Three Classes of ‘‘+’’ Boundaries

It is well-known that English morphology has two classes of affixes: ‘‘+’’ morphemes such as *in+, ad+, ab+, +al, +ity* and ‘‘#’’ morphemes such as *un#, #ness, #ly*. The two classes differ in a number of respects, including: (1) Etymology: + morphemes are (often) historically correlated with Latin; # with German and Greek, (2) Stress Assignment (e.g., *parént+al* vs. *párent#hood*), and (3) Word Formation: + morphemes can attach to bound morphemes (e.g., *crimin-* as in *criminal*); # cannot (**criminhood*). This paper will extend this reasoning in dividing the first class into three parts, Ia, Ib and Ic, as illustrated in the following table:

	+ Boundary			**# Boundary**
	Class Ia	**Class Ib**	**Class Ic**	**Class II**
Examples	ion, ive, ent, or, ory	ity, ic al, ian	ize, ee, itis,ism, ist istic, ment, mental	ness, wise hood, ship
Etymology	Productive in Latin	Norman French	Scientific Literature and Enlightenment	Anglo-Saxon
Stress Retraction	+	+	–	–
Attaches to	stems	bound/free forms	bound/free	forms

Class Ib contains what we generally think of as ‘‘typical’’ + boundary forms (e.g., *parént+al, divin+ity*), both with respect to stress assignment and word formation. It will be argued here that Class Ia obeys a different set of word formation rules and that Class Ic obeys a different set of stress assignment rules.

1. Word Formation Rules (WFR)

Aronoff proposed two distinct types of word formation rules in his thesis [Aronoff]: stem based wfr and word based wfr.

- Stem Based WFR: *subsume/subsumption, consume/consumption, resume/resumption, expense/expensive, conduce/conductive*
- Word Based WFR: *nominate/nominee, nominate/nominal, feminine/feminism.*

Stem based wfr rules relate pairs of words sharing one of a short (100-1000) list of latinate stems, e.g., *fer, mit, sume, duce, scribe*, whereas word based wfr apply to a large (possibly open) class of forms, often ending with *-ate* or some other archaic affixes such as: *-ine, -uli, -us, -um* that may be stripped off or ‘‘truncated’’ as part of the word formation process. Aronoff distinguished the two types of word formation rules in order to account for the fact that some generalizations, especially productivity and allomorphy, are clearly associated with stems, whereas other generalizations are associated with words.

This paper will use Aronoff’s distinction in order to separate Class Ia from other ‘‘+’’ boundary forms. First, though, it may be worthwhile to review Aronoff’s reasons for hypothesizing two types of word formation rules.

1.1 Productivity

The contrast in productivity between stem based and word based wfr is very striking. Note that there are very few gaps in stem paradigms:

0 **0 (pp)** **-ion** **-ive** **-or** **-ance / -ence**

duce	adduce	adduct	adduction	adductor		
	deduce	deduct	deduction	deductive	deductor	
	conduce	conduct	conduction	conductive	conductor	conductance
	educe	educt	eduction	eductive	eductor	
	induce	induct	induction	inductive	inductor	inductance
	introduce		introduction			
	produce	product	production	productive		
	reduce	reduct	reduction			
	seduce		seduction	seductive		
	transduce		transduction			
scribe		conscript	conscription			
	describe	nondescript	description	descriptive		
	prescribe	prescript	prescription	prescriptive		
	subscribe	subscript	subscription	subscriptive		
ceive		accept				
	conceive	concept	conception	conceptive		
	deceive		deception	deceptive		
	perceive	percept	perception	perceptive		
	receive	recept	reception	receptive	receptor	
sign	assign		assignation		assignor	
	consign		consignation		consignor	
	resign		resignation			
here	adhere		adhesion	adhesive		adherence
	cohere		cohesion	cohesive		coherence
	inhere		inhesion	inhesive		inherence
fer	confer				conference	
	defer				deference	
	differ				difference	
	infer				inference	
	offer					
	prefer				preference	
	refer				reference	
	suffer					
	transfer			transference		

In contrast, word based alternations are full of gaps. For example, the word based *-ate/-ee* alternation (e.g., *nominate/nominee, designate/designee*) is limited to just a few cases; the vast majority of words ending with *-ate* do not have variants ending with *-ee*. Moreover, the exceptionality of *nominee* and *designee* must be marked on the particular words involved and cannot be attributed to stems. Note, for instance, that the stem *duct* can be followed by *-ee* in the word *inductee*, but not in any other words in my dictionary: **deductee, *seductee, *productee*, indicating that the exceptionality is associated with the word *inductee* and not with the stem *duct*.[1]

1. In some rare cases, a stem may happen to be followed by fI–ee in two or more words. For instance, the stem *sign* is followed by *-ee* in both *designee* and *assignee*, but this is a coincidence; the two are formed in very different ways: *designee* is from *designate* whereas *assignee* is from *assign*. The contrast in derivation gives rise to the two distinct stress patterns.

