Marginal Sequences are Licit but Unproductive

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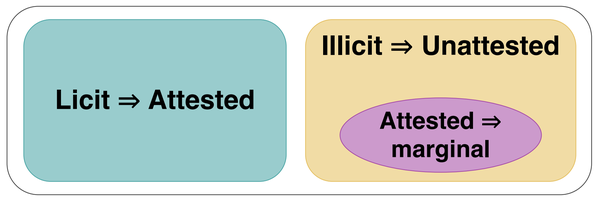
Marginal Sequences in Phonotactic Theory

How are Attestation and Licitness related?

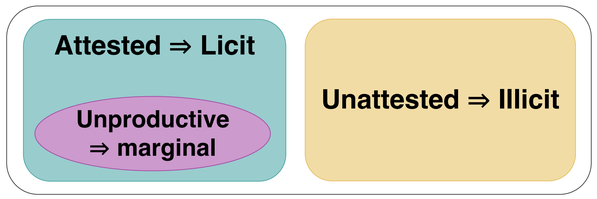
- Attested subsequences are generally Licit
- Unattested subsequences are generally Illicit

Where do Marginal Forms fit in?

- Previous approaches: Illicit but Attested (Hyman 1975)



- Our approach: Attested but Unproductive



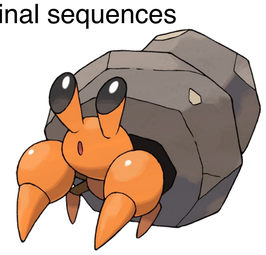
Evidence for Our Model

- **Borrowings:** not repaired

	Spanish	Japanese	English
German: /pfɪtsɐ/	/fajser/	/ɸaid͡za/	/faɪzɹ/
Italian: /spagetti/	/espageti/	/sɯpagetti/	/spəgɛti/
Greek: /sfiŋks/	/esfinxe/	/sɯɸinkɯsɯ/	/sfɪŋks/
Greek: /sfaira/	/esfera/	(sɯɸia)	/sfɪəɾ/

- **New Words:** may contain marginal sequences


spheal


dwebble

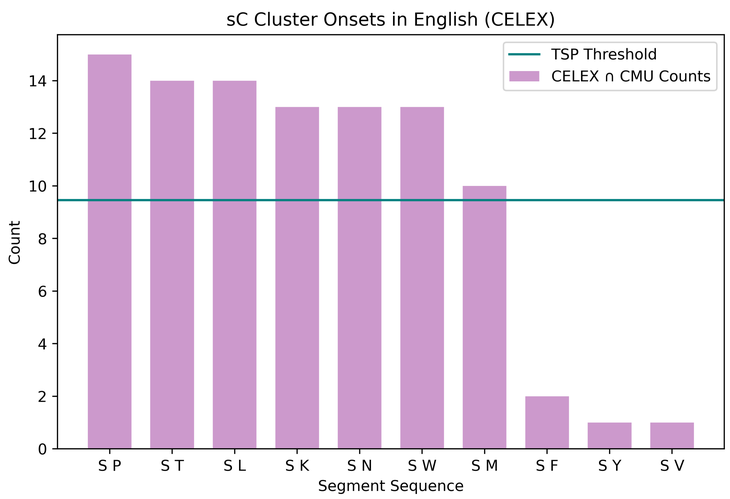
- **Production & Perception Errors**
  - Speakers **struggle to produce illicit sequences**
  - **97% production accuracy** on **/#sC/** sequences by English speakers
    - **C** ∈ {**f, p, t, k, m, n**} (Davidson 2006)

Selected References:
Hayes & Wilson 2008. A maximum entropy model of phonotactics and phonotactic learning. *Linguistic Inquiry.*
Davidson 2006. Phonology, phonetics, or frequency: Influences on the production of non-native sequences. *Journal of Phonetics.*
Gorman 2013. *Generative Phonotactics.* UPenn Dissertation.
Hyman 1975. *Phonology: Theory and Analysis.* Harcourt Press.
Kabak & Idsardi 2007. Perceptual distortions in the adaptation of English consonant clusters: Syllable structure or consonantal contact constraints? *Language and Speech.*
Yang 2016. *The Price of Linguistic Productivity: How Children Learn to Break the Rules of Language.* MIT Press.

