Generative Grammar

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Day 5:
Optimality Theory

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Classical generative phonology – the SPE model:

Chomsky, N. and M. Halle. 1968. *The Sound Pattern of English*. New York: Harper and Row.

- surface phonological forms are derived from underlying representations;
- phonology must provide explicit algorithms that derive all the existing surface phonological forms of a given language (and only those);
- analyses are stated in terms of rewrite rules (formal simplicity and explicitness), which are crucially applied in the appropriate sequence.

Rewrite rules (derivational, sequential, processual analysis):

(i) A → B / X __ Y

(ii) [+voiced] → [-voiced] / __ #

(iii) σσ → ¹σσ / __ #

σ - syllable, ¹ - main stress, # - word boundary

Example: palatalization in Polish
(consonants get palatalized when followed by [i]):

[+cons] → [+high, -back] / __ [-cons, +high, -back]

Phonological representations are linear sequences of segments (matrices of feature values):

[pa] = [+cons, -syll, -son, …] [-cons, +syll, +son, …]

Feature	p	b	m	f	t	l	š	ś	j	k
SYLL	-	-	-	-	-	-	-	-	-	-
CONS	+	+	+	+	+	+	+	+	-	+
SONOR	-	-	+	-	-	+	-	-	+	-
CONTIN	-	-	-	+	-	-	+	+	+	-
VOICED	-	+	+	-	-	+	-	-	+	-
CORON	-	-	-	-	+	+	+	+	+	-
ANTER	+	+	+	+	+	+	-	-	-	-
NASAL	-	-	+	-	-	-	-	-	-	-
LATER	-	-	-	-	-	+	-	-	-	-
HIGH	-	-	-	-	-	-	-	+	+	+
BACK	+	+	+	+	+	+	+	-	-	+

The idea of binary features was obviously inspired by Trubetzkoy and Jakobson (the latter was Halle's teacher at Columbia; *The Sound Pattern of English* is dedicated to Jakobson).

Jakobson, Roman, Gunnar Fant, and Morris Halle. (1952). *Preliminaries to speech analysis*. Cambridge Mass.: MIT Press.

Jakobson, Roman and Morris Halle (1956). *Fundamentals of language*. 's-Gravenhage: Mouton.

Rule ordering is crucial:

A → B / X __
A → C / __ Y

Depending on the ordering of the above rules the underlying sequence /XAY/ will surface as either [XBY] or [XCY]

1. A → B / X __ /XAY/ → XBY
2. A → C / __ Y not applicable

1. A → C / __ Y /XAY/ → XCY
2. A → B / X __ not applicable

Optimality Theory (OT):

- McCarthy, John J. & Alan S. Prince (1993a), „Generalized alignment", in: *Yearbook of morphology*, ed. Geert Booij & Jaap van Marle, Kluwer, Dordrecht, p. 79-153.
- McCarthy, John J. & Alan S. Prince (1993b), *Prosodic Morphology I: Constraint interaction and satisfaction*, ms., University of Massachusetts, Amherst, Rutgers University, New Brunswick, N.J.
- Prince, Alan S. & Paul Smolensky (1993), *Optimality Theory: Constraint interaction in generative grammar*, ms., Rutgers University, New Brunswick, N.J. & University of Colorado, Boulder.

OT focuses mostly on phonology (although it has also been applied to other areas, in particular syntax).

Similarly to other generative frameworks, OT assumes two levels of representation:

- input/underlying form (abstract, idiosyncratic, unpredictable)
- output/surface form (phonetic, predictable, dependent on the underlying structure).

OT criticizes classical generative phonology for its derivationalism.

OT rejects multiple stages of derivation, as well as the idea of rewrite rules. Multi-level derivations are implausible because they imply too many abstract intermediate derivational stages which do not correspond to any psychological/phonetic reality. Rewrite rules are claimed to lack explanatory power and psychological reality. Such rules are totally arbitrary and do not explain **why** certain processes take place.

Phonology should account for the fact that some rules (processes) are much more likely to be attested in natural languages than others – cf:

(i) [+voiced] → [-voiced] / __ #
(final devoicing)
(ii) [-voiced] → [+voiced] / __ #
(final voicing)

OT assumes that grammar is a function that maps underlying forms to surface forms. OT focuses on surface structures (and conditions that shape them), rather than on derivations.

