Frequency, cyclicity, and optimality

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Goals

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1. What is cyclicity?

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2. Rule-based and OT-based accounts

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3. Demonstrate a frequency effect with cyclic stress

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1. What is cyclicity?
2. Rule-based and OT-based accounts
3. Demonstrate a frequency effect with cyclic stress
4. Propose an account using lexically-restricted markedness

Organization

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1. Classical account of cyclic stress in English

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2. Problems with this account

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3. An OT-based account using lexically-restricted faithfulness

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4. Review of frequency effects
5. A frequency effect with cyclic stress
6. A markedness-based account

Cyclic stress in English

còndènsátion

vs.

còmpensátion

Cyclic stress in English

còndènsátion (compare: condénse)

vs.

còmpensátion (compare: cómpensàte)

Cyclic stress in English

còndènsátion (compare: condénse)

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(Chomsky & Halle, 1968)

There are more

	condénse	còndènsátion
	attést	àttèstátion
preserved stress, cyclic:	objéctive	òbjèctívity
	elástic	èlàstícity
	. . .	

	cómpensàte	còmpensátion
no preserved stress, cyclic:	démonstràte	dèmonstrátion
	ánecdòte	ànecdótal
	. . .	

Forms with no cyclic derivation

sèrendípity Cònestóga Trànsylvánia

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These behave like the latter cases (like *cómpensàte* etc.).

Big picture

- còndènsátion:
- còmpensátion:
- sèrendípity:

Big picture

- còndènsátion: stress preserved,
  related simple form (cyclic)
- còmpensátion: no preserved stress,
  related simple form (cyclic)
- sèrendípity: no preserved stress,
  no related simple form (noncyclic)

Cyclic derivation

compensate

condense

Cyclic derivation

compensate $\longrightarrow$ cómpensàte

condense $\longrightarrow$ condénse

Cyclic derivation

compensate ⟶ cómpensàte ⟶ cómpensàtion

condense ⟶ condénse ⟶ condénsation

Cyclic derivation

compensate $\longrightarrow$ cómpensàte $\longrightarrow$ cómpensàtion $\longrightarrow$còmpensátion

condense $\longrightarrow$ condénse $\longrightarrow$ condénsation $\longrightarrow$ còndènsàtion

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1. There are a number of items that do not exhibit cyclic stress even through they have bases of the right form, e.g. forms like *trànsformátion*.
2. There are a number of items like *còndènsátion*, yet that have no cyclic base, e.g. forms like *òstèntátion*.

Should have a cyclic derivation

infórm	ìnformátion
trànsfórm	trànsformátion
lamént	làmentátion
trànspórt	trànsportátion

(Halle & Kenstowicz, 1991: should be like *còndènsátion*)

Should not have a cyclic derivation

ìncàntátion òstèntátion ìncàrnátion

(Halle & Kenstowicz, 1991: should be like *sèrendípity*)

Halle & Kenstowicz's proposal:

Words like *còndènsation* and *òstèntátion* are treated alike: as instances of exceptional stress assignment, rather than cyclicity.

The cyclicity effect is simply exceptional stress.

This won't work

While preservation of a rightmost primary stresses is subject to the exceptions Halle & Kenstowicz discuss, the preservation of a primary stress further to the left is not.

There are two classes of cases.

Cyclic stresses further to the left are regular

wsw:	imágine	imàginátion
	arístocràt	arìstocrátic
	decápitàte	decàpitátion
	syllábicàte	syllàbicátion
sww:	óxygen	òxygenátion
	péregrinàte	pèregrinátion
	váriegàte	vàriegátion
	vítriolàte	vìtriolátion

What do we conclude?

The generalization is that a cyclic secondary stress is necessarily preserved in these cases, while it is only occasionally preserved in the original cases.

The difference is that in the original cases (like *còndènsátion*), the preserved stress would otherwise end up adjacent to the new primary stress, while in these latter cases (like *imàginátion* and *pèregrinátion*), the preserved stress ends up further from the new primary stress.

English stress with OT: Pater (2000) and/or Hammond (1999b)

PARSE-σ

Syllables must be parsed into feet.

TROCHEE

Feet are left-headed.

NONFINALITY

The final syllable is unfooted.

Some ranking arguments

- TROCHEE is never violated, so it must be ranked above anything that might conflict with it.
- The NONFINALITY constraint must outrank the PARSE-σ constraint, as final syllables are unfooted, despite the pressure to do so from PARSE-σ.

