Using the Tolerance Principle as a diagnostic of phonological rules  
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The Problem: Phonological relationships that fall in between phoneme and allophone, using classic but ill-defined diagnostics of predictability and contrastiveness.

Examples:

/\%/-raising, Philadelphia (Fruehwald, 2013)  
Nasal /\%/-split, Philadelphia (Sneller, 2018)

- Trisyllabic Shortening  
  obscene ~ obscurity
  serene ~ serenity
  obese ~ obesity

- Philadelphia /\%/-split – analyzed as both:
  phonemic (Ferguson, 1972; Labov 1989; Dinkin 2013)
  allophonic (Kiparsky, 1995; Labov et al. 2016; Sneller 2018)

  \% → a\%h / /\% [\%ant]\\{nasalV\%voice\%fricative\\}%
  Llene: {mad, bad, glad, planet *}
  Llax: {ran, swam, can, am, carafe, math, gaffe, ...}

Previous Solutions:

- Intermediate categories (quasi-phoneme, hemiphone, deep allophone, fuzzy contrast) (see Hall, 2013)
- Lexical phonology (Kiparsky, 1995)
- Gradient phonology (Hall, 2008)

Proposal: There are no intermediate categories. Phonological processes can tolerate a limited number of lexical exceptions.

Tolerance Principle (Yang, 2016) is one way to define an upper limit to the exceptions a productive rule can tolerate:

\[ e \leq \frac{N}{\ln(N)} \]

\(e\) = exceptions, \(N\) = number of words to which the process could apply

Example: If a child knew 10 verbs: \{walk, smile, play, laugh, jump, cry, run, sing, swim, throw\}, the regular past tense \(-ed\) morphology would still be productive, because \(4 \leq 10/\ln(10)\), or \(4 \leq 4.3\).

Application: Find total \(N\) and \(e\) using CHILDES (MacWhinney, 2000)

- \(/\%/-raising:\ 3 \leq 763.8 = 6733/\ln(6733)\)
- Nasal /\%/-: \(1 \leq 194.7 = 1412/\ln(1412)\)
- Trisyllabic Shortening: \(9 \leq 13.1 = 52/\ln(52)\)
- Philadelphia /\%/-split: \(39 \leq 194.7 = 1412/\ln(1412)\)

Implications and Predictions

Phonological Change:

Individual differences in phonologization when \(e\) is close to the threshold

Phonological Variation:

Lexical exceptions participate in variation alongside the regular process (Sneller, 2018)

References