Sexual orientation, phonetic variation and the roots and accuracy of perception in the speech of Northern England English-speaking men

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Overview

Background

Queerly phrased

- Pre-1997
- Zwicky (1997) in *Queerly phrased: language, gender, and sexuality*
  1.
  2.

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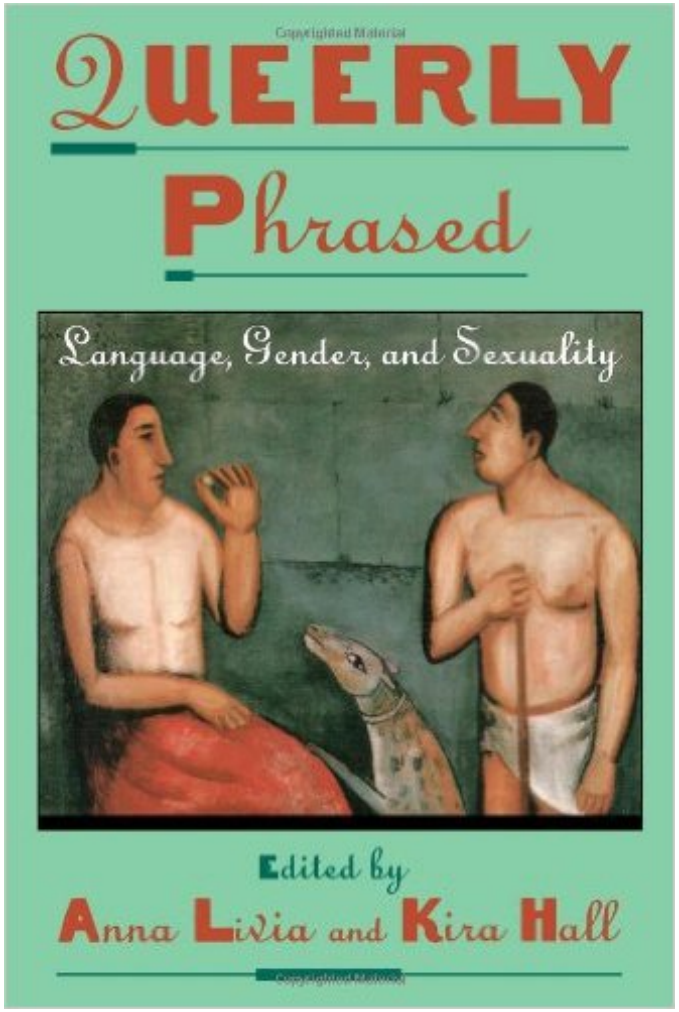

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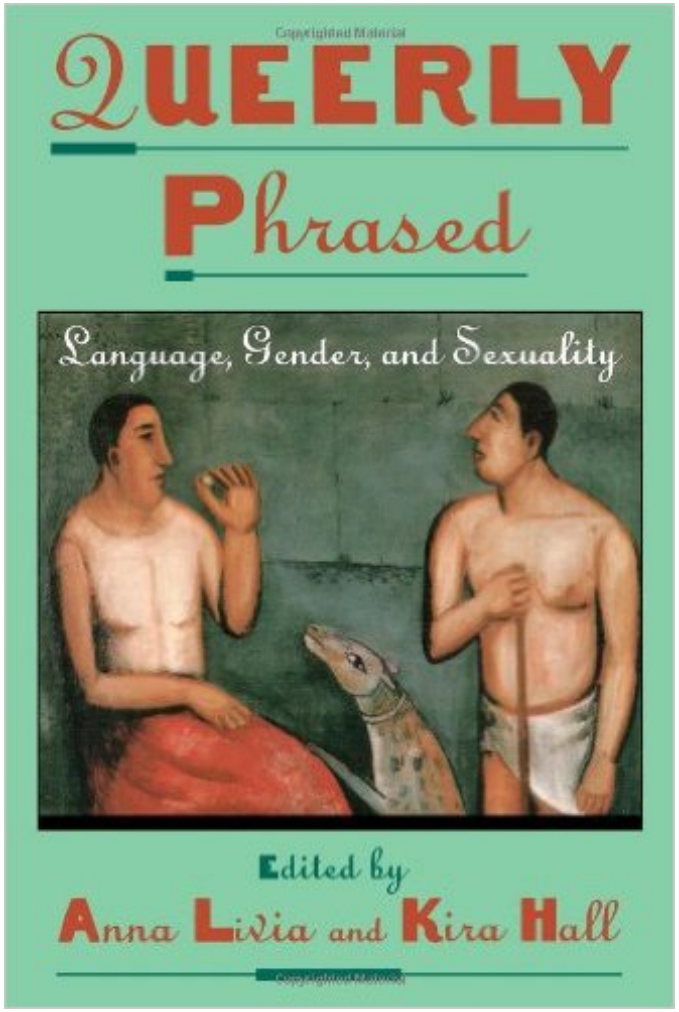

