RULES AND CONSTRAINT: DERIVATIONAL vs. CONTSTRAINT-BASED APPROACHES TO PHONOLOGY

A.   Additional basic phonological concepts relevant to comparing the two approaches:

1.   **Markedness**: Those characteristics of languages that are considered to be more complex and/or universally rarer in languages. "It is an abstract property, referring to the *unusualness* or difficulty of a sound or process". (Odden, 2005)

In the contrast /p/:/b/ in English, /b/ is characterized by the presence of voicing, while /p/ lacks voicing.

In the contrast /pʰ/ : /p/ in Thai, /pʰ/ has aspiration, while /p/ lacks it.

The opposition member which is characterized by the presence of a mark is said to be *marked*, while the member which is characterized with the absence of the mark is said to be *unmarked*.

2.   **Morphophonemics**: Analysis and classification of the *phonological* factors which affect the pronunciation of morphemes or, correspondingly, the *grammatical factors* which affect the pronunciation of phonemes.

B.   Rules and constraints

Derivational Approach: the surface forms are derived by ordered rules (each rule, except the first one, applies to the output of the preceding rule).

Constraint-based Approach: the surface forms are constrained – forms not conforming to these constraints are rejected.

OPTIMALITY THEORY (OT) is a constraint-based theory; it holds that there is a set of possibl*e pronunciations* for any particular *form*.

Form = INPUT
Pronunciation = OUTPUT

Two premises of the theory:
1. The phonology of any language is determined by the ranking of the set of universal constraints → *constraint hierarchy*.

2. Constraint can be violated: if there are *contradictory constraints*, the one that is ranked higher will have priority, the other(s) will be violated.

These premises explains why languages have different phonologies.

The specific generalizations of a language are expressed in the selection of the *best candidate pronunciation* for some input.

The selection of the optimal candidate is accomplished by *constraints* on the mapping from input to output.

There are two forces at work for determining the optimal output:

a. Faithfulness → the force that attempts to make the *output* identical to the *input.*
b. Unmarked way of pronunciation of the forms.

The interaction of these two forces determines the *output.*
These two forces are represented by *universal constraints* – languages rank them *differently*.

There are three constraints representing Faithfulness:

a. MAX-IO: each segment in the input (I) has a corresponding segment in the output (O)
   Deletion of segments is prohibited.
b. DEP-IO: each segment in the output has a corresponding segment in the input; the output is *dependent* on the input, and the constraint is violated by an inserted segment.
   Insertion of segments is prohibited.

c.   IDENT (F): every feature (F) of the input segment is *identical* to every feature in the output segment.

> *A segment in the input is identical to the corresponding segment in the output.*

EVAL (Evaluation): the operation of evaluating the possible output forms. The evaluations are presented in *tableaux.*
Constraints are shown in *columns*, the forms to be evaluated are shown in *rows.*
Constraint violation: *
Winning candidate: ☞

> Constraint ranking is encoded with the left-to-right ordering of constraints
> The violation eliminates that form: ***!**
> Shaded cells: in that column the constraints are *irrelevant* to the fate of the from in that row

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COMPARE THE ANALYSIS OF THE ENGLISH PLURAL AS PRESENTED IN BOTH THE RULE-BASED AND THE CONSTRAINT-BASED APPROACHES
(SECTION 3.4)

EXAMPLE: ASPIRATION (in English)

Assumptions:
- aspiration is absent in the input
- candidate pronunciation can occur freely

Aspiration Constraint: Syllable-initial voiceless stops must be aspirated if the syllable is stressed.

pie   [pʰaj]

Input: /paj/

Candidate pronunciations: [paj] and [pʰaj]

The Aspiration Constraint will select the second candidate: [pʰaj]

Tableau: Analysis of [pʰaj]

	/paj/	Aspiration
☞	[pʰaj]	
	[paj]	*

Constraint violation: *

Winning candidate: ☞

Problem: What about words like [spaj] ?

Since the Aspiration Constraint is unviolated, it could surface as * [spʰaj] – a choice between the candidates is impossible.

Tableau: Analysis of [s**paj**]

/spaj/	Aspiration
[spʰaj]	
[spaj]	

There are two solutions to this problem:

i.   including a second constraint – Antiaspiration Constraint:
                        Consonants after [s] are not aspirated.

Tableau: Analysis of [s**paj**]

	/spaj/	Aspiration	Antiaspiration
	[**spʰaj**]		*
☞	[**spaj**]		

Problem with this approach:
The Antiaspiration Constraint simply recapitulates, in the negative, the Aspiration Constraint.

The Antiaspiration Constraint misses the *general fact about phonological derivations*:

> Forms are what they appear to be, unless there is a reason to believe otherwise, i.e., outputs do not differ from inputs, unless they are forced to.

ii.   Posit a general FAITHULNESS constraint.

Faithfulness Constraint: The output is identical to the input.

To account for the fact that this constraint can be violated in forms like [**pʰaj**]**,** we assume that *constraints differ in their importance*.

