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Dispersion Theory and Reduplicative Fixed Segmentism *

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Abstract

Dispersion Theory has been used convincingly to provide accounts of phonological inventories. Recent work by Padgett (2003) has shown that it can also be used to explain other effects in phonology as well. Here the system developed by Padgett is applied to a problem from prosodic morphology-fixed segmentism in reduplication. This has previously been analyzed as an Emergence of the Unmarked effect by Alderete et al. (1999). This account still treats fixed segmentism as an Emergence of the Unmarked effect, but explains the vowel quality as the result of the emergence of an unmarked vowel inventory. This has an added advantage in that it also permits an account of systems where the fixed segmentism takes on more than one vowel quality.

0. Introduction

Dispersion Theory is an attempt to give auditory contrast a formal role in phonology. It has been used convincingly to provide accounts of phonological inventories. While it is clearly intended to be more than 'just a theory of phonological inventories', the question of how to apply the theory to get it to work for the more common tasks faced by phonologists has not been entirely clear. An important step in this direction is taken by Padgett (2003) who adapts the theory and shows how it can be used to explain changes in the history of Russian. In this note I will try to apply the system developed by Padgett to a problem from prosodic morphology namely the realization of certain segments—most often vowels—with a fixed quality, in contrast to the base copying quality usually expected in reduplication. This phenomenon known as fixed segmentism has previously been analyzed as an Emergence of the Unmarked effect by Alderete, Beckman, Benua, Gnandesikan, McCarthy, and Urbancyzk (1999). This will also be the approach taken here, but I will argue that the conception of markedness used in Dispersion Theory is more appropriate to the phenomenon than that employed by Alderete et al.

1. Dispersion Theory (Padgett, (2003), cf. Flemming, (1995))

The main idea of Dispersion Theory (henceforth DT), is that markedness is not an an absolute property of individual features, features combinations or segments, but rather a matter of

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contrasts. The relevant contrasts are measured in terms of perceptual distance. Essentially the more contrasts a given perceptual space is asked to support, the more marked will be the resulting configuration.

In order to make the discussion more concrete, I will limit myself for the rest of this paper to one particular dimension of perceptual space; namely vowel height. Of course the system can be, and indeed has been, used for other dimensions as well.

Vowel height is primarily the result of aperture, i.e., the amount of jaw opening combined with the tongue body height, but perceptually it encompasses other articulations as well.

Most languages contrast several degrees of vowel height. For example the classic three vowel system {a, i, u} contrasts two heights, while a five vowel system {a, e, i, o, u} contrasts three, and some vowel systems distinguish four or even five degrees of height. Most vowel systems also contrast along other dimensions, for example the front/back/round dimension which Padgett calls color. I will henceforth ignore this dimension and simply use the front vowel symbols together with [a] to indicate the number and distribution of vowel heights. Thus {a, i} will indicate a two height system—possibly the three vowel system {a, i, u}—, while {a, e, i} would be a three height system, and {ə} might indicate a one height system.

In fact the choice of phonetic symbol reflects an important observation which lies at the heart of DT; namely that it is impossible to say once and for all, which is the least marked vowel. While one height systems most frequently employ the vowel [ə], two and three vowel height systems typically avoid the central vowel, preferring vowels such as [a] and [i] instead. This means for markedness that it is impossible to decide which of the two rankings in (1), (a) or (b), should universally be preferred.

(1) a. i,a ≫ ə

b. ə≫ i,a

On the other hand, since DT is based on contrast, there is no contradiction. Both of the two markedness rankings in (2) can be true simultaneously.

(2) a. {ə} ≫ {i}, {a}, ...

b. {i,a} ≫ {i,ə}, {ə,a}, ...

And in fact the list in (2) could be continued for ever larger inventories.

The system Padgett uses to implement this is laid out in (3). Given a fixed perceptual space, and all else being equal, we expect the vowels in any given system to distribute themselves more or less evenly, with each vowel occupying a point more or less at the center of its share of the perceptual space. Example (3a) shows how this works for a number of candidate inventories. In (3b) we have a constraint schema which will evaluate such candidate inventories. Supplying a range of different values for *n*, from 1 to some number appropriate for the relevant dimension, this will result in a series of constraints, which are arranged in a universal fixed ranking as shown in (3c).

