Chunk-schema competition in deriving new forms of known words

Vsevolod Kapatsinski

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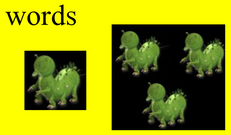
Research question: One wug, two … wug[z] We've never heard the plural of 'wug' yet we know what it is. How do we do this?

Miniature artificial languages presented to adult native English speakers

Training: Listen and repeat
Learn words



bok botʃi

SG → PL	Tapa	Tipi	Tapachi	Tipichi
{t;p}→{t;p}a	3N	N	3N	N
{t;p}→{t;p}i	N	3N	N	3N
k → tʃi	M			
tʃ→ tʃi	0		K	

Tests: Production, rating
Novel words

vit viti? vitʃi?

What would the learners learn?

Usage-based Phonology:
(Bybee 1985, 2001, Langacker 1987, Nesset 2008; implemented here)

First-order schemas / Constructions: Form-meaning pairings

PL-V[-cont;]a#
PL-V[-cont]i#
PL-V[-cont;Pal]tʃi#

tʃ → tʃi
Should help
{k;p;t}→ tʃi

tʃ → tʃi
Should help
{k;p;t}→{k;t;p}i

Rule-based Phonology:
Albright & Hayes (2003), Reiss (2004)

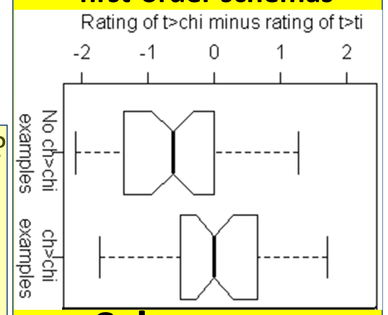
Rules: Changes in context
Split every pair into change and context
Generalize over contexts

0→a / [-cont]___#
0→i / [-cont]___#
{k;g}→ {tʃ;dʒ}i / ___#

or

0 → a /[-cont]__#
0 → i /[-cont]__#
{k;g}→ {tʃ;dʒ} / ____i#

Results support first-order schemas



Schemas

How do we extract these schemas?

Conditional inference tree induction:

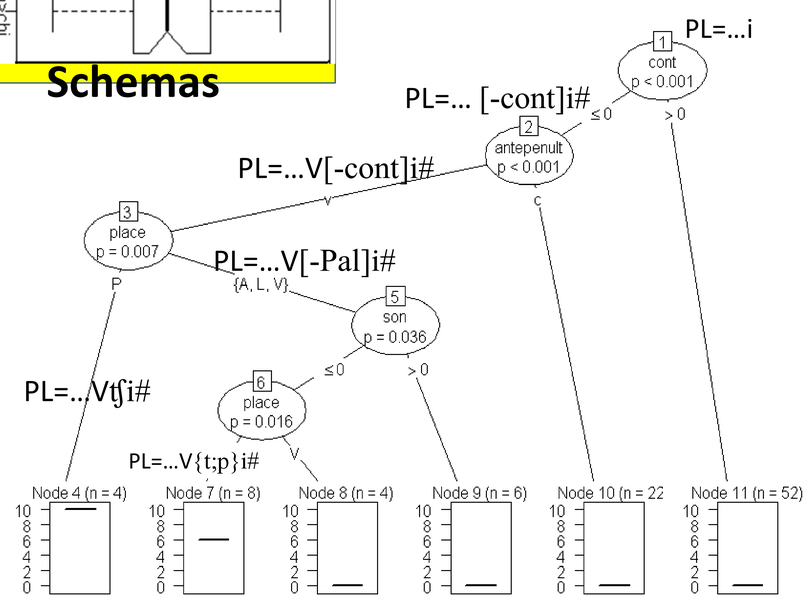
Predictors: phonological features of the wordform
Predicted: if the wordform is a plural

Algorithm:
Select the most informative predictor feature at each step

Most informative: best distinguishes plurals from non-plurals

Primary claim of the algorithm:
Early liberalism: before learning, plurals could be anything; production should be completely driven by perseveration on the known singular form → avoidance of stem changes

In acquisition, specific schemas strengthen over time.



