Challenges to Stratal Phonology

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INTRODUCTION

§1 On the grammatical side, the theory of phonologically driven alternations set out in this course crucially assumes • stratification and • parallel constraint-based computation.
(i) Stratification is needed, inter alia, to • identify stem-level alternations as a class exhibiting special properties (◮☺, ◮☺☺), • lay down the track for the diachronic life cycle of phonological patterns (◮☺☺).
(ii) Parallel constraint-based computation† is needed, inter alia, to • derive Chung’s Generalization, which is one of the crucial properties of stem-level alternations (◮☺, ◮☺☺), • drive the learning model assumed by the theory (§16 below, ◮☺☺).

† Here ‘parallel constraint-based computation’ includes OT (Prince & Smolensky 1993), Harmonic Grammar (Pater 2009), and MaxEnt (Hayes & Wilson 2008), but excludes Harmonic Serialism (McCarthy 2010) and Candidate Chain Theory (McCarthy 2007): see Bermúdez-Otero (2018b: 101-102) on the demarcation of ‘constraint-based Stratal Phonology’. On, for example, Stratal MaxEnt, see Nazarov & Pater (2017).

§2 Therefore, any challenge to constraint-based Stratal Phonology is a challenge to the foundations of the theory of alternations developed in this course.

This session reviews three such challenges:

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STRATUM-INTERNAL OPACITY

Outline of the argument

§4 The challenge (e.g. McCarthy 1999, 2007, Vaux 2008, inter multos alios):
Opacity within a single phonological cycle cannot be handled by parallel constraint-based computation and requires a more powerful theory of derivations:
e.g. • ordered rules  (e.g. Chomsky & Halle 1968, Calabrese 2005, Vaux 2008)
• Harmonic Serialism  (e.g. McCarthy 2010)
or • candidate chains  (e.g. McCarthy 2007)

§5 The response:
(i) Many opaque interactions fall out of the stratal affiliation of the relevant processes without further stipulation.
In such cases, adopting a stratal solution results in learnability advantages (Bermúdez-Otero 2003, ◮☺).
Example below: Catalan /g/-affrication and voicing assimilation.
(ii) Other opaque interactions submit to independently motivated constraint-based solutions:
such as distantial faithfulness (Kirchner 1996, Gnanadesikan 1997, Zuraw 2013) motivated by chains shifts (Kirchner 1996) and saltation (Hayes & White 2015).
Example below: Catalan spirantization and voicing assimilation.

Catalan laryngeal neutralization (Bermúdez-Otero 2006b, 2007)

§6 Standard (Central) Catalan possesses the following obstruent phonemes:

\[
\begin{array}{cccc}
\text{p} & \text{j} & \text{k} \\
\text{b} & \text{d} & \text{g} \\
\text{f} & \text{s} & \text{ʃ} \\
\text{z} & \text{ʒ} & \\
\end{array}
\]

§7 Voice contrasts are neutralized in the coda:
(i) Voicessless realizations in surface codas before a voiceless segment or pause:

\[
\begin{array}{c}
/p/\rightarrow[p] & /y/\rightarrow[y] & /h/\rightarrow[k] \\
/b/\rightarrow[p] & /j/\rightarrow[j] & /g/\rightarrow[k] \\
/s/\rightarrow[f] & /z/\rightarrow[s] & /y/\rightarrow[f] \\
\end{array}
\]

\(\text{e.g.} /p/\text{exc[u]}[p] \rightarrow (\text{\`s})\text{he spits} \quad \text{cf. } /\text{exc[u]}[p]\text{tris} \rightarrow \text{\`s} \text{he spits everything}\
/b/\text{ll[a]}[p] \rightarrow \text{\`he-wolf} \quad \text{cf. } /\text{ll[a]}[f]a \rightarrow \text{\`she-wolf}\
/j/\text{bu[t]} \rightarrow \text{\`puff} \quad \text{cf. } /\text{bu[t]}[ar] \rightarrow \text{\`to puff}\
/k/\text{bu[t]} \rightarrow \text{\`warm puff}\
\]

\(\text{§9} \) The stratal ascription of voicing neutralization:

(i) Voice neutralization must apply at the word level, since it affects word-final prevocalic obstruents, which are in the coda at the word level but undergo resyllabification into the onset at the phrase level.

