Effects of Cosmetic Tongue Bifurcation on English Fricative Production

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18th International Congress of Phonetic Sciences 2015

Interdisciplinary Speech Research Laboratory

ICPhS XVIII Glasgow, 10-14 August 2015 Wednesday, August 12, 2015 Session 8.8, Paper 3 (12:00-12:15)
Q: What is bifurcation?

A: An elective body modification.
Why study tongue bifurcation?
- it’s a novel and growing population of speakers
- expand on case studies (e.g. Bressmann, 2004, Tomaszek, 2015)
- to learn more about the tongue
Principles & Goals

• Core principles of the project:
  o *no value judgment* on individual’s decisions
  o neither deter nor encourage bifurcation
  o gather information and provide evidence

• Goals
  o contribute to the small but growing body of evidence regarding bifurcation and speech
  o offer evidence that can better inform decisions
The Research Question

• Does the speech of bifurcants differ from the speech of controls?
  o elicited speech to look at:
    ▶ 6 Fricatives in English: s, z, θ, ð, š, ʒ
  o Qualitative:
    ▶ sound atypical? How?
  o Quantitative:
    ▶ CoG of the fricatives different? How?

• Conclusion:
  o as a group, bifurcants have more atypical fricatives and different CoG measurements than controls

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**Methods - Participants**

### Bifurcants
- 12 participants
  - Age range 20 – 40
  - 4 women, 4 men, 1 transgender man, 2 genderqueer persons, 1 genderfluid person

<table>
<thead>
<tr>
<th>Age at study</th>
<th>Gender</th>
<th>Bifurc Years</th>
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<tr>
<td>20</td>
<td>Genderqueer</td>
<td>0.5</td>
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<tr>
<td>27</td>
<td>F</td>
<td>1.5</td>
</tr>
<tr>
<td>22</td>
<td>Transgender Man</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>M</td>
<td>3</td>
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<td>26</td>
<td>F</td>
<td>5</td>
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<tr>
<td>28</td>
<td>Genderqueer</td>
<td>7</td>
</tr>
<tr>
<td>25</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>26</td>
<td>M</td>
<td>7</td>
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<td>27</td>
<td>Genderfluid</td>
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<td>40</td>
<td>F</td>
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<td>35</td>
<td>M</td>
<td>10</td>
</tr>
<tr>
<td>33</td>
<td>M</td>
<td>13</td>
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### Controls
- 12 participants
  - Age range 20 – 50
  - 8 women, 4 men

<table>
<thead>
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Unpacking “Atypicality”

- Clicky
  - like lips (or tongue tips) parting

- Slushy
  - like lateral fricative (or medial?)

- Whistley
  - tongue-teeth contact

sagittal head of [θ] from
http://smu-facweb.smu.ca/~s0949176/sammy/
• Elicited speech:
  o 6 blocks of 40 tokens
  o collect ~15 of each target fricative for analysis
  o target fricatives: s, z, θ, ð, ʃ, ʒ
Methods - Stimuli

- Tokens to elicit target fricatives
  - aʃa, asa, aza, aʒa, aθa, aða, oθo, ʌðɚ, isi

- Other tokens:
  - aɪa, ala,ipi, idi, ada, ata, atʃa,
Results - Quantitative

- **Data Analysis**
  - Praat measured Fricative Centre of Gravity
  - compare means & SD

*top: z, õ, ð*
*bright: s, ʃ, θ*
Qualitative Analysis

- What does the speech sound like?

1. “typical” theta
2. “slushy” theta
3. “slushy” theta
Results - Qualitative

• Percentage of fricatives rated as atypical

<table>
<thead>
<tr>
<th></th>
<th>[s]</th>
<th>[z]</th>
<th>[ʃ]</th>
<th>[ʒ]</th>
<th>[θ]</th>
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<td>19.26</td>
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<td>31.96</td>
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<td>CONT</td>
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<td>6.63</td>
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Discussion

- **Bifurcation** = more variation in acoustic data
  - centre of gravity measurement more variable

- **Consistent distortions in some speech sounds**
  - theta most affected - interdental tongue contact and frication through groove or split in bifurcated tongue
  - distortions don’t happen every time, just more often

- **Bifurcants**: 7.67% – 60.36% atypical
- **Controls**: 3.37% - 15.28% atypical
Conclusions & Next Steps

- bifurcation will likely impact some speech sounds (fricatives)
- bifurcation will likely not impair comprehensibility
- individual differences mediate adaptation
- recommend neither for nor against bifurcation
- not all bifurcants can move tongue tips independently
- length of time ≠ effect on speech

Next steps:
- before / after testing
- biomechanical modeling in ArtiSynth
- analyze longer passages of speech (North Wind)
Thank you!

:-3

NSERC USRA grant

linguistics.ubc.ca/bifurcation
References & Recommended Readings


Acknowledgments:

- NSERC USRA grant, UBC Faculty of Arts Work Study program
- Praat scripts adapted from Mieta Lennes
- Joseph Stemberger for feedback and advice
- Kathleen Currie Hall for programming and scripting assistance
- Jonathan de Vries and Avery Ozburn for scripting and help
- Jen Abel for help, feedback and advice
- Noriko Yamane for Ultrasound training and assistance
- Tanya Tam and Nicole Anger for segmenting assistance
- Wini Murphey and Grace Wei for running the pilot
- All the ISRL labmates that helped and participated!
- Russ Foxx, professional body modification artist for help recruiting participants with bifurcated tongues

[linguistics.ubc.ca/bifurcation]