Contrast Analysis

Jeffrey Heinz

February 17, 2016

1 Allophony in OT

How can we account for the systematic variation in the pronunciation of the sounds? In OT, there are *no* morpheme structure constraints. This is 'the principle of the rich base.'

Principle of the Rich Base No constraints hold at the level of underlying representations. (Kager, 1999, p. 19)

This is not just a matter of perspective, though it is that too. It also means that the job of the OT grammar is to convert *any logically possible* underlying form into a well-formed surface form. As we will see this leads to a very different perspective on phonemes.

Let's consider first the complementary distribution of oral and nasal vowels in English. In OT, consider first the following constraints.

(1) *[NASAL V]
Nasal vowels are marked.
Assign one violation for every nasal vowel.

(2) *[ORAL V]N
Oral Vowels cannot be followed by Nasals.
Assign one violation for every [oral vowel][nasal] sequence.

(3) IDENT(NASAL)
Don't change the nasality of sounds.
Assign one violation for an input segment whose corresponding output segment has a different specification for nasality.

If in an OT grammar, *[NASAL V] outranks the other two constraints then this would describe a language where there are no nasal vowels at all. Allophonic variation occurs with a different ranking. When the *contextual markedness* constraint outranks the *context-free* markedness constraint, which outranks the faithfulness constraint, we obtain allophonic variation like we see in English.

contextual markedness	>>	context-free markedness	>>	faithfulness
*[ORAL V]N	>>	*[NASAL V]	>>	IDENT(NASAL)

Because of the rich base, it is important that we consider underlying forms like /bɛd/ and /bɛ̃d/.

Let's work this out for English on the board. And then again for Papago.

1.1 Lexicon Optimization

In the analysis above, both /bɛd/ and /bɛ̃d/ map to [bɛd]. So which is the underlying form? One answer proposed in OT is Lexicon Optimization.

Lexicon Optimization If there are several underyling forms $u_1, u_2, \ldots u_n$ which map to a surface form M, the the one that violates the most important faithfulness constraints the least is the underlying form.

The idea here is to choose the one that is most like the surface form.

What does this mean the underlying representations of *bed* and *Ben* are? How is this similar or different to what a rule-based analysis offers?

1.2 Summary

SPE and OT provide very different views about the nature of the underyling forms. SPE establishes phonemic categories and derives surface variation from rules. OT instead, by principle of the rich base, does not constraint the underlying forms at all. Contrast and nuetralization of underlying contrasts emerge from the interaction of markedess and faithfulness constraints, as we will see in more detail in the next section.

2 Contrast, Allophonic Variation and Neutralization

As we have seen, there is no phonemic inventory per se in Optimality Theory. Instead, the interaction of markedness and faithfulness constraints give rise to underlying speech sounds being allowed to surface so that they are either contrastive, in allophonic variation, or completely neutralized everywhere or only in certain positions.

Contrast emerges when faithfulness is ranked on top.

Allophonic variation emerges when contextual markedness outranks context-free markedness outranks faithfulness.

Complete neutralization emerges when context-free markedness outranks both contextual markedness and faithfulness.

Positional neutralization emerges occurs when contextual markedness outranks faithfulness which outranks context-free markedness.

Let's see some examples.

2.1 Contrast

Imagine a language like French, where nasality is contrastive. In this language this is the case even before nasals. In other words:

- /bɛ/ maps to [bɛ] and
- /bɛ̃/ maps to [bɛ̃] and
- /bɛn/ maps to [bɛn] and
- /bɛ̃n/ maps to [bɛ̃n] and so on.

So how do these constraints need to be ranked to ensure this outcome? Faithfulness must outrank the other two. The first tableaux below shows that it is more important to preserve underlying nasality than to avoid nasal vowels.

/bɛ̃/	IDENT(NASALITY)	*[NASAL V]
a. ☞ bɛ		*
b. bɛ̃	*!	

Similarly, if the underlying sound is oral, we preserve it on the surface, even before nasals. The tableauz below in conjunction with the one above, establish that the IDENT constraint also outranks *[ORAL V]N.