For prefixes, assume a prosodic word boundary at the prefix-stem juncture, crossed by onset-satisfying resyllabification only at the phrase level (§15iv).

(ii) On the other hand, the surface voicing of neutralized obstruents is partly determined by assimilation, which must be phrase-level since it applies across word boundaries.

\(\text{§10} \) A two-step solution:

(i) Coda obstruents lose their laryngeal node at the word level.

(ii) At the phrase level, delaryngealized obstruents are supplied with voicing specifications contextually:

- before obstruents, they assimilate in \(\pm\text{voice}\);
- before sonorant consonants, they get \(\text{[+voice]}\) voiced by default;
- before vowels, fricatives and affricates get \(\text{[+voice]}\) by default;
- the rest get \(\text{[-voice]}\) by default.

See the classic rule-based autosegmental account of Mascaró (1987). On voicing neutralization as delaryngealization, see Steriade (1999b). For the same analysis applied to Quito Spanish, see Bermúdez-Otero (2011: §6).

\(\text{§11} \) Examples:

\(\text{llo/db/ trist} \quad \text{llo/db/ lliure} \quad \text{llo/db/ amig}\
\)

\(\text{§12} \) Data

\(\text{§13} \) /b̪/‘mad’

\(\text{boja} \quad \text{[bɔ.3][3]} \quad \text{‘madwoman’}\
\text{bogeria} \quad \text{[bu.3][3][3]} \quad \text{‘madness’}\
\)

\(\text{§14} \) /b̪/‘mad’

\(\text{boja} \quad \text{[bɔ.3][3]} \quad \text{‘madwoman’}\
\text{bogeria} \quad \text{[bu.3][3][3]} \quad \text{‘madness’}\
\)}
§13 /ʃ/ does not affricate:

/mateʃf/ ‘same’

màtieix [m̩a.teʃi] ‘same.M’

màtieixa [m̩a.te.xi] ‘same.º’

màtieix corb [m̩a.teʃi.kɔɾp] ‘same raven’

màtieix gos [m̩a.teʃi.ɔs], *[ʃ] ‘same dog’

màtieix home [m̩a.te.xi.əm], *[ʃ] ‘same man’

§17 The nonsibilant voiced obstruent phonemes /b, d, g/ have noncontinuant allophones:

(i) In voicing neutralization environments, /b, d, g/ have noncontinuant allophones:

• /b, d, g/ →[p, t, k]

in the coda before pause

llo[p] ‘he-wolf’

in the coda before a voiceless segment

llo[p] tris ‘sad he-wolf’

in prefix-final or word-final onset position

llo[p] amis ‘friends he-wolf’

• /b, d, g/ →[b, d, g]

in the coda before a voiced segment

llo[b] lliure ‘free he-wolf’

(ii) Outside voicing neutralization environments, the continuancy of /b, d, g/ is determined allophonically by a process of spirantization:

• /b, d, g/ →[b, d, g] in a non-prefix/word-final onset...

in gemination

[p] ‘people’

• /b, d, g/ →[b, d, g] in other non-prefix/word-final onset positions:

e.g. llo[b] lliure ‘free he-wolf’

§16 This helps in acquisition:

Q. How does the child learn that /ʃ/ undergoes affrication in codas, given surface counter-evidence like [ma.teʃi.ɔs]?

A. The child acquires the grammar bottom-up, from lower to higher levels, undoing each alternation at the relevant stratum (Bermúdez-Otero 2003).
§18 Properties of spirantization:

(i) Domain: sees across word boundaries, e.g. $a[p\ b]inen$ ‘next year’;

 therefore phrase-level.