	/Canada/	TROCHEE	NONFINALITY	PARSE-σ
☞	[Cána]da			*
	[Caná]da	*!		*
	Ca[náda]		*!	*
	Canada			**!*

Stressing heavy syllables

WSP
Heavy syllables must be stressed (Pater doesn't use this).

FtBin
Feet must be disyllabic (or bimoraic).

WSP >> Nonfinality and FtBin

	/chickadee/	WSP	Nonfin	FtBin	Parse-σ
☞	[chícka][dée]		*		
	[chícka]dee	*!			*
	chi[ckádee]	*!	*		*
	chicka[dée]		*		*!*

Clash-Head

Finally, there is a general tendency to avoid adjacent stressed syllables that Pater formalizes as Clash-Head.

Clash-Head
A stress cannot be adjacent to the main stress.

This constraint prevents stresses from occurring next to a main stress, even if two heavy syllables should occur next to each other.

But such cases do occur, e.g. *càntánkerous*, etc.

Pater: Parse-σ >> Clash-Head.

Cyclicity in English with OT

Pater accounts for cyclic stress by adopting a correspondence constraint that requires that if a vowel is stressed in a base form, then it must be stressed in a derived form.

IDENT-STRESS
If α is stressed, $f(\alpha)$ must be stressed.

IDENT-STRESS >> CLASH-HEAD

	/condensation/	I-S	C-H	FtBin	Parse-σ
☞	[còn][dèns][át]ion		*		*
	[còndens][át]ion	*!			*
	con[dèns][át]ion		*		**!

Exceptional cases and listing

- IDENT-STRESS also applies to forms like *òstèntátion*, requiring that input accent matches output stress.
- Forms that do not stress a heavy syllable before the main stress, like *sèrendípity*, and forms with cyclic bases where the relevant syllable isn't stressed in the derived form, like *ìnformátion* are treated by listing the forms that IDENT-STRESS applies to.
- Forms like *sèrendípity* and *ìnformátion* would then not be listed.

An exceptional case

	/information/	I-S	C-H	FtBin	Parse-σ
	[ìn][fòrm][át]ion		*!		*
☞	[ìnform][át]ion				*
	in[fòrm][át]ion		*!		**

Two Ident-Stress constraints

- There is a second general Ident-Stress constraint that does not include lexical stipulations that is ranked below Clash-Head.
- This second more general Ident-Stress constraint requires that all lexical accents and cyclic stresses be preserved.
- Thus all cyclic stresses, and lexical accents, that do not clash with the main stress are preserved.

Stresses further to the left

	/imagination/	C-H	I-S	FTBIN	PARSE-σ
☞	i[màgi][ná]tion				**
	[ìma]gi[ná]tion		*!		**

Exceptional stress is treated with the same mechanism

	/ostèntation/	I-S(. . .)	C-H	I-S
☞	[òs][tèn][tá]tion		*	
	[òsten][tá]tion	*!		*

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- Hammond (1999a): *nâîve fríend* vs. *òbése chíld*

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2. If so, is it the frequency of *trànsformátion* or the frequency of *trànsfórm* that plays a role?
3. If there is a role to be played by frequency, how should it be modeled using OT?

A study

Is reduction in words with a cyclic derivation also subject to a frequency effect?

- all English nouns ending in *-ation*, along with their putative cyclic bases, e.g. *trànsfórm* and *trànsformátion* (from the MRC Psycholinguistic Database).
- Stressed syllable closed by a sonorant.
- Stressed vowel quality as distinct as possible from schwa.
- Forms with ambiguous stress were thrown out.

Coding

Reduction was coded along a four-point scale depending on how the relevant vowel was represented in *Webster's New Collegiate Dictionary*.

- If only a reduced pronunciation was given, it was coded as a 3;
- if only an unreduced pronunciation was given, it was coded as a 0;
- If both pronunciations were given, then it was coded as a 1 or a 2, depending on which pronunciation was given first: unreduced or reduced respectively.

Frequency information

Frequency information was then collected on both members of the pair from the Brown Corpus with a Perl script written by the author.

(There are approximately 1,026,604 words in the Brown Corpus.)

A sample of the data

red.	base	freq.	derived	freq.
1	condemn	4	condemnation	7
1	conform	10	conformation	3
0	debark	0	debarkation	0
0	decant	0	decantation	0
1	deform	0	deformation	5
1	deport	1	deportation	0
1	disembark	0	disembarkation	0
1	embark	5	embarkation	0
0	exalt	1	exaltation	1
1	exhort	0	exhortation	0
1	export	25	exportation	0
...				

