.

Also, with respect to *pumpkinify*, it should be pointed out that the failure of stress shift seems explainable by a constraint on syllable weight. As the first syllable of this word is made up of CVCC, that is, a superheavey syllable, the set of constraints in (vii) would suffice as a tool for excluding ill-formed **pumpkínifỳ*.

(vii) WEIGHT-TO-STRESS >> *LAPSE >> IDENTSTRESS

(viii)

/púmpkin+ifỳ/	WEIGHT-TO-STRESS	*LAPSE	IDENTSTRESS
(púmpki)ni(fỳ)		*	
pump(kíni)(fỳ)	*!		*

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