(ii) Input:  
  • applies to nonneutralized [b, d, g] in the input to the phrase level;
  • does not apply to delaryngealized [P, T, K] in the input to the phrase level.

 I.e. $llo/b/a$ $llo/b/\ lliure$

§19 Stratum–internal opacity: both spirantization and assimilation are phrase-level!

<table>
<thead>
<tr>
<th>phrase-level input</th>
<th>$lloP_{b}$.liw.rɔ</th>
</tr>
</thead>
<tbody>
<tr>
<td>spirantization</td>
<td>n.a.</td>
</tr>
<tr>
<td>assimilation</td>
<td>$llo_{b}$.liw.rɔ.</td>
</tr>
</tbody>
</table>

Counterfeeding

§20 A distantial-faithfulness effect: no fell swoop from P to $\beta$

| assimilation (✓) | P $\rightarrow$ b | violates IDENT[voice] |
| spirantization (✓) | b $\rightarrow$ $\beta$ | violates IDENT[cont] |
| fell swoop (✗) | P $\rightarrow$ $\beta$ | violates IDENT[voice] & IDENT[cont] |

§21 Similar distantial-faithfulness effects found in chain shifts:

e.g. Grimm’s Law in Proto-Germanic

 ✓ $p > \phi$
 ✓ $b > p$ but ✓ $b > \phi$
 ✓ $b^h > b$ but ✓ $b^h > p$

§22 Different implementations of distant faithfulness:

• constraint conjunction (Kirchner 1996)
• MAP-constraints (Zuraw 2013)
• containment (Popp 2018)

§23 Implementation with constraint conjunction:

<table>
<thead>
<tr>
<th>Phrase-level input</th>
<th>Phrase-level output</th>
</tr>
</thead>
<tbody>
<tr>
<td>$lloP_{b}$</td>
<td>$llo_{b}/\ lliure$</td>
</tr>
</tbody>
</table>

§24 But, even in this case, stratification aids in the acquisition of opacity effects:

Q. How does the child learn that opaqueley nonspirantized [b, d, g] derives from delaryngealized [P, T, K]?

A. Simply by undoing phrase-level alternations:

$WL.$

$PL.$

§25 Back to the Spanish diphthongal alternation (4.18§19):

Basic generalization:  
  • diphthongs in tonic syllables: e.g. $[b\jek-o]$ ‘old man / old’
  • monophthongs elsewhere: e.g. $[beb\Theta-\Theta]$ ‘old age’

Extrinsic rule ordering subverts stratification: Spanish diphthongization again
§26  The alternation misapplies in the presence of certain affixes (in semantically compositional uses): notably,
   • diminutive -(e)it-o
   • augmentative -az-o
   • augmentative -(e)nt-o in denominal and deadjectival uses only
   • superlative -(es)im-o
   • causative a-…-a- in deadjectival change-of-state verbs only

(i)  normal application
     [bjé-x-o]  'old man / old'     [bwen-o]  'good'
     [bex-é-o]  'old age'     [bon-da-é-o]  'goodness'

(ii) misapplication
     [bjé-x-ón-o]  'old_man.AUG'     [bwen-ón-o]  'good.AUG'
     [bjé-x-é-θ-o]  'old_man.AUG'     [bwen-é-θ-o]  'good.AUG'
     [bjé-x-ísim-o]  'old.SUPL'     [bwen-ísim-o]  'good.SUPL'
     [a-fjex-í-e]  'make_old.INF'

§27  Analysis:
   • the suffixes in §26ii are word-level;
   • allomorph selection in the diphthongal alternation must take place in a stem-level cycle.

viésimo

[wL. sl. {bjé-x-o} [bwen-o]
[wL. sl. {bjé-x-o} [bweN-ta, -dor-
[wL. sl. {bjé-x-ísim-o} [bweN-ta
diphthongization  [bwn-ísim-o]  'good.SUPL'

§28  Two generalizations about the word-level constructions in §26ii:
   • they are all very highly productive (Carlson and Gerfen 2011b, b);
   • they are all denominal or deadjectival, not deverbal (Rainer 1993: 175-176).

