Novelty and frequency: An experimental investigation of perceptual linguistic saliency in unfamiliar speech

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Outline

1. **Saliency**
   - Saliency in SLA
   - Definition
   - Sources of Saliency

2. **Experiment**
   - Participants
   - Design
   - Materials

3. **Results**
   - Dorsal Fricatives
   - Alveolar Fricatives
   - Post-alveolar Fricatives

4. **Conclusions**
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Novelty and frequency: An experimental investigation of perceptual linguistic saliency in unfamiliar speech
One of the major challenges for second language (L2) learners is acquiring a novel L2 sound inventory that differs from their native language (L1).

Perception of novel L2 sounds is filtered through their L1 [Dupoux et al, 1999].

- Can facilitate L2 acquisition and production
- Can hinder L2 acquisition and production

Unclear which sounds an L2 learner notices or is aware of.
Saliency in SLA

Acquisition of Novel L2 Sound Inventory
what does a learner notice

- Intuitive notion that some L2 sounds seem to be more “noticeable” than others
  - “obvious”
  - “prominent”
- Not clear what actually determines a sound’s “noticeability” or “saliency”
- This characteristic has been termed “saliency.”
A clear (and useful) definition lacking

- elusive
- largely intuitive

Previous attempts at defining it rely further on vague concepts

- “some way perceptually and cognitively prominent” [Kerswill & Williams, 2002, p. 81]
- “easily noticeable, prominent or conspicuous” [Siegel, 2010, p. 129]
Saliency remains unquantified

- Lacks an empirically objective definition
- Similar to other “intuitive” terms
  - Ease of articulation
  - Difficulty
  - Similarity
  - Markedness
Possible Sources of Saliency

- The factors that underlie a segment’s saliency to listeners unfamiliar with a given language are unclear
- Intuitively many different potential sources of saliency
  - Frequency of a sound
  - Similarity
  - Rarity
  - Acoustics
  - Social-Psychology
  - etc

Each source predicts specific segments as salient
Models of Saliency

- Make model with different testable predictions
- Each model predicts specific segments as salient
- Can check against what is identified/noticed by listeners
**Models of Saliency**

- Acoustics
- Psychoacoustics
- Social-Psychology
- Typological Frequency
- Similarity
- Novelty
- Frequency
  - Absolute token frequency
  - Token frequency to L1 type frequency
  - Rarity
Salient=Sounds that are the most frequent in the stimuli

A pattern we might expect is that token frequency of occurrence within a sample is a factor in a sound being identified as salient.
Salient=Sounds that are more frequent than sounds in your L1

A pattern we might expect is that the token frequency of occurrence compared to the type frequency of that segment in your lexicon is a factor in a sound being identified as salient.
Sources of Saliency

Novelty

Salient = Sounds that aren’t in your L1

A pattern we might expect is that sounds that aren’t in your L1 are identified as salient

- [t d c_btn qГ]
- [f b s z ç j x y χ u ѡ ژ ]
- [b r ɬ]
- [m n n n]
- [θ ʒ l ʌ ū t]
Three Possible Sources

- **Novelty**
  - Salient = Sounds that aren’t in your L1

- **Frequency**
  - Salient = Differences in frequency for a given sound between L1 and audio sample
  - Salient = Token frequency of a given sound

- Compare models to results of a perception experiment
- Restrict this investigation to fricatives

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4 Conclusions
Participants

- American English L1 speakers
- Unfamiliar with any variety of Hebrew or Arabic
- Recruited from CUNY Graduate Center (N=26)
- This talk only looks at a sub-set of participants (the first 18).
Participants

- Non-linguists (N=7)
- Linguists (N=12)
  - Phoneticians, Phonologists, and Language Documenters were excluded
  - One Linguist excluded due to misunderstanding the task
Design

- Language samples presented using E–Prime 2.0 [Psychology Software Tools, Pittsburgh, PA]
- Quiet room with a headphones and a headphone mounted microphone.
- Responses recorded using Audacity and transcribed in Praat [Boersma & Weenink, 2013]
- Paper language background questionnaire
Instructions

1. Listen for any sound(s) (e.g. consonants, vowels, syllables) that jump out at you
2. REPEAT any sound(s) (e.g. consonants, vowels, syllables) that you noticed in the previous passage to the best of your ability
Materials

Stimuli

- Language Samples of translations of Aesop’s fable “The North Wind and the Sun” (except Defaka).
  - Male and Female speakers
  - Mean length = 46.24 seconds (range = 24 sec – 73 sec)

- Stimuli downloaded from:
  - IPA Handbook
  - Edinburgh IPA
  - UCLA Phonetics Archive