A schema is a path that proceeds downwards from the root of the tree terminating in a node that is either 1) a leaf **with a non-zero type frequency** or 2) an ancestor to at least one leaf **with a non-zero type frequency**.

Conclusion: Learners of morphophonology acquire first-order schemas / constructions. Schemas can be acquired as a description of distinctive characteristics of forms with a semantic feature, e.g., plurals. This can be accomplished by means of conditional inference. In producing an unknown form from a known form, schemas compete with chunks from the known form. Stem changes result when some chunk is overruled by a strong, and specific schema.

Schemas and … "Chunk!" constraints

In production of the unknown (plural) form, schemas compete with a tendency to perseverate on chunks from the known (singular) form.

Evidence for "chunk!" constraints:

Preference for insertion over deletion in speech errors and loanword adaptation

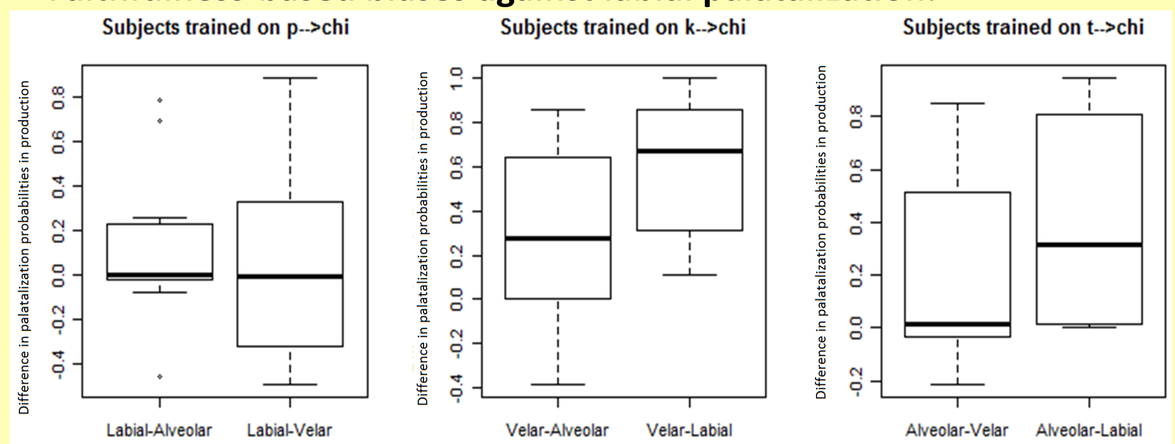
(Goldstein et al. 2007, Hartsuiker 2002, Stemberger 1991 for speech errors
Kang 2011, Paradis & LaCharité 1997 for loanwords; also cf. Contiguity, Kenstowicz 1994)

Telling errors:

bup→buptʃi flo͡ʊk→flo͡ʊktʃi

Preference against stem changes stronger in production than rating

Faithfulness-based biases against labial palatalization:



Holds if –a is the palatalizing suffix too!

Account:

Initial ranking (prior to experiment):
"k!" << "t!" << "p!"
Schemas gradually strengthen through exposure to words containing them
Eventually PL=…Vtʃi overtakes "k!" then "t!" then "p!"

Competition resolution via Harmonic Grammar:

bup	[Pal]i# .0006 tʃi# .08	Vtʃi# 10	[-Pal]i# <.0001 [-cont;-Pal]i# <.0001 V[-cont;-Pal]i# .0001 V[-cont;-Pal;-son]i# .10 V[-cont;{Alv;Lab};-son]i# 2	[-cont]a# <.0001 V[-cont]a# .0004 V[-cont;Lab]a# .04 V[-cont;-son;Lab]a# 6	"[p]!"	Total	p(prod)
bupi			2.1			2.1	25%
bupa				6.04		6.04	73%
buptʃi	.08					.08	1%
butʃi	.08	10			-10	.08	1%