Listener knowledge about linguistic variation: The case of the sociolinguistic variable (ING)

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Big question

• When we’re listening, do we know what we know when we’re speaking?

• Or, more specifically: When perceiving speech, do listeners access knowledge about probabilistic patterns of sociolinguistic variable realization in production?
Background: (ING)

• Many sociolinguistic production studies have investigated the English sociolinguistic variable (ING) = *talking vs. talkin’* (e.g. Forrest, 2015, Hazen, 2008, Kendall, 2013, Labov, 2001, Tagliamonte, 2004)

• We know a lot about (ING)’s probabilistic conditioning, e.g., in general, –*in* is more likely when:
  
  – the word is a progressive verb (vs. other grammatical categories like adjectives, nouns, (sometimes) gerunds)
  – the word has fewer syllables
  – the (ING) is not followed by a velar
  – the (ING) is preceded by a velar
We also know that the realization of the variable impacts listeners’ evaluation of speakers and speaker characteristics (e.g. Campbell-Kibler, 2005, Labov et al., 2011, Levon & Fox, 2014, Tamminga, yesterday).

Campbell-Kibler (2005):
- Listeners think speakers sound more educated & articulate (for example) when they use –\textit{ing}.

Labov et al. (2011; see also Levon & Fox, 2014):
- Frequency with which a speaker used –\textit{in} vs. –\textit{ing} affected how suitable listeners thought that speaker would be as a TV newscaster.
Listener knowledge?

- We know that listeners keep track of probabilistic information in speech

- Sometimes, monitoring for these features is adaptive in that it aids in comprehension (cf. Kleinschmidt & Jaeger, 2015):
  - important to know whether a VOT value tends to correspond to /b/ or /p/ for a particular speaker (cf. Allen & Miller, 2004, Clayards et al., 2008, Theodore et al., 2014)

- However, variability in production does not always result in lexical ambiguity or gross phonetic category mismatches (as is the case with (ING))

- So, in cases where encoding probabilistic details of the variation may not aid in word recognition, are listeners also sensitive to the probabilistic conditioning of variability?
## Experiment 1

- **Stimuli:** 96 sentences, each with one (ING) word

<table>
<thead>
<tr>
<th>Grammatical category</th>
<th>Example</th>
<th>Percentage of stimuli*</th>
</tr>
</thead>
<tbody>
<tr>
<td>progressive</td>
<td>He's <em>writing</em> to his parents.</td>
<td>50%</td>
</tr>
<tr>
<td>adjective</td>
<td>That was an <em>interesting</em> discussion.</td>
<td></td>
</tr>
<tr>
<td>noun</td>
<td>Every <em>morning</em> Ted goes for a run.</td>
<td>50%</td>
</tr>
<tr>
<td>pronoun</td>
<td>I'd do <em>anything</em> to help him.</td>
<td></td>
</tr>
<tr>
<td>gerund</td>
<td>Stop <em>involving</em> me in your plans!</td>
<td></td>
</tr>
</tbody>
</table>

* Distribution roughly following Hazen (2008)

**Stimuli also vary by:**
- preceding phonological environment
- following phonological environment
- number of syllables
- (include word frequency in statistical models)
Experiment 1

• Matched guise (Campbell-Kibler, 2005):
  – Stimuli produced by 4 female talkers

- **–ing frame**
- **–in frame**

- **–ing realization**
- **–in realization**

• 48 participants; each heard 96 sentences (24/talker)
  – For each sentence, ½ of participants heard –ing realization & ½ heard –in realization
Experiment 1

• **Instructions**: Press the –*ing* button when you hear a word ending in –*ing* and the –*in* button when you hear a word ending in –*in*

• **Hypothesis & predictions**
  
  • Question is whether the production constraints on (ING) are included in a listener’s top down information when performing the classification
    
    – If so, this evidence should be reflected in their accuracy and reaction times, alongside typical perceptual effects
Experiment 1: Results

- We see expected perceptual/processing effects, e.g.:

**Frame x realization interaction:**
Listeners are more accurate when the realization of (ING) matches up to the frame in which the token was originally produced.