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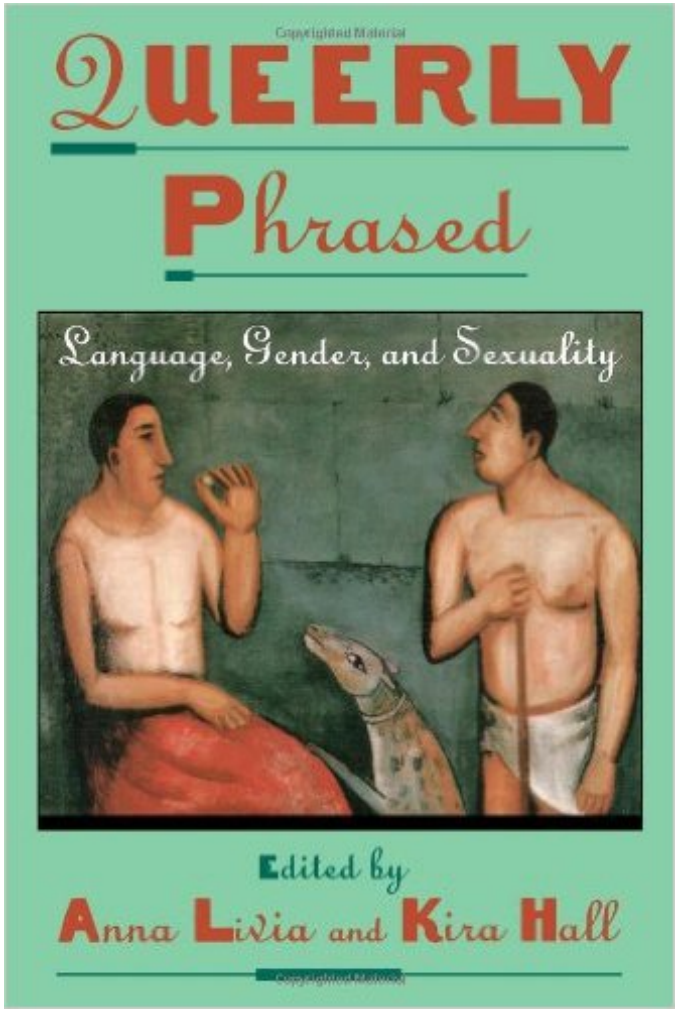

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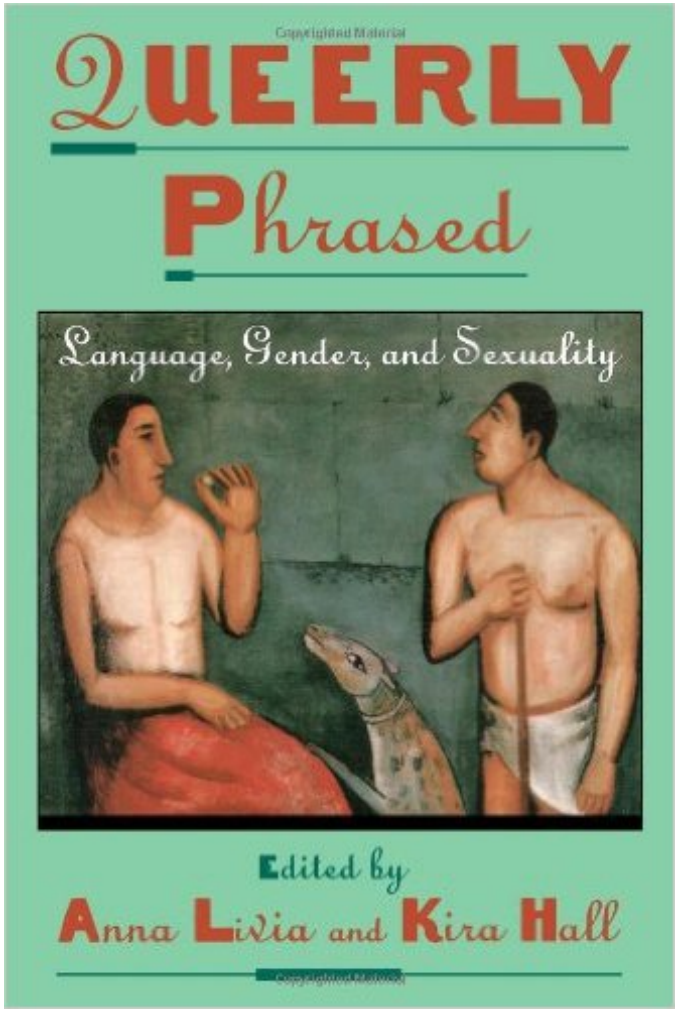

