Segmental phonology in OT (part 2)

In part 1 of this handout, we considered how to model the **complementary distribution** pattern in the OT framework, with respect to the velar/palatal alternations in the Greek data set. Now, we will consider the implications of our Greek analysis for factorial typology, and show that the other two distribution patterns (**contrastive distribution** and **neutralization**) are both predicted to occur, as well as a fourth pattern we can call the **inventory gap** pattern.

2. Contrastive distribution

We have motivated the ranking NoVelFrV >> *Cor-Dors >> Ident[cor] to account for complementary distribution between [k] and [c] in Greek. But it is also important to consider the other possible rankings for these three constraints, that is, their **factorial typology**.

Consider for a moment the ranking Ident[cor] >> NoVelFrV. A language with this ranking will choose not to alter the [coronal] feature of a dorsal consonant, even if that means tolerating a velar consonant in a front-vowel context.

Similarly, the ranking Ident[cor] >> *Cor-Dors gives rise to a language that never changes a [cor] specification in order to avoid a palatal consonant.

Therefore, a language with these two rankings is a language in which input palatals stay palatal, and input velars stay velar, regardless of the phonological context. In other words, palatals and velars are able to contrast in all phonological contexts: they are in **contrastive distribution**, which means that they are separate phonemes of the language.

There are two different rankings that fit this pattern:

- Ident[cor] >> NoVelFrV >> *Cor-Dors
- Ident[cor] >> *Cor-Dors >> NoVelFrV

While these two rankings might possibly produce different phonological patterns in some other aspect of the language, as far as the status of palatals vs. velars goes, both rankings produce languages with contrastive distribution.

The following tableaus confirm that both velar and palatal inputs are maintained in both palatalization and non-palatalization contexts. (Because the ranking between *Cor-Dors and NoVelFrV is not relevant, these two constraints are shown unranked, with a dotted line between them in the tableaus.)

Note that in this discussion, we are not showing W and L marks in the tableaus. This is because we are not making an argument about how the constraints should be ranked to get a particular output. Instead, we are starting from a particular constraint ranking and looking to see which output is chosen as a winner, given that ranking.

(1) Contrastive distribution

(a) /ke/ → [ke]

/ke /	IDENT[COR]	NOVELFRV	*COR-DORS
☞ a. ke		*	
b. ce	*!		*

(b) /ce/ → [ce]

/ce /	IDENT[COR]	NOVELFRV	*COR-DORS
a. ke	*!	*	
☞ b. ce			*

(c) /ko/ → [ko]

/ko /	IDENT[COR]	NOVELFRV	*COR-DORS
☞ a. ko			
b. co	*!		*

(d) /co/ → [co]

/co /	IDENT[COR]	NOVELFRV	*COR-DORS
a. ko	*!		
☞ b. co			*

(2) General ranking for **contrastive distribution**:

F >> { Context-free M, Context-specific M }

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3. Neutralization

Consider the effect of yet another ranking of these three constraints:

- NOVELFRV >> IDENT[COR] >> *COR-DORS

This ranking is in a sense intermediate between the rankings for complementary distribution (see previous handout) and contrastive distribution (above). The ranking NOVELFRV >> IDENT[COR] means that in a front-vowel context, all dorsals will be palatalized, regardless of their input specification.

But what happens *outside* of the specific context for palatalization? Where the constraint NOVELFRV is not at stake, what is relevant is only IDENT[COR] >> *COR-DORS, which means that it is

better to *keep* a palatal consonant (being faithful to its [COR] feature) than to avoid palatals. So in the elsewhere environment, we maintain a distinction between velars and palatals.

To summarize, with this ranking, velars and palatals are contrastive, except in a certain environment where they are both realized as palatals. This is **neutralization**.