The surface form of a given word/morpheme is always viewed as one of many potential surface realizations. Which form is chosen is determined by specific **constraints** that constitute grammar.

Constraints function as a kind of filter (criteria of well-formedness); they define all the desireable characteristics of surface language forms (we therefore assume that some realizations must be more desireable than others).

Three basic components grammar:

- GEN (which generates all possible surface structures/candidates)
- CON (which provides constraints)
- EVAL (which selects the optimal candidate)

They are part of Universal Grammar. The fact that particular grammars differ substantially is assumed to result from **different rankings** of the universal set of constraints (particular rankings are language-specific). Children acquire language by adjusting the inborn set of universal constraints to the ranking of a given natural language.

Universal Grammar: the **complete** set of all constraints that are active in natural languages.

Ideally, constraints should be phonetically and typologically **grounded** (they are not arbitrary, as opposed to rewrite rules).

McCarthy & Prince (1995): GEN is **absolutely** free (Richness of the Base).

Constraints do not constitute a coherent set; they do not complement one another; in many cases they are **mutually exclusive**, and it is impossible to satisfy all of them. All of them are violable.

Candidate A is better than B with respect to a given constraint, if it incurs fewer violations of that constraint (as compared to B). The **optimal** candidate is selected on the basis of the number of violations of the **highest-ranked** constraint.

A single violation of a higher constraint is more important than **any number** of violations of a lower constraint. The optimal candidate does not have to satisfy every single constraint. This idea contrasts clearly with derivational approaches, according to which all rules are **equally** important.

A sample OT tableau:

/Input/	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3
☞ a. candidate 1	**		****
b. candidate 2	***!*		
c. candidate 3	**	*!	

Notation:

Constraints are listed across the top of the tableau: with higher-ranked constraints to the left, and lower-ranked constraints to the right. Competing candidates are listed in the first column of the tableau.

A solid line between constraints means that the constraints are ranked. A dotted line indicates that no ranking can be established.

The pointing finger ☞ indicates the optimal candidate.

Each asterisk stands for one violation of a given constraint (the exclamation mark marks the crucial/fatal violation which excludes a given candidate).

A shaded cell means that this cell is not involved in determining the optimal candidate.

Constraint violation must be minimal: a constraint may be violated only if **necessary** (i.e. only when such a violation helps to avoid a violation of a constraint with a higher rank).

Below is a simple example of an OT-type analysis. Assume the following constraints:

(i) *VoiceObstrFin
No voiced obstruents word-finally.

(ii) IdentInput-Output
Input and output must be identical.

(note that these are not constraints used in real OT analyses; I use them for explanatory purposes only)

Conflicting constraints must be ranked in a hierarchical manner. Rankings are marked in the following way:

(i) *VoiceObstrFin >> IdentInput-Output (Polish)

(ii) IdentInput-Output >> *VoiceObstrFin (English)

The tableau:

/kod/	*VoiceObstrFin	IdentInput-Output
a. ☞ kot		*
b. kod	*!	

Note: candidate A is **optimal**, but not **ideal**!

Two types of constraints:

- constraints on form of the output (well-formedness, grounded in typological/universal markedness generalizations), e.g.:

*CODA - syllables should have no codas

ONSET – syllables should have onsets

*COMPLEXONSET: onsets should be simple

*COMPLEXCODA: codas should be simple

*VOICEDOBSTRUENT: obstruents should be voiceless;

- constraints on the relationship between the input and the output (faithfulness, based on the principles of economy of language processing).

Sample OT analysis: the phenomenon of hiatus (source: Gisbert Fanselow and Caroline Féry, *Introduction to Optimality Theory in Phonology and Syntax*)

hiatus = two vowels in a row

Natural languages deal with hiatus in various ways (vowel deletion, consonant insertion, or… doing nothing)

Traditional rewrite rules:

(i) ellision: V → ø / __ V

(ii) epenthesis: ø → C / V __ V

An OT analtsis – relevant constraints:

- *HIATUS: no hiatus!
- DEP (FILL): each segment of the output must correspond to a segment in the input (no epenthesis!)
- MAX (PARSE): each segment of the input must correspond to a segment of the output (don't delete!)

(12) j. francuski:

/le/+/éléphant/ 'słoń'	*Hiatus	Dep	Max
☞ a. l'éléphant			*
b. le éléphant	*!		
c. le téléphant		*!	