Statistical analysis

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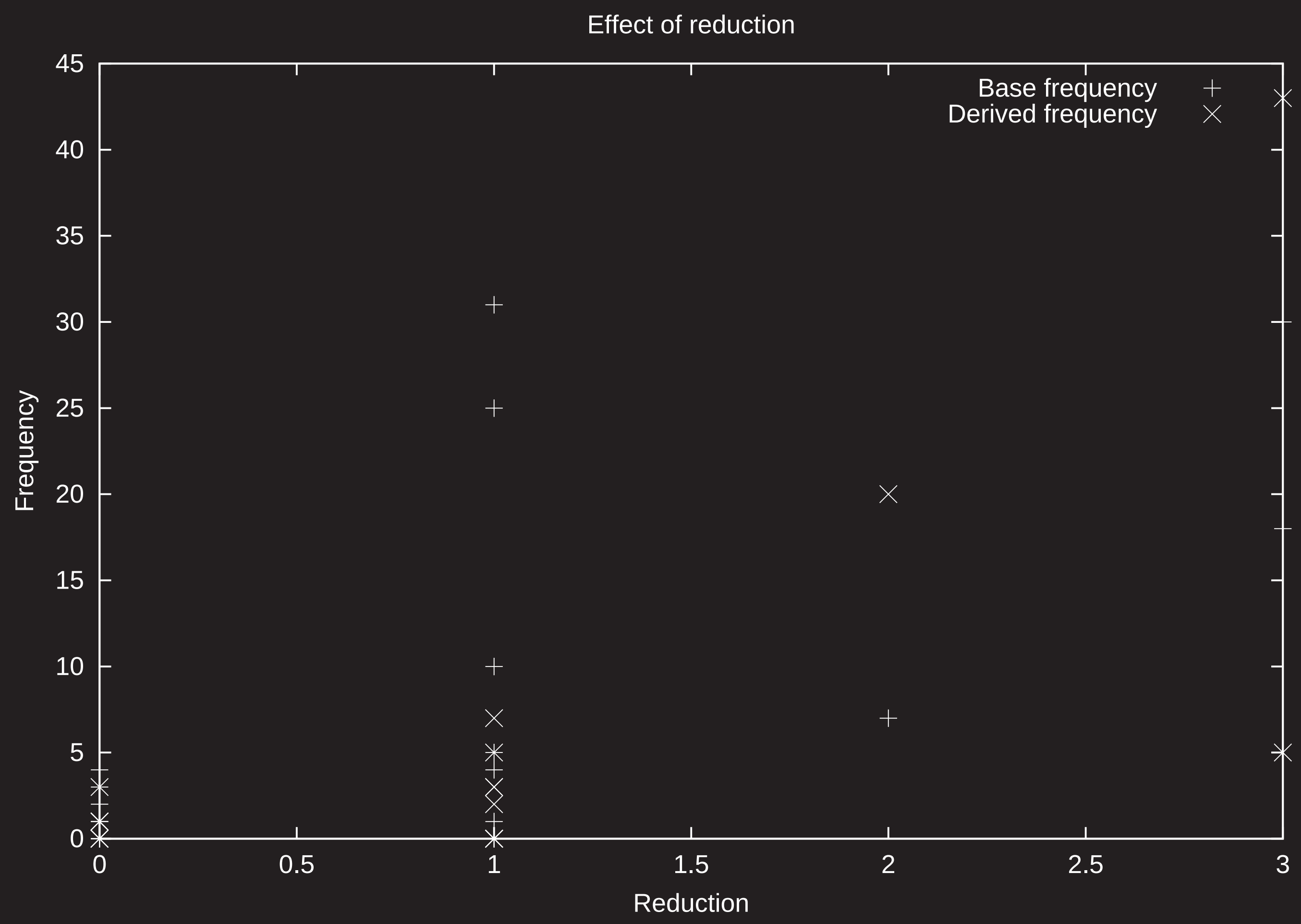
There was a significant correlation with reduction: $R^2 = .087$, $p < .0028$ for base frequency and $p < .0006$ for derived frequency.