Play Sound
Stimuli Types

Varied by

- non-English fricative (Novelty)
  - Pharyngeal fricatives: \([\dot{h} \, \dot{f}]\)
  - Dorsal fricatives: \([x \, y \, \chi \, \nu]\)
- Relative Frequency of English fricative
  - High frequency \([\text{\textbar{[}}}\): probability > .0140
  - Low frequency \([\text{\textbar{[}}}\): probability < .0140

Five types of stimuli

<table>
<thead>
<tr>
<th>Type</th>
<th>Phoneme in Stimuli</th>
<th>[\text{\textbar{[}}}</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>II</td>
<td>✓</td>
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<td>III</td>
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<tr>
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<td>Filler</td>
<td>✓</td>
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</table>

Table: Stimuli Type

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## Stimuli Languages

<table>
<thead>
<tr>
<th>Type</th>
<th>Language</th>
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<tbody>
<tr>
<td>I</td>
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<td>Arabic, Modern Standard</td>
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<td></td>
<td>Modern Sephardi Hebrew</td>
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<td>II</td>
<td>Bulgarian</td>
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<tr>
<td></td>
<td>Dutch</td>
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<tr>
<td></td>
<td>Modern Ashkenazi Hebrew</td>
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<td>III</td>
<td>Galician</td>
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<td>Hungarian</td>
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<td></td>
<td>Portuguese, European</td>
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<td>IV</td>
<td>Amharic</td>
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<td>Norwegian, Bokmål</td>
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<td>Defaka</td>
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<td>Norwegian, Bjørnvatn</td>
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<td>Sindhi</td>
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<td>Swedish</td>
</tr>
</tbody>
</table>
Stimuli Presentation

- Each stimulus presented twice
- Two Blocks
  - Pseudorandomized
  - approx. 20 minutes
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Responses

Range of responses (participant idiosyncrasies):

- Longer non-words
  - [ʃah χots χav]
- A syllable
  - [ʃa] [χa]
- One sound
  - [ʃː]
- “Don’t remember”
- “Nothing”
Responses

Ways of talking about “dorsal fricatives”

- [taxtax tαχtaχ] it’s a very phlegmy sound there in the middle [tαχaαχaχ]
- strong “h” sound [xaɾ hαχ hαx]…
- …sometimes with a hard “h” [χαx xεx] sound, uh, within the, within the sentences
- all those back fricatives dude, they’re super noticeable, um, different positions, but um, they’re the most obvious, um, sound features
- uh, it was fricatives dude I can’t get over those like the velars and the glottals and the whatever fricatives…
- …lots of like, kind of velar back of the throat sounds
Responses

- Responses transcribed in Praat
- Coded for fricatives, affricatives, and rhotics
  - Place of articulation
  - Irrespective of voicing
  - Present=1 or more occurrences
  - Each fricative was coded separately even if a number of different fricatives in a single response
- Participants gave other responses (e.g. stops, vowels) but these were not coded.
Dorsal Fricatives

**Figure**: Dorsal Fricative Log Frequency

**Figure**: Post-Palatal Fricative Responses
Dorsal Fricatives

Figure: Fricative Responses and Log Frequency
Alveolar Fricatives

Figure: Alveolar Fricative Relative Frequency

Figure: Alveolar Fricative Log Frequency Responses
Non-[s] Sibilant Fricatives

**Figure:** non-[s] Sibilant Relative Frequency

**Figure:** non-[s] Sibilant Responses
Non-[s] Sibilant Fricatives

Figure: non-[s] Sibilant Responses and Relative Frequency
Non-[s] Sibilant Fricatives

Figure: non-[s] Sibilant Responses and Log Frequency
Preliminary results show a couple of trends:

- Post-palatal responses being unrelated to fricative frequency – a possible effect of novelty.
- Alveolar fricative and Non-[s] sibilant responses being related to either log frequency or relative frequency.

**Figure:** Fricative Responses and Relative Frequency

**Figure:** non-[s] Sibilant Responses and Relative Frequency
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The preliminary results suggest that frequency is a source of perceptual linguistic saliency only for segments which are in the language of the listener.
Novelty

- Mere presence of a novel segment seems to be an important factor: Novelty Bias
- Similar to the “novel popout” effect in visual processing [Strayer & Johnson, 2000]
- Consistent finding that L1 phonetic drift was stronger when the L2 was novel [Chang, 2013]
Future Work

- Transcribe remain participants
- Analytic statistics
- Compare results to other models of saliency

Ultimately we hope to identify major factors underlying saliency.

An empirically motivated conception of saliency ultimately helps us better understand multilingual acquisition of novel contrasts.
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  - Participants

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Audacity 2.0.3 [Computer software audio editor] (2013) freely available for all computer platforms from: http://audacity.sourceforge.net/


Works Cited II