Previous research: scope and approaches

- Scope:
  - Phonetic variation
  - Perceptual variation
- Approach:
  - Laboratory based
  - Matched guise/digital manipulation
  - Ethnographic

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Something WEIRD going on

- WEIRD (Henrich *et al.* 2010)
  - Majority of research based on societies that are:
    - Western
    - Educated
    - Industrialised
    - Rich
    - Democratic
    - ... and mostly based on the USA
  - Focus behavioural science, but common elsewhere
  - Sexual orientation and the voice research: dominated by North American research, very few exceptions

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- Correlates:
  - /s/
  - Pitch
  - Vowels
- Extra-linguistic factors
  - Context (Podesva 2007, 2008)
  - Topic/ideology (Levon 2009, 2010)

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Research questions

1. How does sexual orientation affect phonetic variation in Northern England English and how does this interact with style and exposure to LGBT people?
2. How accurate are perceptions of sexual orientation based on Northern England English speech and how does this interact with phonetic variables, style, speaker and listener exposure to LGBT people, listener linguistic and cultural background, segmental features and judgemental constraints?

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2. Phonetic variation will be greater in conversation
3. Phonetic variation will correlate with speakers' exposure to LGBT people
4. Perceptions of sexual orientation will directly correlate with phonetic variation

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Hypotheses II

5. Perceptions of sexual orientation will correlate with actual sexual orientation, but with overlap; accuracy will be greater for straight speakers
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8. Accuracy will be greater for listeners with higher exposure

Hypotheses II

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Hypotheses III

9. Accuracy will be greater for listeners who are LGB and/or from the United Kingdom and/or have lived in the United Kingdom and/or speak English as their first language
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Methodology

Scope and approach

- Scope: both phonetic and perceptual variation
- Approach: laboratory-based

Speakers

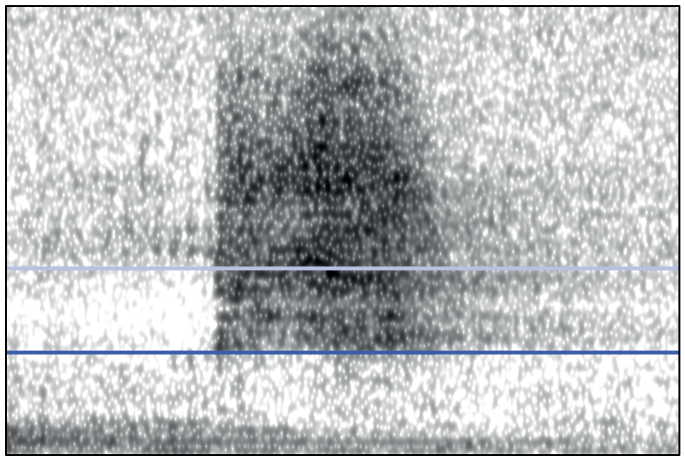
- Recruited from existing contacts
- Four gay and four straight speakers
- Northern England English speakers - countering North American bias, but still WEIRD
- Controls: physique, age, gender identity, ethnicity
- Paired by sexual orientation - prior acquaintances
- Three gay speakers involved in LGBT activism

Speech data

- Recorded in a quiet room
- Process:
  1. Speakers made aware of focus
  2. Took turns to **read passage**
  3. Brought together for **conversation** on politics
- Processed in Praat and other programs
  - 30 second clips in each environment
  - Low-pass filtration

Phonetic analysis

- Praat script and additional measurements
- Variables:
  1. /s/ duration
  2. /s/ intensity
  3. /s/ single spectral measures - low-cut-off frequency; peak frequency
  4. /s/ spectral moments - centre of gravity; standard deviation; skewness; kurtosis
  5. Global pitch



