Palatalization and Centralization in Samothraki Greek

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Summary of the argument

- We present data from Samothraki Greek on the interaction of 
  \( r \) loss, palatalisation of velars, and centralization of front 
  vowels
- Constraint-based models are good in describing *conspiracies*, 
  rule-based models are good in describing *opacity*. The 
  Samothraki facts show both
- We argue that a representational solution is to be preferred 
  over a derivational one
Palatalization and Centralization in Samothraki Greek

Three Processes of Samothraki Phonology
   Palatalization, Centralization, and r Deletion

Derivationalism in Optimality Theory
   Comparative Markedness
   Stratal OT
   Candidate Chains

A representational approach
   No opacity if the processes are well defined
   Independent evidence for BinAss
Palatalization

- Like in other Greek dialects velars are palatalized before the front vowels /i,e/:

  /fegi/  [feg’]  φέγγει  ‘he beams/shines’  (K 66)
  /toki/  [tok’]  τόκοι  ‘(bank) interests’  (K 66)
  /kima/  [k’ima]  κύμα  ‘wave’  (K 62)
  /xino/  [x’inu]  χύνω  ‘pour’  (K 63)
  /γена/  [γ’ena]  γέννα  ‘birth’  (K 63)

Our data in this paper are from Κατσάνης 1996 (= K)
/r/-deletion and lengthening

- /r/ is deleted in onsets, causing lengthening of the following vowel (K 50-55):
  
  /roγa/ [ɔːγa] ρόγα ‘nipple’
  /rema/ [eːma] ρέμα ‘stream’
  /xroma/ [xoːma] χρώμα ‘colour’
  /mavros/ [maνuːs] μαύρος ‘black’
  /krotos/ [koːtus] κρότος ‘bang’

We assume that this shows that onsets in Samothraki Greek are moraic (cf. Topintzi 2006).
Opaque interaction of /r/-deletion and palatalization

velar + front vowel sequences which are the result of r deletion are not subject to palatalization:

/krima/ [ki:ma] κρίμα ‘shame’ | [k’ima] κύμα ‘wave’
/xr’ima/ [xi:ma] χρήμα ‘money’ | [x’ima] χύμα ‘bluntly’
/kri:no/ [ki:nu] κρίνω ‘judge’ | [k’inu] (ε)κείνο ‘that’
/kremnos/ [kəmnu:s] κρεμνός ‘cliff’
Centralization is not due to length

- If the preceding consonant is not velar, we do not find centralization

| /prima/  | [piːma]  | ‘fine’ |
| /prepi/  | [peːp(i)] | ‘it must’ |
| /tripa/  | [tiːpa]  | ‘hole’ |
| /trexo/  | [teːxo]  | ‘I run’ |
| /friði/  | [fiːð]   | ‘eyebrow’ |
Opacity

- Opacity is a classical problem for Optimality Theory.
- A rule $A \rightarrow B / C_D$ is opaque if:
  - We find $CAD$, or
  - We find an A changed to B outside of context $C_D$
- Palatalization is opaque according to the first part definition: we find non-palatalized consonants next to underlyingly front vowels

Notice that technically the process is not completely opaque, since we do not find plain velars before front vowels; it is an opaque conspiracy.
A derivational analysis

<table>
<thead>
<tr>
<th>underlying form</th>
<th>krima</th>
<th>kima</th>
</tr>
</thead>
<tbody>
<tr>
<td>palatalization</td>
<td>-</td>
<td>k’ima</td>
</tr>
<tr>
<td>r deletion</td>
<td>ki:ma</td>
<td>-</td>
</tr>
<tr>
<td>centralization</td>
<td>ki:ma</td>
<td>-</td>
</tr>
<tr>
<td>output</td>
<td>ki:ma</td>
<td>k’ima</td>
</tr>
</tbody>
</table>
A conspiracy

- However, the derivational analysis runs into a classical problem for rule-based accounts: there is a conspiracy.
- Palatalisation and centralisation work on exactly the same environments, viz. a velar obstruent followed by a front vowel.
- In other words, both are responses to the same well-formedness requirement (which we will refer to as *ki).
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A representational approach
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Independent evidence for Tin Ass
An opaque conspiracy

