

# Online interactive tools for undergraduate phonology

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# Highlights

- Advances in technology lead us to rethink certain aspects of how we teach phonology.
- PhonoApps have been developed to help students learn key phonological concepts:
  - **Featurize!** ★ natural classes
  - **Derive!** ★ rule interactions
- The tools are intuitive to use, fully customizable, freely available, run from a browser, can be used off-line.
- PhonoApps also include other teaching and computational tools for phonology, and more are being developed.

# Teaching undergraduate phonology

Undergraduate phonology requires students to grasp two particularly challenging concepts:

- 1 phonological features
  - natural classes
  - feature economy
  - universality versus individual inventories
  - unary/privative versus binary/equipollent
  - different feature theories
- 2 rule-based analyses
  - formalizing rules using features
  - rule interaction
  - figuring out underlying representations

The challenge is compounded in large-enrollment classes.

# Key features

## Key objectives:

- free and accessible
- entirely in-browser, but can be used offline
- simple, ready-to-play interface
- ability to customize
- compatibility with various devices
- additional resources for instructors and users
- developed by a team of undergraduate students

# How to access?

<http://www.phonoapps.com>

Access to PhonoApps

+

additional resources

(how-to-videos, instructor resources)

<http://www.phonology.us>

Direct access to PhonoApps

# Featurize!

- *Featurize!* determines whether a set of segments is a natural class:
  - the inventory can be customized (a default is provided)
  - the features and their specifications can be customized
- If the selected set of segments is a natural class, the app provides:
  - the set of all common features
  - the smallest set of common features
- If the selected set of segments is a not natural class, the app provides:
  - the smallest natural class that includes the specified set
  - the set of all common features of this natural class
  - the smallest set of common features of this natural class

# Derive!

- *Derive!* is a rule-derivation tool:
  - the user inputs the underlying representations
  - the rules are fully customizable
  - the rules can be easily reordered
  - *Derive!* incorporates *Featurize!* so segments and their feature specifications
- The app provides:
  - the surface forms
  - the derivation table with the alternations marked
  - the derivation table can be printed

# Computational tools

Two other tools are currently available:

## ① *Analyze!*

- This tool calculates over- or under-representation of all sounds at all distances in a list of words.
- The segments and their features can be fully customized.

## ② *Gibber!*

- MaxEnt phonotactic learner based on Hayes & Wilson (2008), with improved performance for large lexicons.
- Features can be customized.
- The app can calculate long-distance constraints.
- Agreement-by-Correspondence indices can be used.
- Blocking segments can be specified.



# What PhonoApps can do

- Interactivity makes the tools engaging to the students.
- PhonoApps are not a replacement for pen and paper, but instead allow to develop and integrate new kinds of assignments.
- Increased student satisfaction.

# New types of assignments

- Consider the following three rules:
  - Final Devoicing:  $[-\text{sonorant}] \rightarrow [-\text{voice}] / \_ \#$
  - Vowel Raising:  $V \rightarrow [+high] / \_ [-\text{voice}]$
  - Final Stop Deletion:  $[-\text{continuant} \text{ } -\text{sonorant}] \rightarrow \emptyset / \_ \#$
- Use *Derive!* to figure out how these three rules can interact.
- Q: What kind of underlying representations will be key in determining the interaction of the three rules?
  - Sample answers (all incorrect): URs that begin in a consonant, URs that begin in a coronal stop, URs that end in a low vowel.

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- A: URs that end in a voiced obstruent, voiceless obstruent, voiced stop, voiceless stop, and forms in which the rightmost vowel is a non-high vowel.

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- ① What kind of underlying representations will be key at determining the interaction of the three rules?
- ② Derive the key forms using the *Derive!* tool. Make sure to include sufficient underlying representations (given your answer above) and correctly input the rules. Print out the derivation table and append it below as a pdf.
- ③ Now reorder the rules (at least one change from above) and print out a second derivation table.
- ④ Describe the interaction of Final Devoicing and Vowel Raising. Use your derivation tables (you may reorder rules multiple times to determine the interaction) to help you with this answer.

# Student feedback

- Many students specifically comment on how PhonoApps helped them understanding rule interaction in the teaching evaluations.
- The understanding of rule interaction clearly increases after the assignment that uses *Derive!*
- The tools are particularly useful to students who are independent learners.
- *PhonoApps* may be even more useful in the present situation where in-person classes are limited or suspended.

# Conclusions

- *PhonoApps* are free online tools that can be used in an undergraduate phonology class, focusing on two core topics: natural classes and rule-derivation.
- They were designed in collaboration with students and with the user in mind.
- Additional resources are provided to the instructor and students.
- The students who use them appear to understand the key phonological concepts better.

# Thanks to . . .

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# References I

Hayes, Bruce & Colin Wilson (2008). A maximum entropy model of phonotactics and phonotactic learning. *Linguistic Inquiry* **39**. 379–440.