

Online interactive tools for undergraduate phonology

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Introduction. Advances in technology now make it possible to rethink certain aspects of how we teach phonology. I present *PhonoApps*, a pair of interactive online tools that facilitate students' understanding of sound patterns.

Featurize! facilitates the understanding of relationships between groups of sounds. A user clicks on any combination of segments and the app determines whether it is a natural class and provides the common features. For instance, if {i, i, ʉ, u, ʊ} are selected, the app determines this is not a natural class. The app further also shows that adding [y] results in a natural class of [+high +tense] segments. The user can specify any set of (unary/binary) features and any inventory using any transcription.

Derive! is an online interface that allows users to specify underlying representations, rules, and their order. The set of user-specified rules is applied in the order for a real-time derivation, including the surface forms. Fig. 1 presents a screenshot of *Derive!* with user-specified content: 4 underlying representations and 2 rules. The output is a *Derivation Table* which shows rule application and the surface forms. The order of rules can be changed by the user (Fig. 2).

Uses. The tools allow students to grasp key phonological concepts more easily. For example, seeing the effect of rule ordering on the surface forms in real time facilitates the understanding of opacity. Students can then focus on more complex tasks. The sample assignments in (1) and (2) flesh out the typological implications of features and the effect of language change of features.

- (1)
 - a. What is the minimal number of contrastive features needed for a 7 vowel inventory?
 - b. Provide three 7 vowel inventories with their feature specifications.
- (2) Consider Terei (Papuan, 27k speakers) consonants: {p, t, k, g, m, n, r}.
 - a. Which features are required to distinguish these consonants?
 - b. [n] and [r] have merged into [ɾ̃] in a related language. Is any of features in (a) not contrastive?
 - c. Are [g] and [m] a natural class in Terei or its relative?

Conclusions. Students can now grasp key phonological concepts more directly by engaging with the mechanism of feature assignment and rule interaction. This is an opportunity to explore questions that have not been addressable in undergraduate phonology courses, including typology, opacity, and rule formalization.

The screenshot shows the 'Derive!' interface. At the top, a blue header says 'Enter some IPA (UR) to derive'. Below it, a text box contains the input: 'paʃ', 'paʒ', 'reʒi', 'riɠa'. Below the text box are two rule specification sections. The first rule is: [-sonorant] → [-voice] / ____ #. The second rule is: [+high] → ∅ / [+syllabic]C ____ #. Below the rules, the output shows the surface forms: 'paʃ', 'paʃ', 'reʒi', 'riɠa'. At the bottom, a green plus sign is visible. Below the interface is a 'Derivation Table' with the following content:

Underlying Representation	/paʃ/	/paʒ/	/reʒi/	/riɠa/
[-sonorant] → [-voice] / ____ #	paʃ	paʃ	—	—
[+high] → ∅ / [+syllabic]C ____ #	—	—	reʒi	—
Surface Form	[paʃ]	[paʃ]	[reʒi]	[riɠa]

Figure 1: *Derive!* interface showing counterfeeding of *Final devoicing* and *V deletion*.

The screenshot shows the 'Derive!' interface with the 'Derivation Table' section. The table is as follows:

Underlying Representation	/paʃ/	/paʒ/	/reʒi/	/riɠa/
[+high] → ∅ / [+syllabic]C ____ #	—	—	reʒi	—
[-sonorant] → [-voice] / ____ #	paʃ	paʃ	reʃ	—
Surface Form	[paʃ]	[paʃ]	[reʃ]	[riɠa]

Figure 2: The rules in Figure 1 reversed.