Creaky Voice in a diverse gender sample: Challenging ideologies about sex, gender and creak in American English
Conflicting perspectives on the link between gender and creaky voice, which has been associated with:

- **Men** in the UK (Esling 1978; Henton & Bladon 1988; Stuart-Smith 1999)
- **Young, white women** in the US (Yuasa 2010; Podesva 2013)
- **Chicano/a gangsters** (Mendoza-Denton 2007, 2011)
- **Men** who are (perceived as) **gay/queer** (Podesva 2007; Zimman 2013)

Gendered meaning of creak is still uncertain
Background

• Previous studies all operate within the gender binary
• Limitations of this view:
  • Restricts our theorization of gendered social meaning to two options: **maleness/masculinity** and **femaleness/femininity**
  • Encourages **simplification of gendered meaning** based on broad correlations
  • Does not reflect the **full diversity** of the population. What about **trans speakers**?
  • Hard to tease apart **socialization, identity, physiology**
Our goals

- To include speakers with a wider range of identifications related to sex and gender
- To take a more nuanced view of gender identity and different aspects of sex
- To pay special attention to how creak relates to queer and trans identities
  - Zimman (2012, 2013) suggests that trans men may be especially creaky

Who uses creak?

Can a more diverse sample wrt sex and gender help us get a handle on creak’s social meanings?
Coding for sex and gender

- Factors to consider
  - **Identity**: current self-reported gender
  - **Socialization**: sex assignment at birth
  - **Laryngeal physiology**: exposure to testosterone

- Operationalized as 2 factors, each with 3 levels
  - **Gender identity**: female, male, non-binary
  - **Sex assigned at birth** and current **hormonal status**:
    - Male-assigned (AMAB)
    - Female-assigned, not on testosterone (AFAB)
    - Female-assigned, on testosterone (AFAB+T)
## Identity categories

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Non-binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMAB</td>
<td>Trans women</td>
<td>Cis men</td>
<td>AMAB non-binary</td>
</tr>
<tr>
<td>AFAB</td>
<td>Cis women</td>
<td>Trans men, not on testosterone</td>
<td>AFAB non-binary, not on testosterone</td>
</tr>
<tr>
<td>AFAB+T</td>
<td>N/A</td>
<td>Trans men, on testosterone</td>
<td>AFAB non-binary, on testosterone</td>
</tr>
</tbody>
</table>
Methods: Data collection

- Native speakers of American English, ages 18-35:
  - Recorded in 2013, at Reed College Lab of Linguistics (LoL) in Portland, Oregon
  - 80% self-reported as white or Caucasian
- 2 speech styles:
  - **Casual interview** discussing speaker’s hometown
  - Scripted reading of the **Rainbow Passage**
Methods: Speakers

- Speakers self-reported their gender identity, assigned sex, and hormonal status in a post-recording questionnaire and/or online survey.

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Non-binary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMAB</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>AFAB</td>
<td>6</td>
<td>2</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>AFAB+T</td>
<td>N/A</td>
<td>7</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>15</td>
<td>22</td>
<td>51</td>
</tr>
</tbody>
</table>
We present results from a subsample of 27 speakers:

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Non-binary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMAB</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>AFAB</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>AFAB+T</td>
<td>N/A</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>12</td>
<td>6</td>
<td>27</td>
</tr>
</tbody>
</table>
Methods: Transcription

- **Segmental**: Phonemic transcriptions and segmentations automatically generated by FAVE (Rosenfelder et al. 2011)
  - Full recording of Rainbow Passage
  - First 5 minutes of the casual interview recording
  - Boundaries hand-corrected by RA in cases of FAVE error

- **Prosodic**: Locations of right edges of intonation phrases (IPs), and IP boundary tone type, using ToBI labels (Veilleux et al. 2006, Beckman & Ayers Elam 1997)
  - L-L%: low falling (e.g. declarative)
  - L-H%: low rising (e.g. continuation rise)
  - H-H%: high rising (e.g. yes/no question)
  - H-L%: high plateau (e.g. trailing off)
  - !H-L%: downstepped plateau (e.g. calling contour)
Methods: Auditory coding

- Each vowel was coded by a primary coder for:
  - **Voice quality**: modal, creaky, other (e.g. breathy), or unsure
  - **Pitch accents**: unaccented, accented, nuclear accented
  - **Vowel quality**: generated by FAVE, hand-corrected by RA

- A secondary coder coded for voice quality
  - Mean inter-coder reliability across recordings: **84.9%**

- Discrepancies between coders resolved by authors
  - In cases where no 2 coders agreed on a given vowel’s voice quality code, that vowel was discarded
Methods: Auditory coding

- All coding was done auditorily, as in previous work on creak and gender (Podesva 2013; Zimman 2013)
- Choice also based on results of related work (Khan et al. 2015)
  - 16 trained linguistics students rated relative creakiness of phrase-final word ‘bows’ extracted from the Rainbow Passage
  - Crosslinguistic acoustic cues for creak (H1-H2, H1-A1, H1-A3) were found not to be correlated with our students’ creakiness ratings
  - Creaky voice in American English, at least, seems to be cued by a more complex array of acoustic features
The data: overall patterns