1.2 Allomorphy

Stem based word formation rules attempt to capture both productivity and allomorphy generalizations. Stem based allomorphy (variants of a morpheme, e.g., *scribe* vs. *script*) is purely a function of the stem and the suffix, and is independent of derivational history, prefix, part of speech, semantics, phonology, etymology, dialectical variation, etc. In contrast, word based alternations seem to depend on derivational history. For example, the word *education* is formed from the word *educate* and therefore, does not follow the stem based pattern where *duce* plus *-ion* forms *duction* (not *ducation*): *adduction, deduction, conduction, eduction, induction, introduction, production, reduction, seduction* and *transduction.*

Mark Aronoff noticed the productivity of Class Ia paradigms and attributed this fact to (the mythical) Ben Moshe.

> ‘‘The form of the suffix is never determined by a specific word. It is never the case that one verb in a given root will allow one variant, and other verb in the same root a different variant. The form of the suffix is root governed, that is, morphologically governed. There are no exceptions to this. It is the first law of the root originally discovered by the great Semitic grammarian ben-Moshe (ms) [sic] and called Ben-Moshe’s First Law.
>
> We will illustrate ben-Moshe’s first law in (28) with the root *sume*. The variant of *ion* which appears after *sume* is *+tion*:’’ [Aronoff, p. 102]

(28)

subsume	subsumption	*subsumation
consume	consumption	*consumation [example duplicated in Aronoff]
resume	resumption	*resumation
presume	presumption	*presumation
consume	consumption	*consumation [example duplicated in Aronoff]
assume	assumption	*assumation

In short:

> *Ben Moshe’s Law of the Root*: For each combination of a stem and a Class Ia suffix, there exists (at most) one allomorph of the stem and one variant of the suffix (resulting from stem based wfr).

Aronoff uses the Law to cover cases like *sume/sumption* above where there allomorphy is extremely clear as well as cases like *vert/version* and *sert/sertion* where the allomorphy is somewhat more subtle. Note that the ‘‘t’’ in *vertion* is realized as /zh/ whereas the corresponding ‘‘s’’ in *sertion* is realized as /sh/. Aronoff attributes this distinction to the allophorphy of the stems *-vert* and *-sert*, and then observes that Ben Moshe’s Law correctly predicts that this contrast is maintained in related forms such as *diversion, conversion, perversion* which contain /zh/ as in *inversion*, and *desertion, exsertion, assertion* which contain a /sh/ as in *insertion.*

1.3 The Confidence Puzzle

The Law might also be used to explain the stress alternation in *confide/confidence.* This alternation is problematic because the stem *-fide* seems to be underlying heavy in *confide*, but underlyingly light in *confidence.* Note that certain stems such as *-fer, -cel, -side,* and *-fide* display the confidence alternation, and that others such as *-here, -pel*, and *-pose* do not.

alternation	refer	reference		
	confer	conference		
	infer	inference		
	defer	deference		
	refer	reference		
	excel	excellent	excellence	excellency
	reside	resident	residency	
	preside	president	presidency	
	confide	confident	confidence	confidency
no alternation	adhere	adherent	adherence	adhesive
	cohere	coherent	coherence	cohesive
	inhere	inherent	inherence	inhesion
	expel	expellent	expellant	
	repel	repellent		
	propel	propellent	propellant	
	expose	exposal	exposure	expository
	dispose	disposal	disposure	dispository
	propose	proposal		
	compose		composure	

These paradigms look strikingly similar to those that were used to motivate Ben Moshe's Law. When a stem changes quantity, it seems to do so across the paradigm, in accordance with Ben Moshe's Law. It appears that we are seeing yet another form of allomorphy and that it is governed by the same constraints as all the other forms of allomorphy discussed above.