(3) a. Spacing:

|...a...|...ɛ...|...e...|...i...|	Each segment gets $\frac{1}{4}$ of the perceptual space
|.....a.....|.....e.....|.....i.....|	Each segment gets $\frac{1}{3}$ of the perceptual space
|........a........|........i........|	Each segment gets $\frac{1}{2}$ of the perceptual space
|................ə................|	Each segment gets $\frac{1}{1}$ of the perceptual space

b. $\text{Space}_{\text{HEIGHT}} \geq \frac{1}{n}$: Potential minimal pairs differing in vowel height differ by at least $\frac{1}{n}$th of the full vowel height range

c. $\text{Space}_{\text{HEIGHT}} \geq \frac{1}{3} \gg \text{Space}_{\text{HEIGHT}} \geq \frac{1}{2} \gg \text{Space}_{\text{HEIGHT}} \geq 1$

The tableau in (4) shows how the candidate inventories will be evaluated by the constraint hierarchy (3c). As intended the constraint hierarchy favors inventories with maximum dispersion. Only inventories with a single vowel height are perfect with respect to the entire hierarchy. This is as it should be, since the hierarchy favors dispersion, and a system with a single element along the dimension is maximally dispersed. The remaining candidates are evaluated as follows: for each vowel pair in the inventory whose perceptual distance is below the threshold of a given constraint, the constraint assigns one mark. Thus for example the three height inventory, candidate b, receives two marks from constraint $\text{Space}_{\text{HEIGHT}} \geq \frac{1}{2}$ because there are two vowels pairs in the inventory <a,e> and <e,i> with a perceptual distance below the threshold of half the perceptual space, while a third vowel pair <a,i> has sufficient perceptual distance.

(4)

		$\text{Space}_{\text{HIGH}} \geq \frac{1}{3}$	$\text{Space}_{\text{HIGH}} \geq \frac{1}{2}$	$\text{Space}_{\text{HIGH}} \geq 1$
a.	a e ɛ i	***	***	******
b.	a e i		**	***
c.	a i			*
d.	ə			

So far the approach of Padgett (2003) is largely comparable to that of Flemming (1995). However at this point Padgett takes a rather different tack. Since the goal is to have this constraint hierarchy evaluate actual linguistic forms, and since these constraints are markedness constraints, he proposes that they stand in conflict with a faithfulness constraint. His proposal for the relevant faithfulness constraint is given in (5).

(5) *Merge (Padgett, 2003)

No word of the output has multiple correspondents in the input

This constraint is formulated in terms of correspondence theory, but an important point to note is that it refers to correspondence of *words/forms.* A further point is that it refers to merger of forms, not deletion. In other words the constraint says that if two forms are specified as underlyingly distinct, they should surface distinct. So this is a constraint that militates against loss of contrast. An example of how this works is shown in (6).

(6) UR inventory: tip_1 tep_2 tap_3 → SR inventory: $\text{tip}_{1,2}$ tap_3

Here we see an idealized mini-language inventory consisting of three words. The subscripts in (6) are always meant to refer to the entire form, while the usual segmental subscripts have been omitted for perspicuity. In the output these words are realized as only two contrasting forms, with the two underlying forms /tip/ and /tep/ collapsed onto the same surface form [tip]. This shows an instance of a violation of *Merge.

In order to make it easier to see which forms have been collapsed, I will adopt the following abbreviatory convention:

(7) $\text{ti}_{\text{e}}\text{p}$ tap

This notation is adopted purely for convenience and compactness. It is clearly not equivalent to the original notation used by Padgett. This is acceptable in this paper only because (i) I will only be looking at cases involving merger (while Padgett also considered cases involving chain shifts), and (ii) I will only be looking at cases where the two forms being merged differ in only one segment.

We are now ready to consider how the constraint hierarchy in (3), and the the constraint in (5) can be brought together to derive specific language inventories. We start with the absolute simplest case: a mini-language where all words consist only of single vowels. The tableau in (8) shows how for such a language with the ranking of *Merge below Space $_{\text{HEIGHT}} \geq \frac{1}{3}$, but above Space $_{\text{HEIGHT}} \geq \frac{1}{2}$, we can derive a three height language.