Effect of reduction
Base frequency
Derived frequency
Frequency
Reduction
0
5
10
15
20
25
30
35
40
45
0
0.5
1
1.5
2
2.5
3

Interpreting the results

- The correlation with the frequency of the derived form means that the more frequent the form is, the more likely it is to undergo reduction.
- The correlation with the frequency of the base form means that the more frequent the base form, the more likely the derived form is to undergo reduction.

Consequences

1. These results thus mirror the results in Hammond (1999a) and Hicks et al. (2000).
2. The fact that there is an effect of base frequency on reduction of the derived word shows that the cyclic stress cases, like *còndènsátion*, are empirically distinct from the exceptional stress cases, like *òstèntátion*.
3. Thus, on empirical grounds, an analysis that groups these together cannot be correct.
4. The effect of base frequency is perhaps quite counterintuitive.

Modeling frequency effects with OT

Pater: cyclicity with IDENT-STRESS(...), where specific lexical items are specified in the constraint.

To have frequency play the correct role in Pater's analysis, we would need for forms to be mentioned in that constraint as an inverse function of their lexical frequency.

Examples

- *rèpresentátion* occurs with sufficiently high frequency that it can undergo reduction. Hence, this word is not included in the IDENT-STRESS(...) constraint.
- On the other hand, *èxàltátion* occurs sufficiently infrequently that it can get mentioned.

Base frequency

The more frequent the base, the more likely reduction in the derived form.

Hence, if IDENT-STRESS(. . .) only includes very infrequent bases, it will have the consequence of blocking reduction just in case the base is infrequent.

Problems

1. Doesn’t generalize to novel or nonsense words.
2. Doesn’t generalize to phrasal rhythm.

An alternative

There is no constraint IDENT-STRESS(. . .), and that the CLASH-HEAD constraint is instead lexically specified: CLASH-HEAD(. . .).

The difference is that now the most frequent items would be referred to by this constraint.

For example

	/transformation/	C-H(. . .)	I-S
☞	[trànsfor][má]tion		*
	[tràns][fòr][má]tion	*!	

	/exaltation/	C-H(. . .)	I-S
☞	[èx][àl][tá]tion		
	[èxal][tá]tion		*!

How to model the effect of the frequency of the base on the likelihood of reduction in the derived form

Specifically, if the relatively high frequency of occurrence of *comménd* is what triggers reduction of the relevant syllable in *còmmendátion*, then we need a mechanism whereby the high frequency of the base makes it more likely that the derived form will be included in CLASH-HEAD(. . .).

A natural way to do this

- Suppose that the frequency of a complex derived form is a partial function of the frequency of its parts.
- Thus the computed frequency for *trànsformátion* should be a function not only of how frequent the whole form is, but also how frequent each of its component morphemes are: *trànsfórm* and *-ation*.
- This is, in fact, what the psycholinguistic literature tells us (Taft, 1979).

Thus:

On this view, *còmmendátion* is more likely to be referred to by CLASH-HEAD(. . .) because its frequency is increased by the relatively high frequency of its component morphemes.

Latinate prefixes

- Evidence that this assumption is on the right track comes from English Latinate prefixes.
- Chomsky & Halle (1968) show that the Latinate prefixes of English—those prefixes showing up in borrowings from Latin and French—exhibit reduction even when heavy.
- This is true regardless of the frequency of the word in question.

For example

- Thus an unprefixed word like *cònchólogy* does not undergo initial reduction (as expected).
- However, a prefixed word like *convénticle* does undergo initial reduction (even though the word is extremely infrequent).
- SPE accounts for this by proposing a special class of prefixes and allowing their rule for reduction to be sensitive to this class.

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- If we factor the later into the former, then we make the prediction that we should get reduction of words with Latinate prefixes in a clash environment.
- Words with Latinate prefixes undergo reduction, not because there is a special clause for Latinate prefixes, but because Latinate prefixes are generally quite frequent.

An additional benefit

- An additional benefit of this analysis is that we now have only a single IDENT-STRESS constraint and a single CLASH-HEAD(. . .) constraint.
- Pater's analysis needs two separate IDENT-STRESS constraints.

Empirical conclusions

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2. There is an effect of base frequency as well.
3. This effect is parallel to the frequency effects for the rhythm rule.

Theoretical conclusions

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2. Exceptional stress cannot be equated with cyclic stress in English.

Theoretical conclusions

1. We need lexically-restricted markedness.
2. Exceptional stress cannot be equated with cyclic stress in English.
3. A naive exemplar-based account won't work.