This form of allomorphy is particularly interesting because it challenges an important assumption in theoretical phonology, that syllable quantity can be determined from vowel length (and the number of consonants) without additional lexical marking. Unfortunately, as the Confidence Puzzle clearly demonstrates, allomorphy provides a mechanism for the lexicon to mark (or override) the underlying quantity. Therefore, it is possible to find stems like *-fide* and *-pel* where vowel length and observable syllable quantity point in opposite directions: *confide* ends with a tense vowel and yet permits stress retraction; *expel* ends with a lax vowel and yet blocks stress retraction.

	Behaves Light	Behaves Heavy
Tense	*-fide, -side, -spire, -tain, -stain, -cide, -pare*	*-hale, -grade, -plain, -flame, -vade, -praise, -rade, -suade, -place, -claim, -rive, -vive, -dign, -mise, -scribe, -quire, -vise, -prise, -fice, -pugn, -clude, -prove, -sume, -lude, -trude, -fuse, -plode, -close, -mote, -pose, -void, -join, -plore*
Lax	*-fer, -cel*	*-pel, -mit (-miss), -gress, -press, -cess, -cuss*

1.4 (Almost) No Exceptions to Ben Moshe's Law

Ben Moshe's Law, according to Aronoff, is exceptionless. After some computer assisted investigation, it appears that the rule is, in fact, nearly exceptionless, if not completely so.[2] Many apparent counter-

2. A dictionary search for orthographic sequences taking both *-ation* and *-ion* produced: *legation (legion), domination (dominion), oration (orion), duration, conversation, cessation, dilatation, natation, labefactation, retractation, affectation, dictation, volitation, indentation, notation,* and *potation.* Of these, *legation, domination, oration, duration, cessation, potation, natation* and *notation* are spurious. *Conversation* is from *converse,* not *convert. Indention* is an archaic form of *indentation. Dictation* is truncated from

examples can be dispensed with by attributing the counter-examples to word based wfr, as opposed to stem based wfr, as we did in order to account for *education* which is problematic since most combinations of *duct* and *-ion* yield *duction*, not *ducation*. Aronoff himself uses the word based escape hatch in order to dispense with *consummatation*, which would ordinarily be a problem for Ben Moshe's Law, since *sume* plus *-ion* normally produces *sumption*, not *summation*.

> ''Note that the form *consummation*, as in Shakespeare, is not an exception. Rather it is derived from the base *consummate*, by truncation.'' [Aronoff, p. 102]

Compensative is very much like *consummation*; *compensative* is formed from *compensate* via truncation, as opposed to *expensive* which is stem based and obeys Ben-Moshe's Law. *Friction/frication* also demonstrates the contrast between stem based and word based wfr. *Preventive/preventative* and *interpretive/interpretative* illustrate another class of (apparent) counter-examples to the law. Again, these apparent counter-examples can be accounted for by showing that one of the forms has an alternative source. In this case, *preventative* is from the latin frequentative; the frequenative *-ative* should not be confused with *-ive*.

In general, forms obeying Ben-Moshe's Law show up with a large number of latinate prefixes, as opposed to form like *compensative*, *expectation*, *education* and *preventative*, which violate the Law. Thus, for example, *conducive*, another exception to Ben-Moshe's Law (cf., *conductive*, *deductive*, *inductive*, *productive*), is not found with very many other prefixes (e.g., **educive*, **deducive*, **producive*). Exceptions are unlikely to show up with very many prefixes because prefixes are only productive on stems and these exceptions are word based.

1.5 Class Ia and Stem Based WFR

This paper will provide additional evidence in favor of Aronoff's two types of word formation rules by proposing that some affixes (namely, Class Ia affixes) are (generally) associated with stem base wfr and that other affixes (namely, Class Ib and Ic) are associated with word based wfr. Note that Class Ia affixes (e.g., *-ion*, *-ive*, *-ent*, *-or*) are often found after latinate stems (e.g., *permission*, *permissive*, *confident*, *conductor*) but not generally after truncated morphemes (e.g., **nominion*, **nominive*, **nominent*, **nominor*). Similarly, Class Ib and Ic affixes (e.g., *-al*, *-ee*) are often found after truncated morphemes (e.g., *nominal*, *nominee*), but not generally after latinate stems **subsumal*, **subsumptal*, **subsumee*, **subsumptee*.

