Week 4 – Intro/Summary of Rule Writing and Optimality Theory

September 18, 2012

1 Phonemic Analysis

We have examined three units of phonology so far.

1. Speech sounds

2. Phonemes

3. Features

We have seen that there are two levels.

1. A concrete, surface, phonetic level

2. An abstract, underlying, phonological level

We associate speech sounds and allophones with the concrete, surface level. We associate phonemes with the abstract, underlying level. Features are defined in terms of acoustic or articulatory properties of speech sounds, and therefore are immediately associated with the concrete, surface level. However, certain features, or feature values, could be marked as having a special, abstract phonological status, because they play an important, *distinguishing* role in establishing contrast (cf. Dresher 2009). These are often called *distinctive features*.

We have observed that in many languages certain speech sounds are in *complementary distribution*. This means:

1. they occur in non-overlapping environments

2. the sum of their environments adds up to all logically possible environments

Here is an analogy from *complementary angles* from geometry.
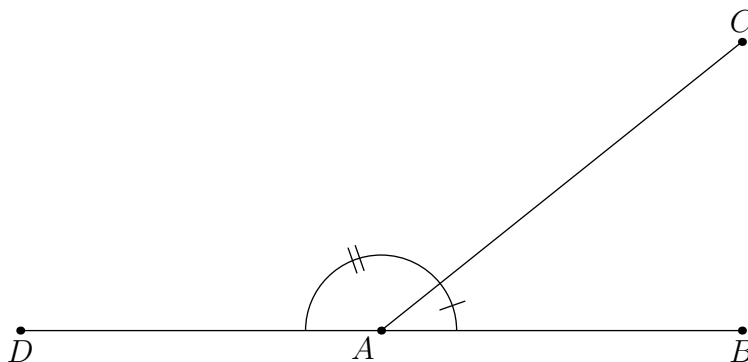
1. The two angles do not overlap.

2. They add to 180 degrees.

When doing phonemic analysis, we don't always find that every sound occurs in every logically possibly environment. We have the difficult problem of deciding which gaps are accidental and which are systematic. Experience helps. It is preferable to make generalizations, provided you are explicit about it.

When the sounds in complementary distribution are also *phonetically similar*–that is they have many properties in common–we can hypothesize they are allophones of a phoneme.

Below we examine how this systematic variation in pronunciation is explained with phonological rules and within Optimality Theory.

2 Explanations from Rule-based theories

How is this systematic varation explained with rules? There are three steps.

1. Typically, the "elsewhere" allophone is selected as having phonemic status and the other allophones are found to occur in specific contexts.

2. There is the strong theoretical claim that mental representations of lexical items only contain these phonemic sounds. These representations are the *underlying* representations. The actual pronunciations are the *surface* representations.

3. For each context where a non-identical allophone occurs, there is a phonological rule that transforms the underlying phoneme into the allophone in that context.

Thus the reason why the observed distribution exists follows from a relatively free distribution of the "elsewhere" allophone underlyingly and its transformation in specific contexts as given by the rules.

★ Let's apply this principle to the Georgian example.

Why is the "elsewhere" allophone chosen to have phonemic status and not some other one? After all, we can again write enough rules to transform any phoneme we want into something provided we write enough rules referring to all the relevant contexts.

Here the principle of "Minimum Description Length" comes into play: A shorter, simpler, more economical grammar is preferred over a longer, more complex, less economical one.

★ Let's see how the MDL principle applies in the case of the Georgian example.

3   Explanations from OT

In Optimality Theory, there are no rules! Only constraints. And the constraints come in two kinds.

1. Those that penalize surface representations because the surface representations match the constraints specifications for violation (**markedness constraints**); and

2. those that penalize changes between the underlying representation and the surface representations (**faithfulness constraints**).

Markedness constraints say "SR! Don't look like this!" Faithfulness constraints say "UR/SR! Do not change the UR in this way to become the SR!"

In OT, the constraints are prioritized. Some constraints are more important than others. This prioritization is *language-specific*. When a constraint A is more important than constraint B we say "Constraint A *outranks* B."

For example in Georgian, it is more important to not have the velarized lateral before front vowels than it is to preserve velarization on laterals. In OT, each of these pressures can be stated as constraints as follows.