For a diachronic explanation, ▶.

§29  But stem-level cyclicity causes a problem: e.g.  cont-a-dor-é-o 'counter'

\[\text{first cycle} \quad \text{second cycle} \quad \text{kbwen.ta.dor} \]

Yet, pace Myler (2015), premise (i) is not in doubt: see Bermúdez-Otero (2016: 408-413)

§30  If  (i) there is a cycle of the stem-level phonology over the inner stem highlighted in §29,
   and (ii) selection, operating over root allomorphs, takes place in this cycle,
   then the wrong results follow:

\[
\begin{align*}
\text{first cycle} & \quad \text{kbwen.ta} \\
\text{second cycle} & \quad \text{kbwen.ta.dor}
\end{align*}
\]

§31  This is a classic puzzle:

If verb and noun stems are stress domains, then Diphthongization is not cyclic [i.e. not stem-level].

(Harris 1989: 345)

§32  The extrinsic-ordering gambit (Halle et al. 1991)

Stress shift counterbleeds diphthongization within a word-level cycle:

\[
\begin{align*}
\text{stress assignment} & \quad \text{bOn} \\
\text{diphthongization} & \quad \text{bwén} \\
\text{stress assignment} & \quad \text{bwénisimo}
\end{align*}
\]

§33  A particularly nasty type of extrinsic ordering:
   • Independently argued never to be necessary even in rule-based models: e.g. Kaisse (1999).
   • Destroys the empirical content of the concept of cyclic domain:

Extrinsically ordering diphthongization before stress assignment at the word level enables Halle et al. (1991) to state something quite contradictory: namely, that diphthongization applies in word-level domains but cannot see word-level affixes.
   • Incompatible with learning models such as Bermúdez-Otero (2003);
   cf §16 and §24 above.

§34  For a better solution, ▶.
PARADIGMATIC DEPENDENCIES WITHOUT CONTAINMENT

The issue

§35 Question (Steriade 1999a, 2008, 2013; Steriade & Yanovich 2015)

• Languages often exhibit morphophonological paradigmatic dependencies between expressions that do not stand in a relationship of containment with each other.
• Can this observation be reconciled with a strictly cyclic approach to the morphosyntax-phonology interface?

§36 My answer (Bermúdez-Otero 2018a, 2018b)

• Yes. Paradigmatic dependencies without containment are established indirectly through the acquisition of underlying representations (URs):
• In such cases, a surface form determines the phonological behaviour of a morphologically related item by providing the learner with cues to the UR of a constituent present in both expressions.

The empirical argument: paradigm extension and suppletion

§37 I argue that interesting and correct predictions about paradigm extension follow from the hypothesis that paradigmatic dependencies without cyclic containment take effect during the acquisition of URs:

notably, paradigmatic dependencies are correctly predicted never to be systematically extended to new items in cases of suppletion.

§38 Empirical case study: Latin rhotacism (Bermúdez-Otero 2018a: §3; cf. Albright 2002)

# Weakly suppletive dependencies like operis N.GEN.SG ⇒ opus N.NOM.PL. ‘work’, though highly reliable in neuter polysyllables, fail to be extended to items like acer–aceris N ‘maple’; cf. *acu

Two types of paradigmatic dependence in cyclic frameworks

§39 Paradigmatic dependence in morphophonology:
The form of a linguistic expression a is predictable from the surface representation of one or more morphosyntactically related expressions {b, c, ...}.

