

The background of the slide is a solid red color. In the top left corner, the word "RUTGERS" is written in a large, white, serif font. Below it, in a smaller, white, sans-serif font, are the words "THE STATE UNIVERSITY OF NEW JERSEY". A large, faint, circular seal of Rutgers University is visible in the background, centered behind the text. The seal features a sunburst design and the text "RUTGERS THE STATE UNIVERSITY OF NEW JERSEY" around the perimeter.

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Output-Driven Maps in Phonology

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Outline

- Surface Orientedness
 - Inadequacies of process opacity
- Output-Driven Maps
 - Formalizes surface orientedness
- Output-Driven Maps in Optimality Theory
- Output-Driven Syntax?

The Intuition: Surface Orientedness

- **Longstanding Issue:** to what extent are phonologies “surface oriented”?
 - (Chomsky 1964; Kiparsky 1971, 1973; Kisseberth 1970)
- **Surface Oriented:** disparities between input and output are only introduced to the extent necessary to satisfy output conditions.
- Said another way: phonological disparities are driven by phonotactic restrictions.

- What could this mean, precisely?
- How can this be formally expressed?

Output Conditions

- Coda Devoicing
- Output Condition: no voiced obstruents in codas.
- Disparity: input voiced segment with a voiceless output correspondent.

- Intuition: the disparity is tolerated in order to satisfy the output condition.
 - surface oriented

Contrary I: Chain Shifts

- Chain shifts are inherently contrary to intuitions of surface orientedness.

$/a/ \rightarrow [e]$ $/e/ \rightarrow [i]$ $/i/ \rightarrow [i]$

- If $/e/ \rightarrow [i]$ is necessary, then should be $/a/ \rightarrow [i]$
- If $/a/ \rightarrow [e]$ is sufficient, then should be $/e/ \rightarrow [e]$

Contrary II: Derived Environment Effects

(Lubowicz 2003)

- Derived environment effects are inherently contrary to intuitions of surface orientedness.

$/a/ \rightarrow [i]$ $/e/ \rightarrow [e]$ $/i/ \rightarrow [i]$

- If $/a/ \rightarrow [i]$ is necessary, then should be $/e/ \rightarrow [i]$
- If $/e/ \rightarrow [e]$ is sufficient, then should be $/a/ \rightarrow [e]$

Process Opacity

- Traditional notions of transparency / opacity (Kiparsky 1971, 1973) are properties of **processes**, not maps.
 - Change your process analysis, and opacity can (dis)appear.
 - Epenthesis and assimilation in Lithuanian (Baković 2007).
- Does not fit well with Optimality Theoretic analyses.
 - Processes are not constructs of the theory.

OT is Inherently Transparent

- Markedness constraints are conditions on the output.
- Faithfulness constraints resist disparities.
- **Therefore:** disparities are always motivated by output conditions.

- Issue: OT grammars can generate chain shifts.

OT is Inherently Opaque

- Markedness constraints are conditions on the output.
- Markedness constraints can be violated by grammatical forms.
- Opacity is linguistic generalization that is violated in surface forms (McCarthy 1999, Idsardi 2000).
- Therefore: OT grammars inherently realize opacity.

- Issue: many seemingly transparent phenomena involve violation of markedness constraints.
 - What's opaque about preserving voicing in onsets?

Shared: Focus on Markedness Constraints

- Both:
 - focus on markedness constraints.
 - adopt markedness constraints as the relevant output conditions.
- Inherently transparent:
 - Opacity is: disparity not motivated by output conditions.
 - violation of output conditions is irrelevant.
- Inherently opaque:
 - Opacity is: violated output conditions.
 - motivation for disparity is irrelevant.

Wanted: A More Abstract Alternative

- Characterize “surface orientedness” solely in terms of input-output maps.
 - Without reference to processes, constraints, etc.
- Such a characterization would apply equally to SPE, Optimality Theory, and other phonological theories.
 - and possibly beyond.

What Kind of Stunt is This?

- Define what it means for disparities in a map to be driven by output conditions,
- **without** committing to what the output conditions actually are.