Formalizing Marginal vs. Licit with the TSP

- **Licit vs. Marginal as a Difference in Productivity**
  - **Licit Onsets/Codas:** occur with a **sufficiently diverse set of nuclei**
    - Occurs with **most nuclei** ⇒ can occur with all
  - **Marginal Onsets/Codas:** can occur with only a few, **lexicalized** nuclei
    - Occurs with a **few nuclei** ⇒ memorize those nuclei
- **The Tolerance Principle (TSP, Yang 2016):**
  - In a language with ***N*** possible nuclei, an attested onset/coda is **Licit** if it occurs with at least ***M*** of these possible nuclei and:

$$N - M \leq \theta_N = \frac{N}{\ln N}$$



Model: Sequence-Wise Generalization Learner (SWG)

- **Motivation & Assumptions:**
  - Phonotactic knowledge **represented over syllables**
  - Representations initially **featurally-underspecified** during acquisition

We present a Syllable-Based computational model that learns a Positive Phonotactic Grammar categorizing forms as Licit, Marginal, or Illicit.

- **Learning Algorithm: recursive, feature-based subdivision** to learn phonotactics as **increasingly-specific sequences of feature sets**
  - At each step, intersect all sequences in current input to give underspecified sequence ***S***
  - If **sufficiently many sequences** matching ***S*** are licit, **add *S* to set of licit sequences**
  - Otherwise, **subdivide the input** based on the most frequent feature at the index in the string with the greatest difference between ***N*** and ***M,*** and recurse
  - If **no generalization & no more features to subdivide on**, then ***S* is marginal**

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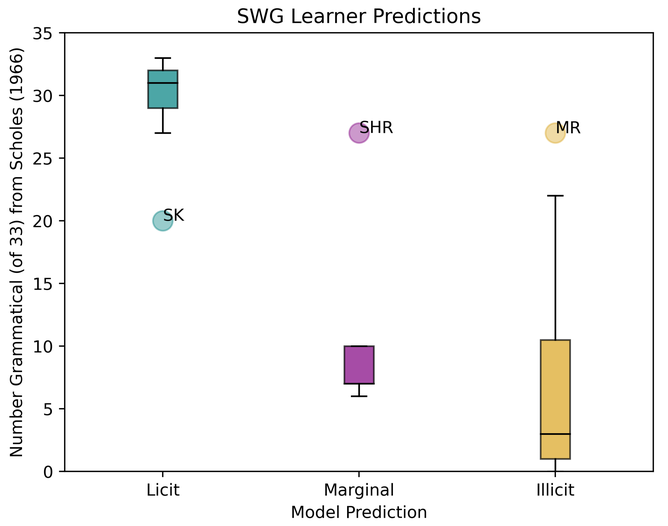
Data

- **Training:**
  - **CELEX ∩ CMU Pronouncing Dictionary:** ~41k words
  - Syllabify and extract syllable constituents (Gorman 2013)
  - Phonological Features from Hayes & Wilson 2008
- **Judgments:**
  - **Scholes:** complex onsets in monosyllabic nonce words
  - Binary decisions by 33 seventh graders

Results



	Attestation	SWG	H&W
Pearson's *r*	0.78	0.86	0.84
Spearman's TR *ρ*	0.74	0.78	0.79
Goodman-Kruskal *γ*	0.89	0.89	0.65
Kendall's τ_b	0.62	0.66	0.61

Future Work

- **Developmental Implications**
  - Model predicts **initial stage of conservatism**
  - Must **accumulate sufficient evidence** for licitness
- **Further comparisons**
  - Human judgments on English & **other languages**
  - Comparison to H&W and **other models**
- How can we learn **syllable contact constraints** in this framework?
- How does SWG fare on languages with **smaller vowel spaces?**
  - Prediction: **more onsets/codas will pass TSP** and be licit because ***N* will be smaller**