§40 Paradigmatic dependencies with and without containment:

(i) Present-day English: pretonic secondary stress (§10,§17)
   initial dactyl  &middot;&middot;&middot; predictable from &middot;&middot;&middot; (containment)
   no initial dactyl &middot;&middot;&middot; &middot;&middot;&middot; predictable from &middot;&middot;&middot; (containment)

(ii) Early West Saxon: NOM.PL. inflection in neuter a-stem nouns
   [-o] in werod ‘troop’ werod-o predictably from oblique werod-e (no containment)
   [-u] in wæter ‘water’ wæt-u predictably from oblique wæt-e (no containment)

(Bermúdez-Otero & Hogg 2003: §3)

§41 Dependency with containment through cyclicity (§40.i):

1st cycle  imagine imagine
2nd cycle  imagination imagination

§42 Dependency without containment through lexical acquisition (§40.ii):

UR  /werod-/ /wætr-/  acquisition/production
SR  werod  werod-e  werod-o  wæter  wæt-u  wæt-e

Derivations:

‘troop.NOM.PL’ ‘troop.NOM.PL’ ‘water.NOM.SG’ ‘water.NOM.PL’
/werod/ /werod-u/ /wæt/ /wæt-u/

u-apocope — — werod — n.a. after obs. son
epenthesis — — — wæter
werod werod-o wæt wæt-u

§43 Generalization: Paradigmatic dependencies without containment are established indirectly through the acquisition of URs.

§44 Schema for paradigmatic dependencies without containment in cyclic frameworks:

[B] predictable from [A] ⇒ The learner sets up a shared underliner /X/ from which [A]–[B] is derived by regular phonology.

UR  /X/ acquisition/production
SR  [A] [B]

§45 Extension of paradigmatic dependencies:
Given [A’], the learner sets up the underliner /X’/ and derives [A’]–[B’] from /X’/ by means of the same regular phonology that derives [A]–[B] from /X/.
§50  confidence score  Preclassical examples

#f \[oːris\]_{GEN.SG} \rightarrow [or]_{NOM.SG} / [X]_{polysyl.,nom.}# 0.723 soror–sorōris 'sister'
#f \[oːris\]_{GEN.SG} \rightarrow [oːs]_{NOM.SG} / [X]_{polysyl.,nom.}# 0.611 honōs–honoːris 'honour'
#f \[eris\]_{GEN.SG} \rightarrow [us]_{NOM.SG} / [X]_{polysyl.,nom.}# 0.643 opus–operis 'work'
#f \[eris\]_{GEN.SG} \rightarrow [er]_{NOM.SG} / [X]_{polysyl.,nom.}# 0.374 aker–akeris 'maple'
#f \[eris\]_{GEN.SG} \rightarrow [us]_{NOM.SG} / [X]_{polysyl.,nom.}# 0.545 korpus–korporis 'body'
#f \[Vris\]_{GEN.SG} \rightarrow [Vr]_{NOM.SG} / [X]_{polysyl.,nom.}# 0.198 marmor–marmoris 'marble'

§51  The *acus problem

• The rules with the highest confidence score for neuter polysyllables are
  \[\text{[eris]}_{\text{GEN.SG}} \rightarrow \text{[us]}_{\text{NOM.SG}} / [X]_{\text{polysyl.,nom.}}\]
  \[\text{[eris]}_{\text{GEN.SG}} \rightarrow \text{[er]}_{\text{NOM.SG}} / [X]_{\text{polysyl.,nom.}}\]

• By parity of reasoning, the alternations generated by these rules should be extended to their targets as well:
  the allomorphy of *opus-ōperis should be extended to neuters with GEN.SG forms in -ēris, the allomorphy of *corpus-corporis should be extended to neuters with GEN.SG forms in -ōris,

Thus, §49+§50 predict aker–akeris > akeris–akeris N ‘maple’
marmor–marmoris > marmor–marmoris N ‘marble’

⚠ The prediction is incorrect: innovative N NOM.SG forms like *acus and *marmor do not occur.

§52  Cyclic frameworks avoid the *acus problem:

Levelling as input-restructuring (▶△)

It is trivially easy to describe the change that did happen as UR-restructuring:

\[
\begin{array}{c|c}
\text{Preclassical} & \text{Classical} \\
\hline
\text{UR} /\text{honoːs/-} & /\text{honoːr/-} \\
\text{SR} \text{ honoːs–honoːris} & \text{honoːr–honoːris}
\end{array}
\]

§53  But the paradigm extensions incorrectly predicted by Albright (§51) could not come about through UR-restructuring...
...because alternations like [opus]–[oper-] and [korpus]–[korpor-] were synchronically suppletive.