Terminology

- A **candidate** is an input, an output, and a correspondence relation between them.
 - $/p_1a_2k_3a:4/ \rightarrow [p_1\acute{a}_2k_3a_4]$
- A candidate has a set of **disparities**.
- A phonological **map** is the set of grammatical candidates.

From Intuition to Formalization

- **Surface Oriented:** a term of convenience used to refer to certain intuitive notions about phonological maps.
- **Output-Driven:** a defined property of phonological maps that formally captures the intuitions of surface orientedness.

Output-Driven Maps (Tesar 2014)

- A map is output-driven if:
 - for every grammatical candidate $A \rightarrow X$ of the map:
 - if candidate $B \rightarrow X$ has greater similarity than $A \rightarrow X$,
 - then $B \rightarrow X$ is also grammatical.

- Simplified:
 - for every grammatical candidate $A \rightarrow X$ of the map:
 - if input B is more similar to X than A is,
 - then B also maps to X .

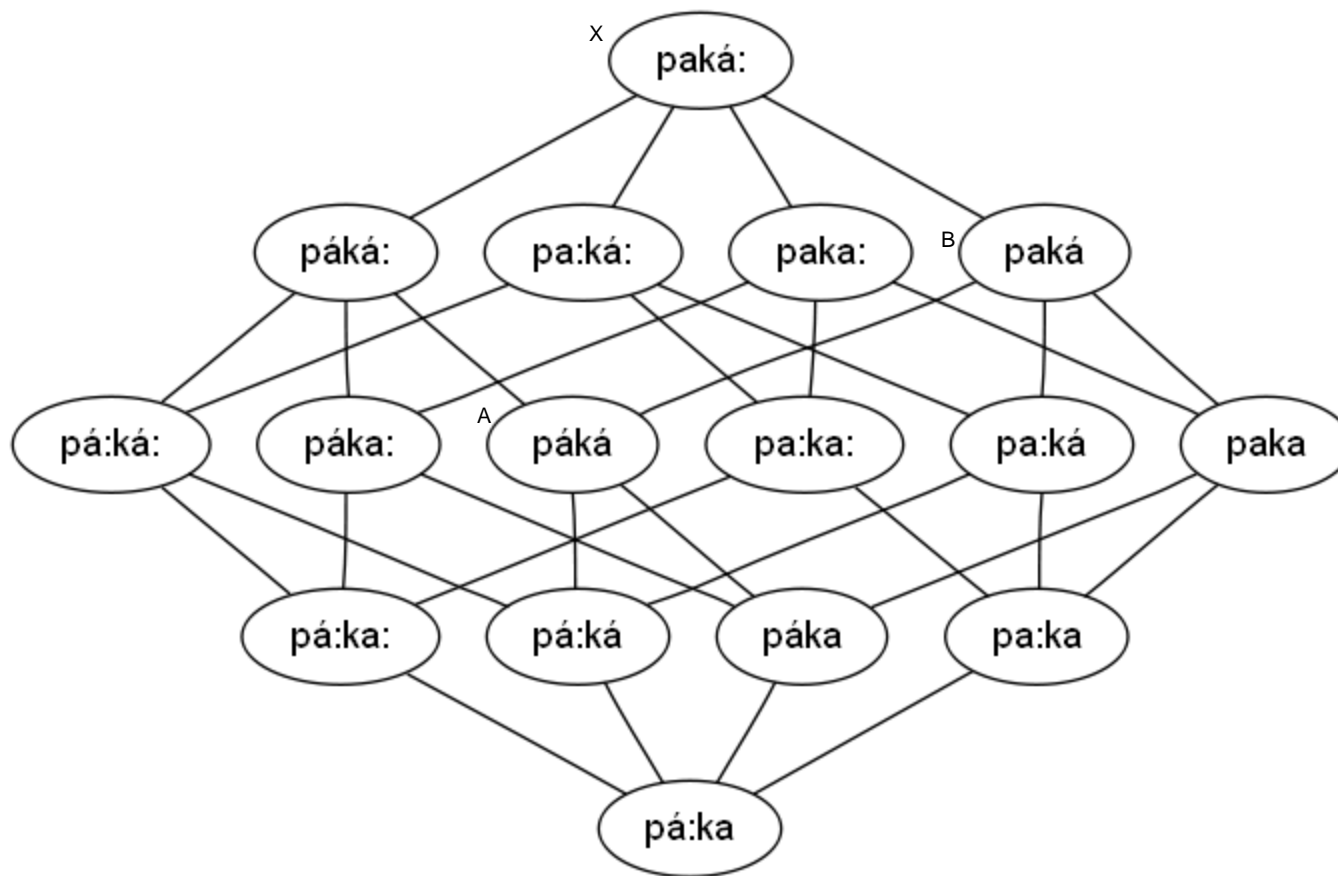
Greater Similarity

- Candidate $B \rightarrow X$ has **greater similarity** than $A \rightarrow X$ if every disparity in $B \rightarrow X$ has an identical corresponding disparity in $A \rightarrow X$.
 - Only defined for pairs of candidates sharing the same output.

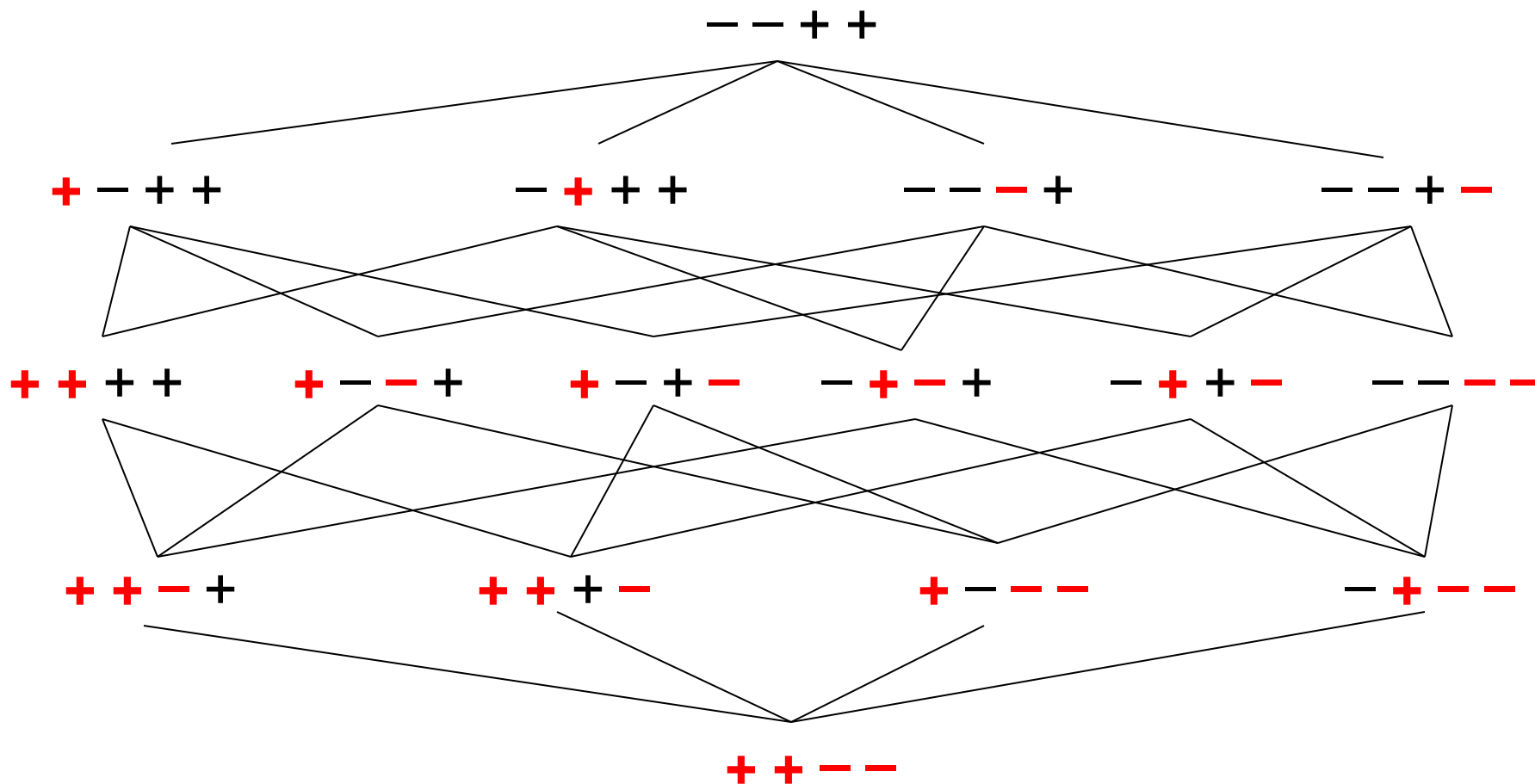
		(+/-stress +/-length)
$A \rightarrow X$	<i>páká</i> → <i>paká:</i>	[+ - + -] → [- - + +]
$B \rightarrow X$	<i>paká</i> → <i>paká:</i>	[- - + -] → [- - + +]