(13) j. niemiecki

/Beamte/ 'urzędnik'	*Hiatus	Max	Dep
☞ a. Be?amte			*
b. Beamte	*!		
c. Bamte		*!	

(14) j. maori

/puea/ 'być pomszczonym'	Dep	Max	*Hiatus
☞ a. puea			**
b. puteta	*!*		
c. pea		*!	

/V/	DEP (FILL)	MAX(PARSE)	ONSET
☞ V			*
ø		*!	
CV	*!		
VC	*!		*

/V/	DEP (FILL)	ONSET	MAX (PARSE)
V		*!	
☞ ø			*
CV	*!		
VC	*!	*	

/V/	ONSET	MAX(PARSE)	DEP (FILL)
V	*!		
ø		*!	
☞ CV			*
VC	*!		*

Given the above set of constraints, we **predict** that no language will choose the VC option.

Examples of criticism with respect to OT:

- it isn't technically a theory (its predictions are not falsifiable),
- it isn't restrictive enough, it overgenerates (anything is, in principle, possible),
- its findings aren't really insightful because they merely rephrase well-known typological generalizations, instead of **explaining** them.

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Jaye Padgett, *A Soccer Squib*
(source: *Jorge Hankamer WebFest*)

To honor Jorge on this special occasion, I would like to present a critical review of one of his best-known works, *Deletion in Coordinate Structures*. Alas, I still haven't read it. Also, I don't remember enough about syntax. None of this would be a problem if it were June, since we professors are unemployed over the summer. But as the deadline for submission draws near, I thought it wiser to switch topics.

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Instead I'm going to provide the beginnings of an Optimality Theoretic analysis of Jorge's soccer playing. I've collected a lot of data on the topic over the past decade. It turns out that most of a player's soccer strategies are **a function of a hierarchy of a number of fixed, violable constraints** in a strict dominance relation. Or at least, when viewed from the perspective of OT it sure seems that way.

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First some notational conventions:

J = Jorge
E = An enemy, i.e., someone on the other team
o = The soccer ball
J(o) = Jorge controls the soccer ball
E(o) = The enemy controls the soccer ball
#J = Jorge is injured
#E = The enemy is injured

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Here are the constraints needed for the analysis:
J(o), *E(o), *#J, *#E

Implicit in the first two constraint formulations are some fundamental markedness notions involving Jorge's playing. In this regard J(o) and *E(o) might be compared to ONSET and NOCODA respectively. The existence of J(o) and nonexistence of E(o) **predicts**, all else equal, that there will be events in which Jorge strives to control the ball, and events in which Jorge is not involved; crucially, there are no events predicted in which Jorge *strives* to give control of the ball to a member of the opposite team.

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Similarly, given *E(o) and no *J(o), there will be events in which Jorge attempts to remove control of the ball from a member of the opposite team, and events in which Jorge is not involved. However, there should be no events in which Jorge *strives* to wrest control of the ball from himself.

These predicted markedness patterns **correlate very highly** with observed fact, though there are questions involving interpretation of the data that go beyond the scope of this unfinished squib.

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To begin to see how these constraints are ranked, consider the following tableau. Inputs consist of two or more players, a ball, and an optional '#', meaning that someone will have to be hurt to get the ball.

/ J o E # /	*E(o)	*#J
a. ☞ #J(o) E		*
b. J #E(o)	* !	

Candidate (a) below involves Jorge in control of the soccer ball, while it is the Enemy who controls the ball in (b). Given the ranking *E(o) >> *#J, candidate (a) wins, in spite of the injury implied to Jorge.

/ J o E # /	*E(o)	*#J
a. ☞ #J(o) E		*
b. J #E(o)	* !	

This ranking **predicts** that faced with the choice, Jorge will choose to get control of the soccer ball rather than avoid injury. Such events are **abundantly** attested in soccer games, and so this prediction is **strikingly** confirmed. Note that there are less obvious consequences of the analysis that also turn out to support it. For example, Jorge will play soccer even when he has the flu. This is obviously injurious to him, but it ensures that the Enemy will control the ball less.

At this point the rest of the analysis, and the typological consequences, should be clear. I have a soccer game to go play. Happy birthday, Jorge.

Thank you!

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