- *The Distributional Claim*: Class Ia affixes (e.g., *-ion*, *-ive*, *-ent*, *-or*) attach to latinate stems (e.g., *fer*, *mit*, *sume*, *duce*, *scribe*) whereas Class Ib and Ic affixes (e.g., *-al*, *-ity*, *-ic*, *-ee*, *-ism*, *-ist*) attach to words (possibly via truncation).

One of the consequences of this claim is that *feral*, *feric*, *ferity*, *ferrous* and *ducal* cannot be related to the latinate stems *fer* and *duce* because Class Ib affixes such as *-al*, *-ic*, *-ity* and *-ous* do not attach to latinate stems. This observation may be important for practical computer applications of morphological analysis to unknown words, especially for speech synthesis.

In addition, this distributional claim forces a form of level ordering [Kiparsky], [Mohanan]. Note that Class Ia affixes affixes can be found inside Class Ib affixes (e.g., *festivity*, *conventional*) but not the other way around (e.g., **fest+ity+ive*, **convent+al+ion*), because Class Ia affixes (e.g., *-ive*, *-ion*) must be attached to latinate stems and therefore, they cannot follow Class Ib affixes.

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dictate. Labefactation, *retractation* and *volitation* are extremely rare forms, whose status is dubious. This leaves only *dilatation* and *affectation* as possible problems for Ben Moshe.[3]

1.5.1 Multiple Class Membership The distributional claim is somewhat weakened, unfortunately, by the fact that some affixes such as *-able* share membership in more than more class. Just as others (e.g., [Aronoff, section 6.2] have assumed that *-able* belongs to both ‘‘+’’ and ‘‘#’’, it will be assumed here that *-able* belongs to all three classes: Ia, Ib and Ic. The difficulty is that *-able* may or may not feed allomorphy, truncation and stress retraction:

- With Allomorphy: *circumscriptible, extensible, defensible, perceptible, divisible, derisible* Without Allomorphy: *circumscribable, extendable, defendable, perceivable, dividable, deridable*
- With Truncation: *educable, irrigable, navigable, regulable, demonstrable, operable, separable* Without Truncation: *educatable, irrigatable, navigatable, regulatable, demonstratable, operatable, separatable*
- With Stress Retraction: *cómparable, réparable, prerable*[4] Without Stress Retraction: *compárable, repárable, preférable*

Aronoff assumed that forms which feed allomorphy, stress retraction and/or truncation contain a ‘‘+’’ boundary and that forms which block these processes contain a ‘‘#’’ boundary. The present proposal assumes that forms which feed allomorphy are in Class Ia, that forms which feed both truncation and stress retraction are in Class Ib, and that the rest are in Class Ic.

1.6 Class Ic

2. Class Ic

Certain affixes such as *-ee* and *-ism* as in *nominee*, *employee*, *assignee*, *designee* and *feminism* have always been a problem for level ordering since they share some Level I properties (e.g., attachable to bound/truncated forms such as *nomin-*) but not others (e.g., stress retraction, vowel shift, laxing, and most other Level I phonological rules). Note, for example, that *nominee* cannot be level II because *nomin* is not a word. But on the other hand, *employee* cannot be Level I because *-ee* does not induce stress retraction (**émployèe*). Since these affixes don’t fit either the Level I pattern or the Level II pattern, it will be assumed that they ought to be treated as a separate case (Class Ic), at least for descriptive purposes.

Class Ic forms will be analyzed as pseudo-compounds. *Assignee*, for example, is formed by combining the two pieces *assign* and *ee* with a right dominant foot [W S] so that the main stress falls on *ee*. Other Class Ic forms such as *cocainism* are combined with a left dominant foot so that the main stress falls on *cocain*.

In both cases, the internal metrical structure of the left piece is kept intact. Note that the stress on *sign* in *assign* is preserved in *assignee* and the stress on *cain* is preseved in *cocainism*; *assignee* does not become **àssignée*,[5] *cocainism* does not become **cócainism*, *employee* does not become **èmployée*, and so on. Similarly, the internal structure of the left piece is kept intact in *generalize, mineralize* and *federalize*, which do not become **genéralize, *minéralize* and **fedéralize*, respectively.

- *The Pseudo-Compound Claim*: Class Ic boundaries do *not* destroy metrical structure.

The following table is presented as further evidence for this claim. The table lists a number of words ending in *-ist*, *-ism* and *-ize*. Notice that the stress pattern of the left piece is fixed across all three forms; for example, *romantic* has 010 stress in *romaticist* (0100), *romaticism* (01020) and *romanticize* (0102).