- Similarity is **relational**.

Relative Similarity (up = greater similarity)



Relative Similarity (+/-stress +/-length)



(A Piece of) An Output-Driven Map

- *páká:* → *páka* 2 disparities
 - *páká* → *páka* 1 disparity
 - *páka:* → *páka* 1 disparity
 - *páka* → *páka* 0 disparities (Identity Mapping)
-
- Output-driven: simply removing some obstacles to an output ensures reaching that same output.

Idempotency

- All grammatical outputs “map to themselves”.
 - Common assumption, especially in phonotactic learning.
- All output-driven maps are idempotent.
 - No input is more similar to an output X than X itself.
 - If any input maps to X , then X maps to X .
- Consequence: maps with chain shifts are not output-driven.

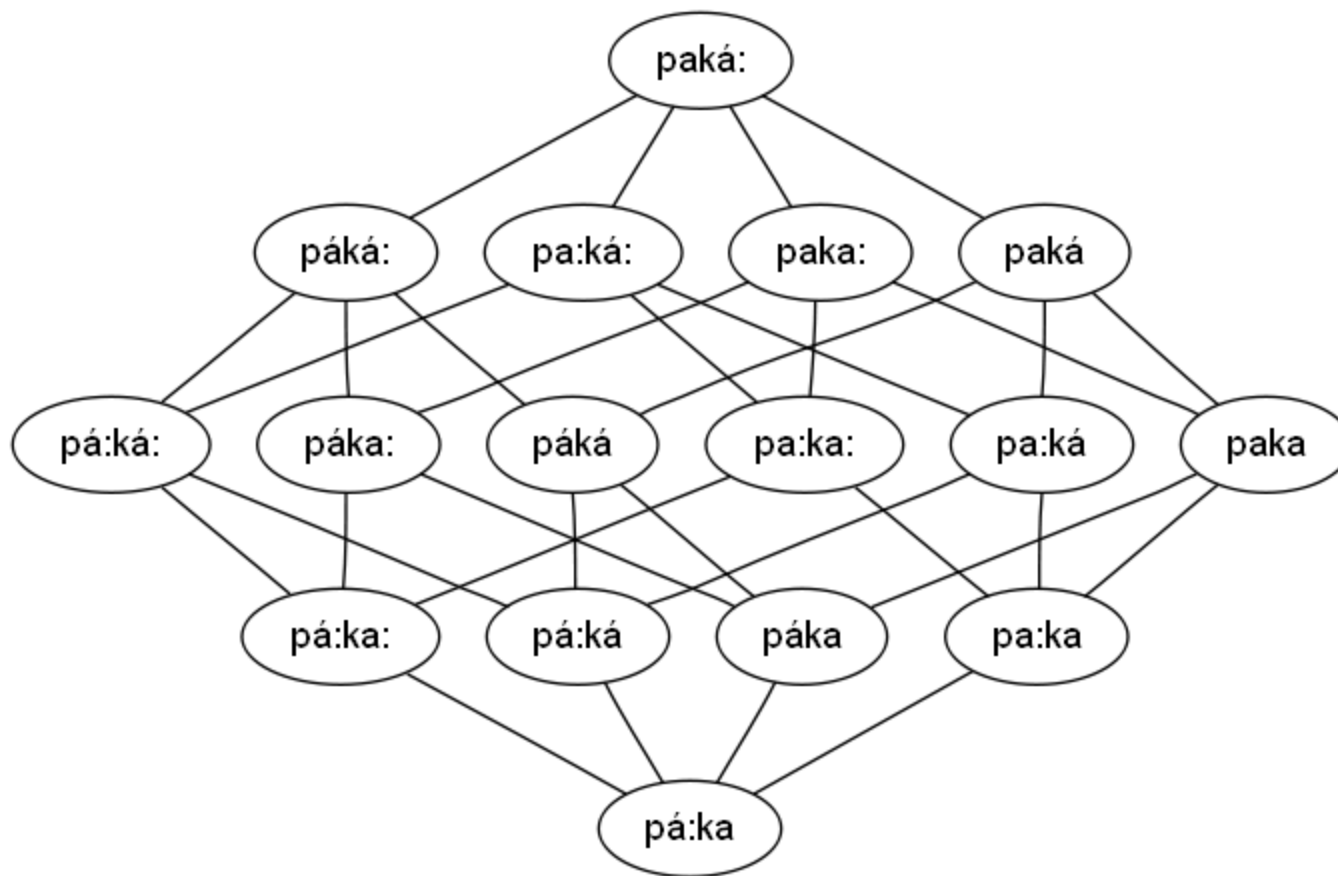
Derived Environment Effects

- DEEs are not output-driven.

$/a/ \rightarrow [i]$ $/e/ \rightarrow [e]$ $/i/ \rightarrow [i]$

- $/e/ \rightarrow [i]$ has greater similarity than $/a/ \rightarrow [i]$
- DEEs are just like CSs:
 - Not output-driven: $A \rightarrow X$, but **not** $B \rightarrow X$
 - Chain Shift: $B=X$
 - Derived Environment Effect: $B \neq X$

ODM Unifies CSs and DEEs



Output-Driven Maps in Optimality Theory

- An OT system is guaranteed to define only output-driven maps if:
 - All constraints of *Con* are **output-driven-preserving**.

Output-Driven-Preserving Constraints

- A constraint is ODP if:
 - when $B \rightarrow X$ has greater similarity than $A \rightarrow X$,