In English, Aspiration is more important than the Faithfulness Constraint.

Aspiration outranks the Faithfulness Constraint

A violation of a higher-ranked constraint has a greater effect than a lower-ranked constraint.

Tableau: Analysis of [**pʰaj**]

/**paj**/	Aspiration	Faithfulness
☞ [**pʰaj**]		*
[**paj**]	*!	

NOTE: Constraint ranking is encoded with the left-to-right ordering of constraints; Both candidates get a violation, but the higher violation is the telling one: indicated by **!**
(see above)

Notice, that the violation of the general Faithfulness Constraint is irrelevant because of the violation of the higher-ranked aspiration. This is indicated with shading the lower-ranked constraint.

Tableau: Analysis of [s**paj**]

/spaj/	Aspiration	Faithfulness
[s**pʰaj**]		*!
☞ [s**paj**]		

Here Faithfulness is relevant, because there is no violation of aspiration.

Approach (ii) is superior to Approach (i), because

- the Faithfulness Constraint does not recapitulate any part of the Aspiration Constraint
- the Faithfulness Constraint is a direct reflection of the inertia of the input

Constraints can interact via the relationship of *importance* which is formalized as *ranking*.

Tableau: Two interpretations of ranking

/x/	A	B
[y]	*!	
☞ [z]		**

/x/	A	B
☞ [y]	*	
[z]		**!

First Tableau: Candidate [z] wins, because constraint **A** *strictly outranks* constraint **B**. No number of violations of **B** is sufficient to overpower the higher ranked constraint. This ranking relationship is termed STRICT RANKING (see below).

Second Tableau: Candidate [y] wins, because two violations of the lower-ranked constraint B are sufficient to overpower the single violation of constraint.

STRICT RANKING: *One* violation of a higher-ranked constraint is worse than *any number* of violation of a lower-ranked constraint.

In OT, *Strict Ranking* is adapted (by most).

Ranking Principle: All constraints are strictly ranked.

Proper mapping from INPUT to OUTPUT

GEN (=generate)

Aspiration example: so far only Aspiration has been allowed in the mapping from INPUTS to OUTPUTS.

However, phonological generalizations govern *other properties* of sounds as well.

Three approaches could be taken here:

1. Languages differ in terms of what properties GEN can manipulate.
    For example, English can manipulate Aspiration, French could not.
    Problem: this approach would expand the domain in which OT could treat
    phonological generalizations.

2. Maintain the universality of GEN, but limit it in some ways.
    Two types of limit:
    a. substantive – it would prevent GEN from manipulating phonetic properties
        that never figure in some phonological generalization: For example, assuming
        (falsely), that there were no generalizations in any language that affected the
        nasality of vowels → i.e., disallowing GEN from altering the nasality of a
        vowel.
    b. formal – not allowing GEN such as */t/ → [r] / ___ [ɒ]

3. Enrich our understanding of Faithfulness: For example, nothing but the Aspiration
    value should be affected.

If the Faithfulness Constraint is *decomposed* into separate constraints requiring
faithfulness to the INPUT, then we must specify the different rankings of those
constraints with respect to Aspiration.

<center>FAITHFULNESS CONSTRAINT DECOMPOSED</center>

Faithfulness (Aspiration)
        The output is identical to the input with respect to Aspiration.

Faithfulness (Voicing)
        The output is identical to the input with respect to Voicing.

Faithfulness (POA)
        The output is identical to the input with respect to Place of Articulation.

Faithfulness (MOA)

      The output is identical to the input with respect to Manner of Articulation

Faithfulness (Vowels) [preliminary]

      The output is identical to the input with respect to the number of vowels.

    These subconstraints are abbreviated as F(X)

Tableau: Faithfulness (X)

/paj/	F(VOI)	F(POA)	F(MOA)	F(V)	ASP	F(ASP)
☞ [pʰaj]						*
[paj]					*!	
[baj]	*!					
[maj]			*!			
[apaj]				*!		

Here, alternative candidates are rules out by higher-ranked faithfulness constraints.

        X >> F(X)

(>> indicates ranking)

Choosing between rules and constraints:

In a derivational approach, sometimes *both* -- rules and constraints -- are needed. Further, in a rule-based phonology, constraints are also needed to account for the *well-formedness* of morphemes having only a single form.

Duplication Problem:

αvoice - αvoice : Sequences of obstruents within the syllable must agree for voicing (English)

*[æbs] *[æpz] *[zti:] *[sbi:] ungrammatical

[ɔks] *ox* [ædz] *adze*   grammatical

A constraint-base approach will apply to *all* forms, regardless of the forms being derived or not.

How does OT address the issues that concerns linguists?

a. **LANGUAGE VARIATION** is characterized as different rankings of the same set of constraints.
b. **SPECIFIC PATTERNS** are derived from language-particular rankings of these constraints.
c. **UNIVERSALS** are present in the universal – but violable – constraints.
d. **MARKEDNESS** is inherent in the model.

   - each constraint is a markedness statement
   - specific aspects of markedness result from ranking.