1. Overview

Learnability can create biases in typology:
- Hard-to-learn patterns are more likely to change across generations, becoming underattested.
- Underattested patterns are not necessarily likely to change.
- The learnability of a language is not just affected by what forms are allowed, but how common they are.
- Lexical Frequency of forms conditions learning.

The Sweet Spot Effect:
- Over time, lexical frequencies affect which patterns dominate a language's family.
- Some patterns are only likely with very specific rare lexical frequencies.
- Rare patterns are attested only by languages that fall in this sweet spot of lexical frequencies.

2. Methodology

Learnability using an agent-based Generational Learning Model (or iterated learning)
- A learning agent observes some limited number of forms and then matures (mimicking critical period)
- The mature agent stops learning and teaches a new learning agent (and so on)

Each agent is modeled as a MaxEnt grammar
- Learners are initialized with high weighted markedness, and low weighted faithfulness constraints
- On each iteration, sample one input form from teacher based on the lexical frequencies, and output forms for both the learner and the teacher
- If learner and teacher disagree, update learner's weights

3. Frequency affects dominant patterns

<table>
<thead>
<tr>
<th>Family</th>
<th>All-Final</th>
<th>[t]-Final</th>
<th>No-Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finno-Ugric</td>
<td>Estonian</td>
<td>Finnish</td>
<td>N/A</td>
</tr>
<tr>
<td>West Germanic</td>
<td>English</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Oceanic</td>
<td>Proto-Gela</td>
<td>N/A</td>
<td>Gela</td>
</tr>
</tbody>
</table>

Three languages with All-Final pattern, that belong to families with different distribution.

- English (West Germanic) [All-Final]
  - Child-directed speech
  - Most [t] and [k] of any tested language
  - [t]-Final is learned stably
  - But All-Final is very stable too.
  - 64% of simulations remain All-Final.

- Estonian (Finno-Ugric) [t-final]
  - Child-directed speech
  - Low rate of [k] leads to loss of final [k]
  - [t]-Final pattern is learned relatively fast, leading to stability.
  - 80% of All-Final simulations ended up [t]-Final

4. Explaining Rare Patterns

Previous work on learnability has uncovered simplicity bias.
- patterns that use less features are easier to learn

[t]-Final is more featurally complex than All-Final or No-Final because it is defined using both place and syllable position.

- Attested typology shows this bias: Only Finnish shows the [t]-final pattern. (O’Hara 2018)
- Finnish frequencies found from lexical corpus (Goldsmith & Riggle 2013)
- Finnish frequency condition stability of [t]-final.

If some lexical frequency distributions can cause [t]-Final to be learned easily, what causes its underattestedness?

Claim: The complex [t]-Final pattern is only predicted in a small subset of the possible frequency distributions

Experiment
- Ran simulations on 2002 frequency distributions,
- Iterated on each of the 6 frequencies with a step size of .1, where the sum=1.

[t]-Final is conditioned in the smallest sector.
A. Constraints Used

- Assign a violation for each velar stop
- Assign a violation for each velar or bilabial stop
- Assign a violation for each stop
- Assign a violation for each input segment without an output correspondent
- Assign a violation for each vowel-initial syllable
- Assign a violation for each consonant-final syllable

A. References