- We thus find a (rather unique) example of a process interaction which shows the characteristics both of a conspiracy and of opacity.
- Conspiracies are the classical argument for constraints and against rules; opacity is the classical argument for rules and against constraints.
- However, various models have been developed within OT which incorporate a limited form of derivationalism.
- Yet also these models fail to capture the generalisation in an elegant way.
Comparative Markedness

- One rather weak version of derivationalism in OT is Comparative Markedness.
- In this theory, we divide every traditional markedness constraint $C$ into two markedness constraints $C_N$ and $C_O$.
- $C_O$ is violated if the marked structure already exists underlyingly; $C_N$ is violated otherwise.
- In this case we could introduce $*k_iO$ (violated by /kima/ → [kima]) and $*k_iN$ (violated by /krima/ → [kima]).
- This is a weak type of derivationalism, since we still only have two levels of representation – input and output.
Comparative Markedness does not suffice

- One conceptual problem with this approach is that it weakens our understanding of conspiracies: there is no longer one constraint, but there are two

- However, C.M. also has the technical problem that we want the solutions to the problem to be different in both cases

- In order to account for the palatalisation, we would need to state that
  \[ *ki_O \gg \text{NoCentralization} \gg \text{NoPalatalization} \]

- But in order to account for the centralization, we need to state that \[ *ki_N \gg \text{NoPal} \gg \text{NoCentral} \]
Stratal OT

- Stratal OT is a model in which phonological forms go through a sequence of phonological evaluations, each a parallel OT grammar.
- In this case, we could assume that palatalisation applies at one level, and centralisation and r deletion at another.

Stratal OT, or Derivational OT is mostly known from work by Kiparsky, Rubach, Bermúdez-Otero et al.
Constraints

- *ki: An onset velar obstruent and a following vowel should agree in palatality (Rubach 2007)
- NoCentral: Unrounded vowels should be front.
- NoPalatal: Velars should not have a palatal secondary articulation.
- *r/Onset: [r] should not occur in the onset
- Max-x: Preserve underlying timing units.
- Max-r: Preserve underlying /r/.

Max-r is used here for convenience; for a full analysis see Topintzi 2006.
### Level I

<table>
<thead>
<tr>
<th></th>
<th>kima</th>
<th>Max-r</th>
<th>*r/O</th>
<th>*ki</th>
<th>NoCentral</th>
<th>NoPalatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>槛 k’ima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>kima</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>c.</td>
<td>kıma</td>
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</tbody>
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<table>
<thead>
<tr>
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<th>krima</th>
<th>Max-r</th>
<th>*r/O</th>
<th>*ki</th>
<th>NoCentral</th>
<th>NoPalatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>槛 krima</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>b.</td>
<td>k’ima</td>
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</tbody>
</table>

The ranking of \( \text{Max-} \times \) is irrelevant at this level.
### Level II

<table>
<thead>
<tr>
<th></th>
<th>k’ima</th>
<th>*r/O</th>
<th>Max-r</th>
<th>*ki</th>
<th>NoPALATAL</th>
<th>NoCENTRAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>🍇 k’ima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>kima</td>
<td></td>
<td></td>
<td>!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>kıma</td>
<td></td>
<td></td>
<td>!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>krima</th>
<th>*r/O</th>
<th>Max-r</th>
<th>*ki</th>
<th>NoPALATAL</th>
<th>NoCENTRAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>krima</td>
<td></td>
<td></td>
<td>!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>k’i:ma</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>c.</td>
<td>kı:i:ma</td>
<td></td>
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<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>ki:ma</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>

Max-x is responsible for lengthening at this level.
Evaluation of Stratal Analysis

- The stratal analysis can capture the opacity by ordering, and to some extent the conspiracy effect.
- The latter happens by two simultaneous rerankings:
  - $\text{NoCentral} \gg \text{NoPalatal} \rightarrow \text{NoPalatal} \gg \text{NoCentral}$
  - $*r/O \gg \text{Max}-r \rightarrow \text{Max}-r \gg *r/O$
- Notice however that this is still an arbitrary reranking of various constraints.
- In particular, there is no evidence that these differences in any way are connected to morphological differences, as Stratal OT would predict.
Candidate Chain Theory

- A different way of implementing derivationalism in OT is Candidate Chain Theory (McCarthy 2006)
- This theory makes the claim that there are no arbitrary rerankings (there is only one grammar), and
- it does not need a connection between phonological derivation and morphological structure
How it works