(3) Neutralization

(a) /ke/ → [ce]

/ke/	NoVelFrV	Ident[cor]	*Cor-Dors
a. ke	*!		
☞ b. ce		*	*

(b) /ce/ → [ce]

/ce/	NoVelFrV	Ident[cor]	*Cor-Dors
a. ke	*!	*	
☞ b. ce			*

(c) /ko/ → [ko]

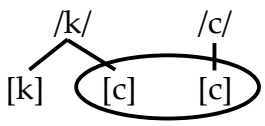
/ko/	NoVelFrV	Ident[cor]	*Cor-Dors
☞ a. ko			
b. co		*!	*

(d) /co/ → [co]

/co/	NoVelFrV	Ident[cor]	*Cor-Dors
a. ko		*!	
☞ b. co			*

In other words, we have a language in which /k/ and /c/ are separate phonemes, because in a non front-vowel environment such as [_o...] or [_r...], there are potentially minimal pairs. But input /k/ becomes [c] in one environment, namely, before front vowels.

(4) Neutralization, schematically



(5) General ranking for **neutralization**:

Context-specific M >> F >> Context-free M

4. Inventory gaps

There are two more possible rankings for these constraints:

- *COR-DORS >> NOVELFRV >> IDENT[COR]
- *COR-DORS >> IDENT[COR] >> NOVELFRV

In both cases, we have *COR-DORS >> NOVELFRV, which means that palatal consonants are avoided even in palatalization contexts. Both rankings also include *COR-DORS >> IDENT[COR], which means that palatal consonants are avoided even if they were in the input. Therefore, both of these rankings produce a language in which palatal consonants simply **never appear**.

(6) No palatal consonants at all

(a) /ke/ → [ke]

/ke/	*COR-DORS	NOVELFRV	IDENT[COR]
☞ a. ke		*	
b. ce	*!		*

(b) /ce/ → [ke]

/ce/	*COR-DORS	NOVELFRV	IDENT[COR]
☞ a. ke		*	*
b. ce	*!		

(c) /ko/ → [ko]

/ko/	*COR-DORS	NOVELFRV	IDENT[COR]
☞ a. ko			
b. co	*!		*

(d) /co/ → [ko]

/co/	*COR-DORS	NOVELFRV	IDENT[COR]
☞ a. ko			*
b. co	*!		

(7) General ranking for **inventory gaps**:

Context-free M >> { Context-specific M, F }

5. Factorial typology and cross-linguistic predictions

The six possible rankings of the three constraints discussed here produce four kinds of distribution: **complementary distribution** between allophones [k] and [c] (§1/previous handout), **contrastive distribution** between phonemes /k/ and /c/ (§2), **neutralization** where /k/ and /c/ are separate phonemes of the language but are both realized as [c] in the palatalization context (§3), and the **inventory gap** pattern where only [k] ever appears and there is no [c] in surface forms at all (§4).

However, none of the six rankings of these three constraints will produce a language that has palatal consonants in surface forms without having any velar consonants in surface forms. This is a good result, as languages don't ever seem to have this pattern. (This indicates that we have made good choices about defining our constraints, since the factorial typology is making accurate predictions about language typology.)

What we are seeing here is that the **same context-free markedness constraint** can cause **different effects** depending on how high it is ranked in the constraint hierarchy of a given language. Ranked at the top, it forces the language to lack a certain segment type altogether. Ranked below a context-specific markedness constraint, it it responsible for causing the "other" allophone of a phoneme to be the default.

This means that an OT approach to complementary distribution makes a **very general, very interesting prediction**: The same segment or natural class that is avoided altogether in some languages will be the less-preferred allophone of a phoneme (i.e., *not* the elsewhere allophone) in other languages. A direct connection is thus made between two patterns which, in a rule-based approach, cannot be *directly* connected as part of the model of mental grammar (even though phonologists understood long ago that the two patterns are in fact related; "phonetic naturalness" in terms of cross-linguistically preferred or dispreferred segments has often been mentioned in arguing in favor of a proposed UR or rule).

Here is another useful consequence of this connection between segments missing from inventories and segments that act as context-specific allophones: Knowing that this kind of relationship often exists can help us identify and formally define new markedness constraints, because it gives us a general criterion for understanding the role of context-free and context-specific markedness constraints in phonological patterns.