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4. By reasoning employed above to account for the Confidence Puzzle, *cómparable, réparable, prerable* may be considered examples of allomorphy along side *divisible.*

5. *Designee* might be considered a counter-example to the claim that Class Ic boundaries do not destroy metrical structure. The constrast between *dèsignée* and *assignée* is accounted for by noting that *designee* is truncated from *designate*, which is formed at Level I, where one would expect to find stress retraction, vowel shift, laxing and so on. *Assignee*, on the other hand, does not undergo these Level I processes, because it comes directly from *assign*, and does not pass through Level I.

-ist	-ism	-ize	Stress of Left Piece
romanticist	romanticism	romanticize	010
exorcist	exorcism	exorcize	10
dialogist	dialogism	dialogize	010
psychologist	psychologism	psychologize	010
catechist	catechism	catechize	10
verbalist	verbalism	verbalize	10
vocalist	vocalism	vocalize	10
idealist	idealism	idealize	010
realist	realism	realize	10
specialist	specialism	specialize	10
socialist	socialism	socialize	10
industrialist	industrialism	industrialize	0100
finalist	finalism	finalize	10
internationalist	internationalism	internationalize	20100
emotionalist	emotionalism	emotionalize	0100
journalist	journalism	journalize	10
federalist	federalism	federalize	100
moralist	moralism	moralize	10
naturalist	naturalism	naturalize	100
universalist	universalism	universalize	2010
capitalist	capitalism	capitalize	100
individualist	individualism	individualize	20100
ritualist	ritualism	ritualize	100
evangelist	evangelism	evangelize	010
symbolist	symbolism	symbolize	10
organist	organism	organize	10
mechanist	mechanism	mechanize	10
humanist	humanism	humanize	10
antagonist	antagonism	antagonize	010
unionist	unionism	unionize	10
communist	communism	communize	10
militarist	militarism	militarize	100
terrorist	terrorism	terrorize	10
systematist	systematism	systematize	100
stigmatist	stigmatism	stigmatize	10
dogmatist	dogmatism	dogmatize	10
hypnotist	hypnotism	hypnotize	10

In this respect, Class Ic affixes differ from most other Level I affixes which induce stress retraction. Strong retractors (e.g., *-ate, -ation*) often mung metrical structure: *design* (01) / *designate* (102). Even weak retractors (e.g., *-ent, -ant, -ence, -able, ance, al, ous, ary*) can modify metrical structure: *confide* (01) / *confident* (100). Class Ic affixes are unusual, because they do not induce stress retraction.

Admittedly there are a few forms ending in *-ist, -ism* and *-ize*, where the affix does not appear to be stress neutral (e.g., *immunize, subsidize*). These forms are extremely problematic for our proposal since they appear to display classic level I stress alternations (e.g., *immúne/ímmunize*). Perhaps some of the stress alternations can be accounted for by appealing to an alternative derivations. For example, if *subsidize* came from *subsidy* (instead of *subside*), then there would be no stress shift to be embarrassed about. Of course, there won't always be an alternative derivation in all cases; *immunize*, for example, cannot be explained away in this fashion and must be treated as an exception.

Many so-called cyclicity arguments can be used as further evidence that Class Ic boundaries do not destroy metrical structure. Consider *capitalistic* and *militaristic*, where it has been noted [Withgott] that the *t* can flap in *capitalistic* but not in *militaristic*, presumably because *capitalistic* comes from *capital* where the *t* flaps, whereas *militaristic* comes from *military* where the *t* does not flap. These facts are completely

consistent with the observation that *-istic* is a Class Ic affix and that Class Ic affixes do not destroy metrical structure. The same flapping facts hold across a wide number of Class Ic affixes, as illustrated in the following table.

	+Flap	**–Flap**
-ist	capitalist	militarist
-ism	capitalism	militarism
-istic	capitalistic	militaristic
-ize	capitalize	militarize
-ization	capitalization	militarization
-itis	capitalitis	militaritis
-ite	capitalite	militarite

In conclusion, we have argued that Class Ic affixes do not fall neatly into either Level I or Level II because they share some Level I properties (attachable to bound/truncated forms such as *nomin-*) and some Level II properties (lack of stress retraction). Thus, it will be assumed that Class Ic should be treated as a separate case. In the next section, it will be argued that the residue of Level I must be split into two cases: Class Ia and Class Ib.

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