 - and $B \rightarrow Y$ has fewer violations than $B \rightarrow X$,
 - then $A \rightarrow Y$ must have fewer violations than $A \rightarrow X$.
- Consequence: all markedness constraints are ODP.
- Markedness cannot distinguish:
 - $A \rightarrow X$ vs. $A \rightarrow Y$
 - $B \rightarrow X$ vs. $B \rightarrow Y$

A Developing Theory of Faithfulness

- A constraint can only be non-ODP if it makes reference to something outside of the output itself.
 - Faithfulness: reference to both input and output.
- “Basic” IO faithfulness constraints are ODP.
 - MAX, DEP, IDENT
- Others are non-ODP.
 - Conjoined faithfulness constraints
 - Positional faithfulness constraints

Learning Output-Driven Maps (Tesar 2014)

- Output-drivenness greatly accelerates the learning of underlying forms (along with rankings).
- Structure in the space of inputs which can be powerfully exploited.
- Limitation: presumes that **all** phonological maps are output-driven.

Output-Driven Syntax?

- What are syntactic maps like?
- What is the space of possible inputs?
- What is the inventory of disparities?
 - movement?
 - feature merging?

Conclusions

- Output-Driven Maps capture intuitions about surface orientedness in a general way.
 - Combines well with Optimality Theory.
- Applying the concept to a domain requires being specific about what the map is.
 - Inputs
 - Outputs
 - Disparities

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