- **Wide range across speakers** in use of creak
The data: overall patterns

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Non-Binary</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMAB</td>
<td>26%</td>
<td>26%</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>AFAB</td>
<td>38%</td>
<td>35%</td>
<td>22%</td>
<td>37%</td>
</tr>
<tr>
<td>AFAB+T</td>
<td>n/a</td>
<td>23%</td>
<td>23%</td>
<td>23%</td>
</tr>
<tr>
<td>total</td>
<td>35%</td>
<td>26%</td>
<td>29%</td>
<td></td>
</tr>
</tbody>
</table>
We ran a *mixed-model logistic regression* on individual vowels

- **Response:** Voice quality (creak is the application value)
- **Predictors:**
  - **Internal factors**
    - Word (random)
    - Vowel quality
    - Stress (primary, secondary, none)
    - Pitch accented (yes, no)
    - Position in IP (final, non-final)
    - IP bndry tone (LL, LH, HH, HL)
    - IP-initial vowel (yes, no)
    - Style (casual, reading)
  - **Social factors**
    - Speaker (random)
    - Year of birth (continuous)
    - Gender id (F, M, non-binary)
    - Sex (AFAB, AFAB+T, AMAB)
    - Sexual orientation (asexual, bi, gay, queer, straight)
Results: Internal factors

- All internal factors selected were in line with previous literature

<table>
<thead>
<tr>
<th>Factor</th>
<th>p value</th>
<th>Level</th>
<th>n</th>
<th>Proportion of vowels that are creaky</th>
<th>Factor weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP boundary tone</td>
<td>p &lt; .001</td>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position in IP</td>
<td>p &lt; .001</td>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP-initial vowel</td>
<td>p &lt; .001</td>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vowel quality</td>
<td>p &lt; .001</td>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>p = .00161</td>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Style</td>
<td>p &lt; .001</td>
<td>Casual</td>
<td>0.248</td>
<td>13788</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reading</td>
<td>-0.248</td>
<td>7054</td>
<td>.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.438</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.562</td>
</tr>
</tbody>
</table>
Results: Social factors

- The social factors show a more complicated picture
  - Gender identity, sexual orientation, and age are NOT predictors of creak as a main effect
  - **Sex is the only social predictor of creak**

<table>
<thead>
<tr>
<th>Factor</th>
<th>p value</th>
<th>Level</th>
<th>n</th>
<th>Proportion of vowels that are creaky</th>
<th>Factor weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>p = .0419</td>
<td>AFAB</td>
<td>0.492</td>
<td>7126</td>
<td>.37</td>
</tr>
<tr>
<td>AMAB</td>
<td>-0.239</td>
<td>9230</td>
<td>.26</td>
<td>.441</td>
<td></td>
</tr>
<tr>
<td>AFAB + T</td>
<td>-0.254</td>
<td>4486</td>
<td>.23</td>
<td>.437</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

- We return to our original goals, specifically in how we tease apart various aspects of sex and gender.
  - **Identity**: self-reported gender identity
  - **Socialization**: sex assignment at birth
  - **Laryngeal physiology**: exposure to testosterone
- We’ve determined that **gender identity does not predict use of creak**
So should we just replace “gender” with “sex assignment at birth”? 
Not exactly. **Sex assignment at birth** alone does not predict creak either. 
Speakers assigned female at birth fall into two categories with respect to use of creak:
- AFAB speakers (not on T) favor use of creak
- AFAB+T speakers disfavor use of creak, like AMAB speakers
Discussion

• Ah! So then is it the physiological aspect of sex?
• **Laryngeal physiology is the common trait here.**
  • AFAB speakers not on T favor creak
  • AMAB and AFAB+T speakers disfavor creak
• Helps us group cis men and trans men on T (less creak) apart from trans men not on T (more creak).
Discussion

• One possible interpretation:
  • Men are presumably motivated to sound more masculine
  • Cis men and trans men on T achieve this through laryngeal changes from testosterone exposure
  • Trans men not on T may utilize creak as an alternative

• However, this account cannot explain why cis women use creak at such a high rate!
  • We do not assume that all people, regardless of gender or sex, are motivated to sound more masculine
  • Thus, this cannot be the end of the story
Conclusions

- Our study complicates our view of gender and creak
  - *Wider range* of sex/gender categories
  - Explicitly tease apart separate influences of *identity*, *socialization*, and *physiology*

- **Laryngeal physiology was the best predictor** of creak use, not gender identity or assignment at birth

- We’re currently working to further complicate this finding with additional data in our sample

- We invite your input and suggestions
Acknowledgments

• This project was funded by Reed College’s Stillman Drake Fund and Summer Scholarship Fund.
• Many thanks to our speakers, our tireless RAs (pictured below), and our audience here at NWAV!
References


Khan, Sameer ud Dowla; Becker, Kara; Zimman, Lal. 2015. Acoustic correlates of creaky voice in English. Talk presented at the 170th Meeting of the Acoustical Society of America, Jacksonville.


Veilleux, Nanette; Shattuck-Hufnagel, Stefanie; Brugos, Alejna. 2006. Transcribing Prosodic Structure of Spoken Utterances with ToBI. MIT OpenCourseWare. http://ocw.mit.edu