Perceptual experiment

- Google Forms
  1. Three sections of individual clips
     - Seven-point semantic-differential scale for sexual orientation
     - Variety of question types on other characteristics
  2. One section paired speakers - forced choice
- Translations: Malay and Russian
- Distribution: university administrators; Facebook
- 45 listeners

Judging accuracy

Perceived sexual orientation	Accuracy
1 (definitely gay)	1
2	0.83
3	0.67
4	0.5
5	0.33
6	0.17
7 (definitely not gay)	0

Table: Conversion of scalar perceived sexual orientation to accuracy for gay speakers

Statistical analysis

- Linear mixed-effects regression
  - Random effects: speaker (phonetic) and listener (perceptual)
  - Fixed effects: independent variables
  - R, lmer4 package

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Results

Statistical significance

- *p*-values a contested measure of significance
- lmer4 package provides *t*-statistics
- *t*-statistic $\geq \pm 2 \approx$ *p*-value ≤ 0.05
- *p*-values provided for convenience

Hypothesis one

Phonetic variation will correlate with sexual orientation, but with overlap

Hypothesis one: /s/ standard deviation [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	2969.095	165.551	17.935	1.62e-06
Straight	-583.692	233.666	-2.498	0.0462

Table: Effect of sexual orientation on /s/ standard deviation

Hypothesis one: /s/ standard deviation [2]

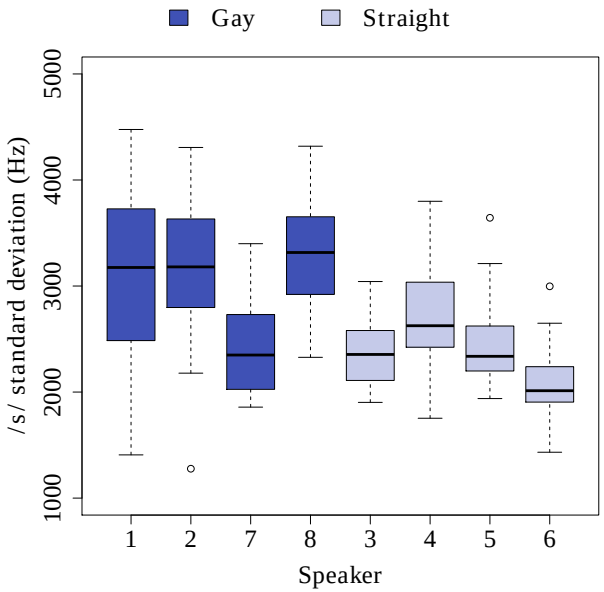


Figure: /s/ standard deviation by speaker

Hypothesis one: /s/ peak frequency [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	9996.989	165.551	37.125	2.07e-08
Straight	-1595.257	233.666	-4.208	0.00567

Hypothesis one: /s/ peak frequency [2]

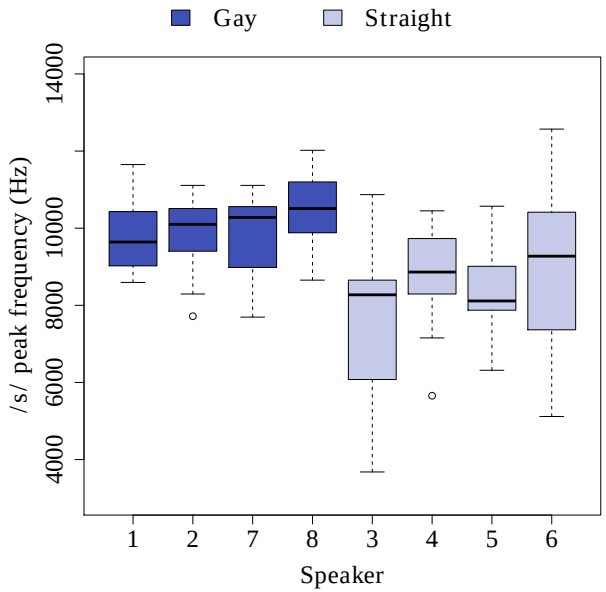


Figure: /s/ peak frequency by speaker

Hypothesis one: global pitch [1]

	Estimate	Std. error	t-statistic	p-value
(Intercept)	120.680	3.660	32.974	5.18e-08
Straight	-18.616	5.176	-3.597	0.0114

Hypothesis one: global pitch [2]