1. (a) Generalization: Velarized laterals do not precede front vowels.

   (b) Violation assignment: Assign one violation for every velarized lateral which precedes a front vowel in the surface form.

   (c) Formal notation: *ɫ[+syllabic,-front].

2. (a) Generalization: The value of the surface realization of the feature [Dorsal] should match its underlying value.

   (b) Violation assignment: Assign one violation for every value of the feature [Dorsal] whose value in the surface form in some speech sound differs from its value for the corresponding speech sound in the underlying form.

   (c) Formal notation: IDENT(DORSAL)

/łeło/	*ł[+SYLLABIC,-FRONT] IDENT(DORSAL)
a. łeło	*
b. leło	*
c. lelo	**

Table 1: This is an OT Tableau. The asterisks show that the surface form [łeło] violates the markedness constraint, but not the faithfulness constraint, and that the surface forms [leło, lelo] violate the faithfulness constraint, but not the markedness constraint. Also, [lelo] violates the faithfulness constraint twice.

The table below illustrates how the violations are assigned. Note since the IDENT(DORSAL) constraint incurs a violation for every value of features in the underlying form which do not match their values in the surface form. This means that in underlying forms, sound segments have all their features! (Hence in OT as it is practiced, there is no special status for *distinctive* features.)

According to the constraint *ł[+SYLLABIC,-FRONT], candidates [leło, lelo] are more optimal, or *harmonic*, than the "fully-faithful" candidate [łeło]. On the other hand, the constraint IDENT(DORSAL) makes a three way harmony distinction:

łeło > leło > lelo

Constraints, and their rankings, *order* candidates. This order is sometimes called the *harmonic ordering* and the most harmonic candidate is the optimal one, and is the output of the grammar (the underlying representation is the input). It is common to talk about the output as the *winning candidate* or as the surface form.

Here is an OT tableaux illustrating an analysis where *ł[+syllabic,-front] outranks IDENT(DORSAL) (as indicated by the solid line seperating the two and the left/right order).

/łeło/	*ł[+SYLLABIC,-FRONT]	IDENT(DORSAL)
a. łeło	*	
b. ☞ leło		*
c. lelo		**

Table 2: Here we have ranked the markedness constraint above the faithfulness constraint (indicated by the left-to-right ordering and the solid vertical line). This tableau shows then that [leło] is more *harmonic* than [łeło] with respect to this ranking. The "pointy finger" indicates that this is the most harmonic candidate surface form in the tableau.

Let's now imagine a version of Georgian, where there this ranking was reversed.

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/łeło/	IDENT(DORSAL)	*ł[+SYLLABIC,-FRONT]
a. ☞ łeło		*
b. leło	*	
c. lelo	**	

Table 3: Here we have reversed the ranking of the constraints. It is now more important NOT to change the value of a voicing features than it is to avoid the markedness constraint. Hence here [łeło] is more harmonic than [impala].

★ What does constraint ranking have in common with alphabetical order?

★ What happens if /lelo/ is submitted to this grammar?

★ Is there potentially a contrast between [l] and [ł] before non-front vowels?

★ Let's discuss the implications of the answer to the last question for OT analyses of phonemes.

 Two big questions about OT:

1. What are the constraints?

2. How are the candidates determined?

 The answers so far on OT have been roughly as follows.

1. There are finitely many constraints. Every language has the *same* constraints because the constraints are part of *universal grammar*. The *only* difference across languages is the constraint *ranking*. Research in OT tries to uncover the nature of the constraints.

2. There are possibly *infinitely many* candidates. In principle, any possible surface form is included. Counterintuitively, there are computational ways of finding the optimal (or most harmonic) candidate despite there being possibly infinitely many of them.

★ Let's try to work out an analysis for Mohawk, where long vowels only occur in stressed syllables when followed by a CV sequence.

4   Preview of next class

Features are phonological units "smaller" than speech sounds. Next class we examine the concept of the syllable, which are phonological units "larger" than the speech sounds. Once we cover the syllable, this will conclude our unit on phonological units, and we will begin to study phonological processes and the key phonological principle of morphological analysis.

References

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