/bɛn/	IDENT(NASALITY)	*[ORAL V]N	*[NASAL V]
a. ☞ bɛn		*	
b. bɛ̃n	*!		*

In short, the faithfulness constraint must rank above the markedness constraints because the language preserves the underlying nasality no matter what.

2.2 Allophonic Variation

Now consider a language like English where there is allophonic variation. Nasal vowels occur before nasals but oral vowels occur elsewhere.

- /bi/ maps to [bi] and
- /bin/ maps to [bĩn] and so on.

In order to get allophonic variation, the contextual markedness constraint must outrank the context-free markedness constraint, which outranks the faithfulness constraint. The first tableaux establishes that*[NASAL V] outranks IDENT(NASALITY).

/bĩ/	*[NASAL V]	IDENT(NASALITY)
a. ☞ bi		*
b. bĩ	*	

The second tableaux establishes that *[ORAL V]N outranks both *[NASAL V] and IDENT(NASALITY).

/bin/	*[ORAL V]N	*[NASAL V]	IDENT(NASALITY)
a. ☞ bĩn		*	*
b. bin	*		

In other words, the language is willing to change nasality of underlying sounds to get oral vowels on the surface, except if that would violate the higher ranked contextual markedness constraint. What outputs does this ranking consider optimal for /bi/ and /bĩn/?

2.3 Exercise

Let's do an OT analysis of Papago of the allophonic variation in Papago. Recall that the alveolar stops [t,d] are in complementary distribution with the alveolar affricates. The affricates occur before high vowels, the stops elsewhere. The SPE analysis posited the phonemes /t,d/ and a rule of spirantization:

(4) Spirantization
Alveolar stops become affricates before high vowels.
[alveolar,stop] $\longrightarrow$ affricate / ____ [high,V]

Papago (Tohono O'odham): spoken in Arizona (Saxton &Saxton 1969)

tatai	'tendon'	*činig*	'to move the lips'
tatal	'mother's younger brother'	*čikpan*	'work'
tamš	'gums'	*daswua*	'to pile'
tohnto	'degenerate'	*doaǰida*	'healing'
tokih	'cotton'	*ǰigos*	'storm'
todsid	'to frighten'	*ǰiwikon*	'to scrape'
čuagia	'net bag'	*ǰuni*	'dried cactus fruit'
čučul	'chicken'	*dakpon*	'to slip'
čukma	'dark'	*do?ag*	'mountain'
čiposid	'to brand'	*ǰusukal*	'lizard sp.'
čiłwin	'to rub'	*ǰuhki*	'rain'
čigitog	'to think'	*ǰiwhiadag*	'arrival'

2.4 Complete Neutralization

In some languages, there are no nasal vowels anywhere. In other words

- /bi/ maps to [bi] and
- /bĩ/ maps to [bi] and
- /bin/ maps to [bin] and
- /bĩn/ maps to [bin] and so on.

How do the constraints have to be ranked this time? Make the ranking arguments.

★ How is complete neutralization handled in SPE?

2.5 Contextually Limited Contrasts (Positional Neutralization)

In Toba Batak (Austronesian), there are near-minimal pairs indicating a voicing contrast.

[pinoppar]	'descendent'	[biaŋ]	'dog'
[dukkar]	'let out'	[tuak]	'palm wine'
[korea]	'Korea'	[garut]	'name of town in Indonesia'

But word-finally all stops are voiceless.

[sukkup]	'adequate'	[surat]	'letter'
[hotop]	'fast'	[rappok]	'steal'
[dohot]	'with'	[halak]	'man'

This looks like Russian. However, unlike Russian, there are no alternations which indicate any of the roots have voiced obstruents word-finally!

★ How would this be accounted for in SPE?

★ How about in OT?

In short, a full description of a phonology of a language not only describes which sounds are contrastive, but also in which environments they contrast, and in which environments they do not.

References

Kager, René. 1999. *Optimality Theory*. Cambridge University Press.