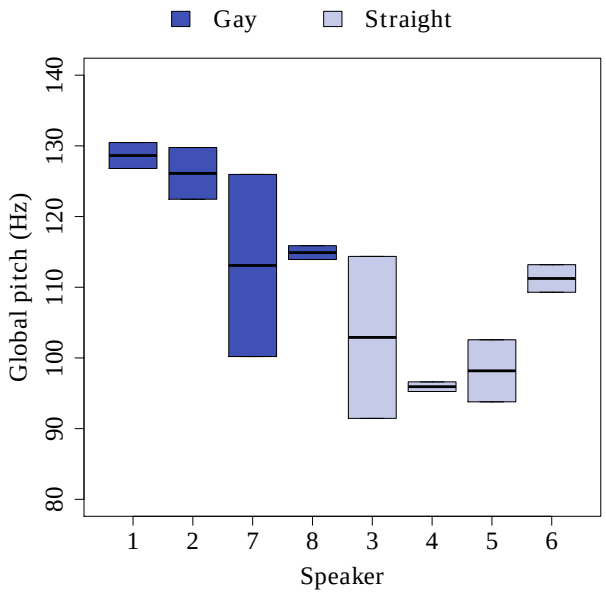


Figure: Global pitch by speaker

Hypothesis one: non-significant results

All other variables were non-significant

Hypothesis two

Phonetic variation will be greater in conversation

Hypothesis two: /s/ duration in read passage

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	0.071792	0.004928	14.569	9.65e-06
Straight	0.015389	0.007013	2.194	0.0714

Hypothesis two: /s/ duration

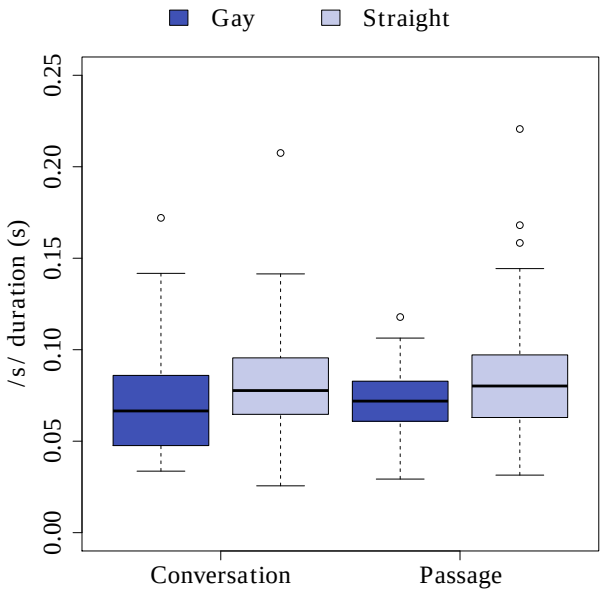
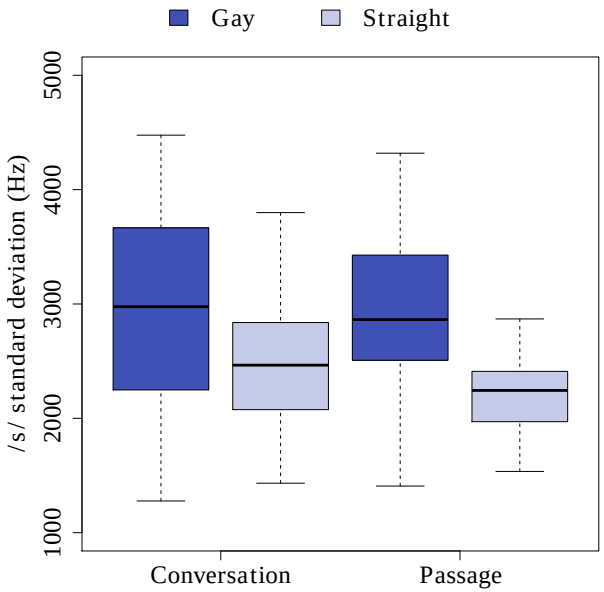


Figure: /s/ duration by sexual orientation and environment

Hypothesis two: /s/ standard deviation in read passage

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	2922.635	137.318	21.284	5.2e-07
Straight	-691.647	194.526	-3.556	0.0113

Hypothesis two: /s/ standard deviation



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Hypothesis two: /s/ peak frequency in conversation

