An opaque conspiracy 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 centralisation 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.
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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 BinAs
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)
/γενα/ [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):

/rɔɣa/  [ɔ:ɣa]  ρώγα  ‘nipple’
/rɛma/  [ɛ:ma]  ρέμα  ‘stream’
/xɔromo/  [xo:ma]  χρώμα  ‘colour’
/maʋroʊs/  [maʋu:s]  μαύρος  ‘black’
/koːtɔs/  [ko:tus]  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:

\[ /krima/ \quad [kiri:\ma] \quad \text{kríμα} \quad 'shame' \quad | \quad [k'ima] \quad \text{κύμα} \quad 'wave' \]
\[ /xrima/ \quad [xiri:\ma] \quad \text{χρήμα} \quad 'money' \quad | \quad [x'ima] \quad \text{χύμα} \quad 'bluntly' \]
\[ /kri'no/ \quad [kiri'nu] \quad \text{κρίνω} \quad 'judge' \quad | \quad [k'inu] \quad (ε)κείνο \quad 'that' \]
\[ /kremnos/ \quad [këmnu\:s] \quad \text{κρέμνος} \quad 'cliff' \]
Centralization is not due to length

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

/primä/   [piːma]  ‘fine’
/prepi/    [peːpi]  ‘it must’
/tripa/    [tiːpa]  ‘hole’
/trexo/    [teːxo]  ‘I run’
/friði/    [fiːði]  ‘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>krīma</th>
<th>kīma</th>
</tr>
</thead>
<tbody>
<tr>
<td>palatalization</td>
<td></td>
<td>k’īma</td>
</tr>
<tr>
<td>r deletion</td>
<td>kī:ma</td>
<td></td>
</tr>
<tr>
<td>centralization</td>
<td>kī:ma</td>
<td></td>
</tr>
<tr>
<td>output</td>
<td>kī:ma</td>
<td>k’īma</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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No opacity if the processes are well defined
Independent evidence for binas

Nina Topintzi & Marc van Oostendorp
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.
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 $*k_i_O$ (violated by /kima/ → [kima]) and $*k_i_N$ (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 xx)
- **NoCentral**: Preserve underlying frontness of /i/.
- **NoPalatal**: Preserve underlying backness of /k/.
- **r/Onset**: [r] should not occur in the onset
- **Max-x**: Preserve underlying timing units.
- **Max-r**: Preserve underlying /r/.
## Level I

<table>
<thead>
<tr>
<th></th>
<th><strong>Max-r</strong></th>
<th><em>r/O</em></th>
<th><em>ki</em></th>
<th><strong>NoCentral</strong></th>
<th><strong>NoPalatal</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k’ima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<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>

<table>
<thead>
<tr>
<th></th>
<th><strong>Ident-r</strong></th>
<th><em>r/O</em></th>
<th><em>ki</em></th>
<th><strong>Max-pal</strong></th>
<th><strong>Max-back</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. krima</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. k’ima</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

The ranking of **Max-<x>** 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>ki:ma</td>
<td></td>
<td>*</td>
<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:
  - NoCentral ≫ NoPalatal → NoPalatal ≫ NoCentral
  - *r/O ≫ Ident-r → Ident-r ≫ *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.
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 $F_1$. 
CC and Samothraki

- The relevant constraint in this case would be:
  - \texttt{Prec(NoPalatal, Max-r)}: A violation of faithfulness constraint \texttt{Max-r} may not be followed by a violation of faithfulness constraint \texttt{NoPalatal} \texttt{(r deletion may not be followed by palatalization)}. 

Nina Topintzi & Marc van Oostendorp
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## Transparent case

<table>
<thead>
<tr>
<th></th>
<th>*r/O</th>
<th>ID-r</th>
<th>*ki</th>
<th>PREC</th>
<th>NoCEN</th>
<th>NoPAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
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<tr>
<td>b.</td>
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<tr>
<td>c.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>
### Opaque case

<table>
<thead>
<tr>
<th>Candidate</th>
<th>*[r/O]</th>
<th>ID-*</th>
<th><em>k</em></th>
<th>PREC</th>
<th>NOCEN</th>
<th>NOPAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. krima → kima → k’ima</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. krima → kima</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. krima → kima → k’ima</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 $\text{Prec(NoPalatal, Max-r)}$, 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 faithfulness constraint against spreading (**Max(F)**).

```
  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).

```
          k   i
       ├──   └──
  C-pl  C-pl
       │       │
[dors] V-pl
       │
   [cor]
```

- We assume that *ki is best satisfied by centralization because that preserves the underlying features rather than deleting them (**Max**).
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

\[
\begin{array}{c}
\text{x} \\
\text{r} \\
\text{i}
\end{array}
\]

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 [kı̈ma] 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:
  - **BinAs(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 r deletion

<table>
<thead>
<tr>
<th></th>
<th>*r/O</th>
<th>MAX-x</th>
<th>*ki</th>
<th>BinAS</th>
<th>*EMPTY</th>
<th>Max(F)</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>
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</table>

Nina Topintzi & Marc van Oostendorp

An opaque conspiracy in Samothraki Greek
**r deletion**

<table>
<thead>
<tr>
<th></th>
<th>*r/O</th>
<th>Max-x</th>
<th>*ki</th>
<th>BinAs</th>
<th>*Empty</th>
<th>Max(F)</th>
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<tbody>
<tr>
<td>a. krima</td>
<td>*!</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>b. k’ima</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. k’i:ma</td>
<td></td>
<td></td>
<td>*!</td>
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<td></td>
<td>*</td>
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<tr>
<td>d. ki:ma</td>
<td></td>
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<td>*!</td>
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<tr>
<td>e. k’ima</td>
<td></td>
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<td>*</td>
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</tbody>
</table>
Independent evidence for **BinAs**

- BinAs(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 ([adırfus, *adırfus] ‘brother’).
- Also, if the preceding consonant is not velar, we do not find the centralisation: (/priakóni/ → [pirjákon] ‘jagged file used to sharpen knives’, /alétria/ → [alétirja] ‘plough PL’, /tria/ → [tirjá] ‘three’).
R metathesis

- /ayrjus/ $\rightarrow$ [ayırjus]
- 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**

\[ a \gamma i r j u s \]

- [j] really needs the feature, because there is no back glide.
- We cannot assign [cor] only to one of ɣ and i, because of *ki.
- But we cannot assign it to both either, because of BinAs.
- 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/ → [tésara] ‘four’
/ánem-os/ → [ánomos] ‘wind’
/fayxo/ → [fóyo] ‘eat’ + 1Sg.Pres

Data and basic analysis from Revithiadou et al.

Nina Topintzi & Marc van Oostendorp
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Non- iterative spreading

- Non- iterative spreading is a well-known phenomenon for more 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 **BINAS**

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