- The Generator function can only make one change at a time (delete one segment, insert one segment, add one association line, etc.)
- Evaluation then proceeds as in standard OT
- The one output is again fed into the Generator function, which can again make one change at a time
- The procedure stops when the input of a loop equals the output (which is guaranteed to happen)
Extrinsic rule ordering

- Input and output and intermediate forms are stored in a ‘candidate chain’
- The difference of two adjacent forms in a candidate chain can be described in terms of one faithfulness violation
- There are constraints on candidate chains, which function as extrinsic rule ordering
- These constraints take roughly the following form:
  - $\text{PreC}(F_1,F_2)$: A violation of faithfulness constraint $F_2$ may not be followed by a violation of faithfulness constraint $F_1$. 

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CC and Samothraki

The relevant constraint in this case would be:

- \( \text{Prec}(\text{NoPalatal}, \text{Max-r}) \): A violation of faithfulness constraint \( \text{Max-r} \) may not be followed by a violation of faithfulness constraint \( \text{NoPalatal} \) (\( r \) deletion may not be followed by palatalization).
### Transparent case

<table>
<thead>
<tr>
<th></th>
<th>*r/O</th>
<th>MAX-r</th>
<th>*ki</th>
<th>PREC</th>
<th>NoCen</th>
<th>NoPal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. kima→k’ima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. kima</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>*!</td>
</tr>
<tr>
<td>c. kima→kıma</td>
<td></td>
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<td></td>
<td>*!</td>
</tr>
</tbody>
</table>
**Opaque case**

<table>
<thead>
<tr>
<th>krima</th>
<th>*r/O</th>
<th>MAX-r</th>
<th>*ki</th>
<th>PREC</th>
<th>NoCen</th>
<th>NoPal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. krima→k:i:ma→k’i:ma</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. krima→k:i:ma</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. krima→k:i:ma→k:i:ma</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Candidates with centralization or palatalization before r deletion are not generated because those feature changes are not optimal in that environment.
Evaluation of CC Analysis

- The CC analysis can capture both the opacity and the conspiracy aspects of the phenomenon in one single constraint ranking.
- Without stipulating a relation to the morphology which is not apparent.
- However, it does this at a great theoretical cost, viz. by using a constraint $\text{Prec}(\text{NoPalatal}, \text{Max-r})$, relating two phenomena which are not conceptually related (the opacity effect is basically stipulated).
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How do the processes look?

- We present a representational approach, in which we try to explain the fact that palatalisation is blocked in exactly those cases in which r is deleted rather than stipulate it.
- The idea is that palatalisation is spreading,
- that deletion of $r$ leaves a trace
- and that spreading is not allowed across this trace
- For this reason, *ki has to be satisfied in a different way, viz. by deletion of the palatal feature: centralization
What is palatalization?

- We assume monovalent features and feature geometry.
- Under such a view, palatalization is spreading (due to *ki)
- *NoPalatal* is a constraint against palatal vowels.

```
k   i
|   |
C-pl  C-pl
[\-\-\-]
[dors]  V-pl
|  |
[cor]
```
What is centralization?

- Centralization on the other hand is feature-loss (due to *ki)
- **NoCentral** is a constraint against placeless vowels (*Empty).

\[
\begin{array}{c|c}
{\text{k}} & {\text{i}} \\
\hline
{\text{C-pl}} & {\text{C-pl}} \\
\hline
{\text{[dors]}} & {\text{V-pl}} \\
\hline
\end{array}
\]

- We assume that *ki is best satisfied by palatalization because that preserves the underlying features rather than deleting them
What is r deletion?

An important aspect of r deletion in Samothraki is that it leaves a trace, in the form of a timing slot = lengthening of the vowel

\[
\begin{array}{c}
\times & \times \\
\hline
r & i \\
\end{array}
\]

See Topintzi 2006 for more discussion of the relevant faithfulness relation.
Why does r deletion create an environment for centralization?