(8)

	a e ɛ i	Space $\geq \frac{1}{3}$	*Merge	Space $\geq \frac{1}{2}$	Space ≥ 1
a.	a e ɛ i	*!**		***	******
b. ☞	a $\text{e}_{\text{ɛ}}$ i		*	**	***
c.	$\text{a}_{\text{eɛ}}$ i		**!		*
d.	$\text{ə}_{\text{eɛi}}$		**!*		

What we are seeing in this tableau is an instance of Stampean Occultation. This means that even if we specify more than three vowel heights underlyingly, the contrasts will be reduced, since maintaining more than three contrasts would require compressing the perceptual space for vowel height by more than $\frac{1}{3}$ of the total space for certain vowels pairs. Better then to collapse certain contrasts, though which contrasts is not determined by the current analysis.

The next tableau displays a tableau for a language with a slightly expanded segment and syllable inventory which also permits simple onsets consisting of [t] or [p].

(9)

	a ta pa e te pe ɛ tɛ pɛ i ti pi	Space $\geq \frac{1}{3}$	*Merge	Space $\geq \frac{1}{2}$	Space ≥ 1
a.	a ta pa e te pe ɛ tɛ pɛ i ti pi	*!**3x		***3x	******3x
b. ☞	a ta pa $\text{e}_{\text{ɛ}}$ $\text{te}_{\text{ɛ}}$ $\text{pe}_{\text{ɛ}}$ i ti pi		*3x	**3x	***3x
c.	$\text{a}_{\text{eɛ}}$ $\text{ta}_{\text{eɛ}}$ $\text{pa}_{\text{eɛ}}$ i ti pi		**!3x		*3x
d.	$\text{ə}_{\text{eɛi}}$ $\text{tə}_{\text{eɛi}}$ $\text{pə}_{\text{eɛi}}$		**!*3x		

As can be seen here, the results from the idealized case in (8) carry over to this case as well even though the calculation of the violations is different.

In coming tableaus I will continue to restrict myself to appropriately idealized sublanguages under the assumption that the simple case be expanded to more realistic cases. (For more discussion of this matter see Padgett (2003).

2. Fixed (or 'Default') segmentism in Reduplication

We now come to the actual matter of discussion. Many languages with reduplication, do not copy entirely faithfully. Instead some segments—more commonly the vowels, but sometimes consonants as well—are not copied. Instead the segment shows a predictable unvarying quality, quite often the 'default' for the language. Sawai is a typical case:

(10) *Sawai CVC reduplication (Whisler, 1992)*

pɛsposɛ	'cloudy'
mɛtmot	'corpse'
pɛkpuk	'lump, mound'
lɛmlem	'dew'
sɛgsa gɛ	'spear'
tɛptib	'stake'
tɛptɛp	'drop of blood'

Sawai has a 7 vowel system, with a total of four vowel heights. In reduplication the vowel quality is not copied and the vowel in the reduplicant consistently take the shape [ɛ]. This incidentally is also the epenthetic vowel of Sawai.

Applying DT to a highly idealized version of Sawai, including also a simplification of the vowel heights from four to three, we can first see how we derive the general vowel inventory.

(11)

tip$_1$ tep$_2$ tap$_3$	Faith-IO	*Merge	Space ≥ $\frac{1}{3}$	Faith-BR
a. ☞ tip$_1$ tep$_2$ tap$_3$			**	
b. tep$_{1,2,3}$	*!*	**		

By ranking *Merge in the right place within the Space $_{\text{HEIGHT}}$ hierarchy, we ensure that underlyingly specified vowels surface correctly.

Now let us consider what happens with reduplicated forms.

Following now fairly standard assumptions, reduplication is not specified in an underlying form, but only as either an 'empty morpheme' or as an instruction to double the base morpheme (Spaelti, 1997). Either way the reduplicant escapes the usual pressures against deleting or changing underlying material, summed up as Faith-IO in the tableau here. On the other hand the reduplicant is instead subject to constraints requiring that it fully and faithfully copy the base. These requirements are covered by Faith-BR in the tableau. But nothing requires these two pressures to be ranked together in the tableau. Ranking Faith-BR above Faith-IO has no particular effect, but ranking it below gives a pattern that is observed in reduplicative systems again and again, and is known as Emergence of the Unmarked. In the analysis here we will see what happens once such a ranking interacts with our DT account of the vowel inventory.