**Canonical form effect:**
More accurate for –*ing* realization overall.
Experiment 1: Results

**Predictability effect:**
Listeners are more accurate the later on in the sentence the (ING) word occurs; suggests that this is a predictive process
**Experiment 1: Results**

**Frequency x realization interaction (marginal):** For –*in* realizations, listeners are LESS accurate for higher frequency words.

**Speed/accuracy tradeoff;** listeners are FASTER for higher frequency words for –*in* realizations → LESS accurate.
Experiment 1: Results

**Following environment effect:**
In velar following environments, listeners are less accurate in their classification of variants.

But, following alveolar should be more accurate for –*in* than –*ing* if in line with production.
Experiment 1: Results

• Crucial question: Do responses also show sensitivity to production patterns?
  – Biggest predictor in production: grammatical category
  • Least likely to be –\textit{in} in production: adjective, pronoun 3 (\textit{anything} & \textit{everything}), & noun

Results:
• Interaction of grammatical category x realization
• Larger effect of realization for categories strongly disfavoring –\textit{in} in production (pronoun 3 & adjective)
  • (Noun likely acting differently due to item effects; overrepresentation of lexical item “morning”)
Experiment 1: Results

• Results reflect general perceptual and processing effects

• However, it also seems that listeners do have some expectations in perception about production norms (grammatical category x realization)

• Might comprehenders demonstrate knowledge of production conditioning factors more when auditory/perceptual factors are less involved?
Experiment 2

• Given a written sentential frame, without any auditory information, do listeners generate expectations about how the variable is likely to be realized?

• **Participants:** 83 Mechanical Turk workers

• **Stimuli:**
  – 96 sentences from Experiment 1
  – 6 control sentences
    • Control sentences: should never be –*in* (“That’s the **thing** I want”)

  – Each participant was pseudo-randomly given 40 of the 96 (+ 6) sentences
Experiment 2

• Instructions (excerpt):
  – “Imagine that each sentence below is being spoken out loud. Please select how surprising it would be to hear the underlined word in each sentence pronounced with an –IN rather than –ING ending.”
  – “Answer by rating on a scale of 1 (not at all surprising to hear –IN) to 6 (extremely surprising to hear –IN)”

• Analysis:
  – Do production conditioning factors predict the median rating of how surprised participants would be to hear –in?
Experiment 2: Results

Most surprised to hear –in

Not surprised to hear –in

• Most surprised to hear –in for pronoun 3, adjectives, & nouns, keeping with production norms
• Other factors (e.g. frequency, phonological env.) predictive as well
• Without “interference” from auditory perceptual factors, evidence of knowledge of production norms is stronger
Current/future directions

• We’re ultimately interested in investigating the factors involved in comprehension of speech; triangulate in on what perceptual factors interact with production factors.

• In real speech, realization would be embedded in a frame with many consistent cues → generate expectations from the frame + the variable realization (cf. Sumner et al., 2014)

  Task: Classify original sentence frames

  The “Producing –in Instantly Makes You Southern” Effect

• Strength of the –ing/–in percept itself varies; “Accuracy” in Exp 1 was based on speakers’ intent, not on bottom-up percept.

  e.g. Following velars can create –ing percept even for –in realizations

  Task: Classify isolated words
Conclusion

• These experiments demonstrate that listeners are at least somewhat sensitive to probabilistic details of production norms when perceiving (ING)
  – Evidence that listeners have expectations about whether a particular word will be realized as –\textit{in} or –\textit{ing}

• The challenge remains to further unpack the interaction between knowledge of production patterns and other perceptual processes

• Many interesting open questions remain:
  – How much is the sociolinguistic variable itself involved in keeping track of the sociolinguistic variable?
  – Why don’t general perceptual/processing factors wash out production factors over time?
  – Do speech perception and social evaluation exert different influences on the tracking of variables?
  – How much do listeners keep track of an individual speaker’s characteristic (ING) realization?
Thank you!

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