- If palatalization is usually preferred, why is it dispreferred after r deletion?
- Notice that one independent difference between [kima] and [kı:ma] is the length of the vowel
- We propose that palatalization can spread from a short vowel, but not from a long vowel, maybe due to a binarity constraint on feature association:
  - BinAss(F): A feature F can be associated to maximally two positions (see McCarthy 2004, Key 2005)
Allowed and disallowed

<table>
<thead>
<tr>
<th>Allowed</th>
<th>Disallowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>x x x x</td>
<td>x x x x</td>
</tr>
<tr>
<td>p i k i</td>
<td>k i</td>
</tr>
</tbody>
</table>

No opacity if the processes are well defined
Independent evidence for BinAss
No r deletion

<table>
<thead>
<tr>
<th></th>
<th>*r/O</th>
<th>MAX-])<strong>ki</strong></th>
<th>BinAss</th>
<th>*NoCentral</th>
<th>NoPal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k’ima</td>
<td></td>
<td></td>
<td></td>
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<td>*</td>
</tr>
<tr>
<td>b. kima</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. kıma</td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>
### r deletion

<table>
<thead>
<tr>
<th></th>
<th>krīma</th>
<th><img src="max-x" alt="r/O" /></th>
<th>*ki</th>
<th>BinAss</th>
<th><em>[NoCentral</em></th>
<th>NoPal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>krīma</td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>kr'ima</td>
<td>!</td>
<td>!</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c.</td>
<td>kr'i:ma</td>
<td>!</td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>d.</td>
<td>kr:ma</td>
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<tr>
<td>e.</td>
<td>kr:ma</td>
<td>!</td>
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<td>*</td>
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</tbody>
</table>
Independent evidence for BinAss

- BinAss(F) gives us a representational way of understanding non-iterative rule application
- Examples from this can be given both for other phonological phenomena in Samothraki, in other Greek dialect and elsewhere
More binarity in Samothraki

- There is independent evidence in Samothraki that there is a binary requirement.
- This comes from r metathesis.
- In words with velar+r+front vowel+another vowel (/ayrius/ ‘wild’) we find metathesis of r rather than deletion ([ayirjus]).
- Presumably this serves to avoid superlong vowel sequences.
- Also here we find centralization, but this cannot be due directly to coda r, since underlying coda r does not have this effect ([adirfs, *adirfs] ‘brother’).
- Also, if the preceding consonant is not velar, we do not find the centralisation: (/priakoni/ → [pirjakon] ‘jagged file used to sharpen knives’, /altria/ → [altrjJa] ‘plough Pl’, /tria/ → [trija] ‘three’).
R metathesis

► /aɣrius/ → [aɣɻrjus]

► Note that the $r$ occurs in the coda of the syllable (otherwise metathesis would not lead to onset avoidance)

► and a palatal glide occurs in the onset following it

► We suppose that the palatality of the glide comes from the underlyingly front vowel

► Thus result of the $r$ metathesis is the following (Topintzi 2006)
Picture of R metathesis

\[
\begin{align*}
\text{a} & \quad \text{γ} & \quad \text{i} & \quad \text{r} & \quad \text{j} & \quad \text{u} & \quad \text{s} \\
\quad & \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad [\text{cor}] \\
\end{align*}
\]

- [j] really needs the feature, because there is no back glide
- We cannot assign [cor] only to ı, because of *ki
- But we cannot assign it to both either, because of BinAss.
- We thus only assign it to [j]
Binary spans in Cappadocian

- In Cappadocian dialects, bisyllabic harmonic spans are built at the end of the word: both vowels are the same
- Construction of the final spans is insensitive to morphological structure and (mostly) to stress
- There thus seems to be a real phonological binarity requirement

/tésera/ $\rightarrow$ [tésara] ‘four’
/ánem-os/ $\rightarrow$ [ánomos] ‘wind’
/fay-ô/ $\rightarrow$ [fóyo] ‘eat’+1Sg.PRES

Data and basic analysis from Revithiadou et al.
Non-iterative spreading

- Non-iterative spreading is a well-known phenomenon for many languages.
- It has been analyzed in terms of Comparative Markedness (which approach fails completely for Samothraki).
- But there are few other approaches on the market.
- The following example is from Ekegusii (Bickmore 1996).
- This can be seen as the result of some constraint promoting spreading, and BinAss.

/kór-a/ → [kórá] ‘to do’
/kór-er-a/ → [kóréra] ‘to do for’
/káan-er-a/ → [káánera] ‘to deny for’
/símek-er-a/ → [símekera] ‘to plant for’