Now let us consider tableau (12).

(12)

RED-tip$_1$ RED-tep$_2$ RED-tap$_3$	Faith-IO	*Merge	Space ≥ $\frac{1}{3}$	Faith-BR
a. tip-tip$_1$ tep-tep$_2$ tap-tap$_3$			***!*	
b. ☞ tep-tip$_1$ tep-tep$_2$ tep-tap$_3$			**	**
c. tep-tep$_{1,2,3}$	*!*	**		

This tableau considers only the reduplicative sub-lexicon of our hypothetical Sawai. First of all we have the possibility of reduplicating all our morphemes faithfully. If we do so however we run against the problem that by duplicating the segments of the base we also duplicate all its violations. With the base segments this is unavoidable, since they are bound by faithfulness constraints, most notably *Merge, as was already seen in tableau (11). But the reduplicant is not bound by *Merge in the same way. This is because *Merge calculates violations over entire forms. But even if we copy the reduplicant unfaithfully, the reduplicated form as a whole is still distinct, because of the telling vowel in the base. This leaves only Faith-BR to ensure perfect copying. But if, as in (12), Faith-BR is low ranked we will see the emergence of a more unmarked vowel inventory with fewer possible contrasts, leading to the appearance of fixed segmentism.

A further advantage of this theory is that it also works for systems with 2 'fixed' vowels. Consider the following system from the Doka Timur dialect of West Tarangan.

(13) *Doka Timur West Tarangan (Nivens, 1993)*

'ke	ki'ke	'wood'
'top	tip'top	'short'
'top-di	tap'topdi	'short-3p'
'let-na	lit'letna	'male-3s'
'les-ay	lat'lesay	'male-3p'
'rua	ri'rua	'two'
'loir	li'loir	'clean-3s'
'loar-ay	la'loar	'clean-3p'
'ro-na	rin'rona	'dry-3s'
'ro-ay	ra'roay	'dry-3p'

In Doka Timur West Tarangan the vowel of the reduplicant appears as either [i] or [a]. This variation is predictable, but beyond the scope of this paper.

Now in this case I will again consider only the reduplicative sub-lexicon of a hypothetical mini-West Tarangan. The analysis is quite parallel to that of Sawai.

(14)

RED-tip$_1$ RED-tep$_2$ RED-tap$_3$	Faith-IO	*Merge	Space $\geq \frac{1}{2}$	Faith-BR	Space ≥ 1
a. tip-tip$_1$ tep-tep$_2$ tap-tap$_3$			***!*		
b. tep-tip$_1$ tep-tep$_2$ tep-tap$_3$			**	**!	
c. tep-tep$_{1,2,3}$	*!*	**			
d. ☞ tip-tip$_1$ tap-tep$_2$ tap-tap$_3$			**	*	*
e. ☞ tip-tip$_1$ tip-tep$_2$ tap-tap$_3$			**	*	*

What then is the difference?

In the earlier analysis we had not considered all candidates, and all the necessary constraints. In particular Space $_{\text{HEIGHT}} \geq 1$ was omitted. In fact if we reconsider tableau (12) we see that we need to include it, and rank it above Faith-BR, in order to prevent the candidates equivalent to (14d) and (14e) from coming out on top. If however we rank Space $_{\text{HEIGHT}} \geq 1$ at the bottom we get exactly the result we need for Doka Timor West Tarangan, though we will still need to include further constraints to predict the correct distribution of the two variants.

Essentially what we are seeing in this analysis is the emergence of an unmarked vowel inventory. Whether this inventory has one vowel or two is a parameter which is open to variation.

3. Conclusion

This analysis explains reduplicative fixed (or default) segmentism as emergence of an unmarked vowel inventory for the reduplicant. This is possible because the vowel quality of the reduplicant is essentially redundant. Since the bases remain distinct, the reduplicant itself is not needed to maintain contrast between forms, and ends up showing the more limited range of contrasts predicted by the emerging inventory. Treating fixed segmentism in reduplication in this manner also permits us to account for systems with multiple variants, something that the previous Emergence of the Unmarked analysis (Alderete et al., 1999) was unable to do.

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