§54 There were no synchronically valid phonological rules capable of deriving the [u]–[e] alternation from a single underlying \( /V/ \):
Prehistorically, all short unstressed vowels had neutralized to [e] before [r], but this had ceased to be true when nouns like ['tempus-temperis] 'time' became ['tempus-temporis'], cf. ['temperi-'] 'in a timely manner' (Weiss 2009: 118, 239, 307).

§55 The same is true of the [s]–[r] alternation: by the Classical period, rhotacism survives as a process of phonologically driven allomorph selection, but is no longer an automatic alternation.
Synchronic exceptions include
- /s/ from historical \(/s\)/: causa 'cause'
- irregular dissimilatory blocking: miser 'wretched', but cf. 'swesor > soror
- loanwords: basis 'pedestal' (from Greek)
eetc. (Roberts 2012)

§56 Prediction §37 is confirmed!

<table>
<thead>
<tr>
<th>BRACKETING PARADOXES</th>
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The issue

§57 The term 'bracketing paradox' covers a large and heterogeneous set of phenomena (Spencer 1988: 680–681; Stump 1991: note 38). The problems they raise have received a wide range of solutions (Newell 2019).
The relevant cases for us are those in which cyclic phonological domains appear to mismatch the morphosyntactic constituents suggested by semantic scope;

\[ \Box\text{§7–§11.} \]

§58 Classic examples: English ungrammaticality (Bermúdez-Otero 2018b: 122–123) English transformational grammarian (Bermúdez-Otero 2016: 422–423)

Brugmann Fellow course, Leipzig: session ❷, 8 July 2019

Case study: transformational grammarian

§59 Paradoxical reading: 'practitioner of transformational grammar'

Bracketing suggested by semantic scope: [[transformational grammar] ian]
Bracketing needed for phonology: [[transformational] [grammarians]]

§60 Syntactic evidence against [[transformational grammar] ian]:
Grammarian behaves as a constituent:
- one-substitution: He is a generative grammarian but not a transformational one.
- right-node raising: I know many generative but few transformational grammarians.

§61 Morphological evidence against [[transformational grammar] ian]:
The noun is a domain for allomorph selection:
- BAROQUE LUTE-IST 'player of the Baroque lute' \(\leftrightarrow\) Baroque luten-ist
- BAROQUE LUTE-ER 'maker of Baroque lutes' \(\leftrightarrow\) Baroque luth-ier

§62 Semantic evidence against [[transformational grammar] ian]:
The noun is a domain for allosemic selection (in the sense of Marantz 2013):
- Modern hispanist denotes a type of hispanist.
  Idiosyncratically, hispanist does not denote someone who studies all Hispanic things but only someone who studies Hispanic culture and society.
  Hence, a modern hispanist is someone who studies modern Hispanic culture and society, and not someone who studies, say, generic variation in modern Hispanic populations.
- Nuclear physicist denotes a type of physicist (one who practises nuclear physics); nuclear physician denotes a type of physician (one who practises nuclear medicine).
  The relevant allosemes of the base physic- are only selected in the presence of the appropriate suffixes:
    - physic-\(i\) 'drug' (obsolete)
    - physic-ian 'practitioner of medicine'
    - but physic-al 'material'
    - physic-s 'science of matter and energy'
    - physic-ist 'practitioner of physics'

§63 Alternative solution:
- The correct, and only, bracketing is [[transformational][grammarians]].
- The paradoxical readings are generated in the semantics by the same mechanisms that yield non-intersective interpretations in cases like former president, wannabe actor, alleged murderer, habitual thief, and beautiful chef (e.g. Larson 1998).
REFERENCES


Brugmann Fellow course, Leipzig: session 8, 7 August 2019.