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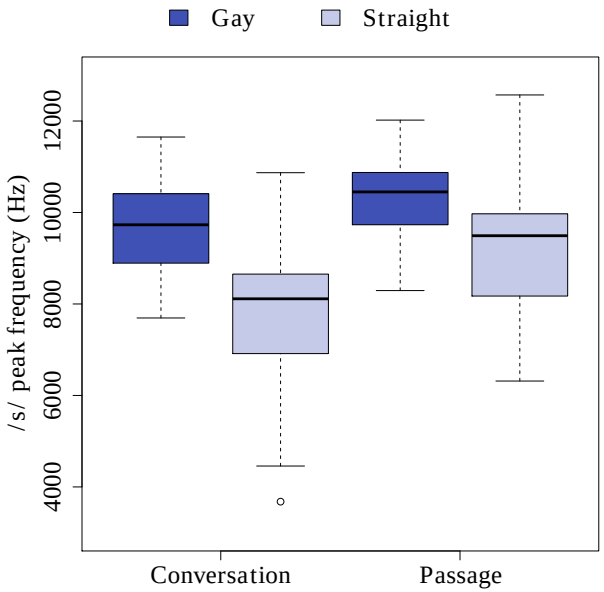

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Hypothesis two: global pitch in read passage

	Estimate	Std. error	t-statistic	p-value
(Intercept)	118.587	5.831	20.337	9.19e-07
Straight	-20.801	8.247	-2.522	0.0451

Hypothesis two: global pitch in conversation

	Estimate	Std. error	t-statistic	p-value
(Intercept)	122.773	3.665	33.50	4.71e-08
Straight	-16.432	5.183	-3.17	0.0193

Hypothesis two: global pitch

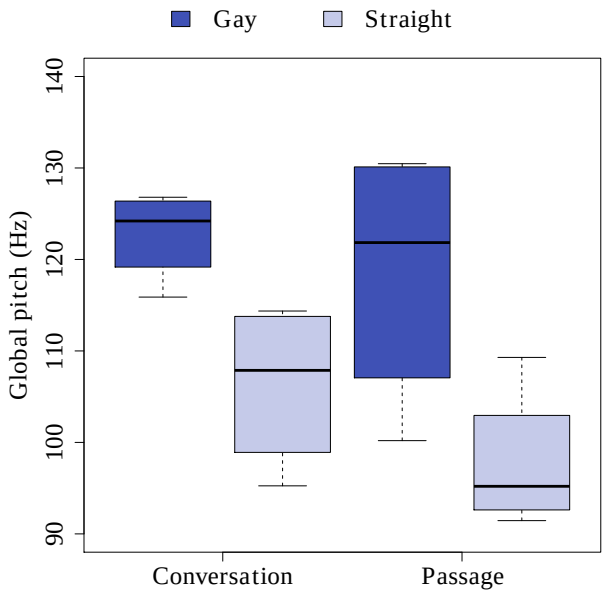

Figure: Global pitch by sexual orientation and environment

Hypothesis two: non-significant results

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Hypothesis three

Phonetic variation will correlate with speakers' exposure to LGBT people

Non-significant

Hypothesis four

Perceptions of sexual orientation will directly correlate with phonetic variation

Hypothesis four: /s/ duration [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	2.3266	0.2979	7.810	2.13e-14
Mean /s/ duration	25.4611	3.5781	7.116	2.85e-12

Hypothesis four: /s/ duration [2]

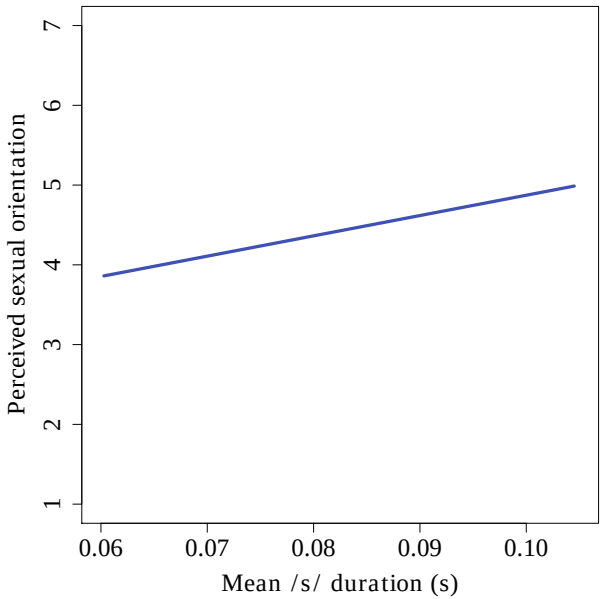


Figure: Perceived sexual orientation by mean /s/ duration based on model prediction

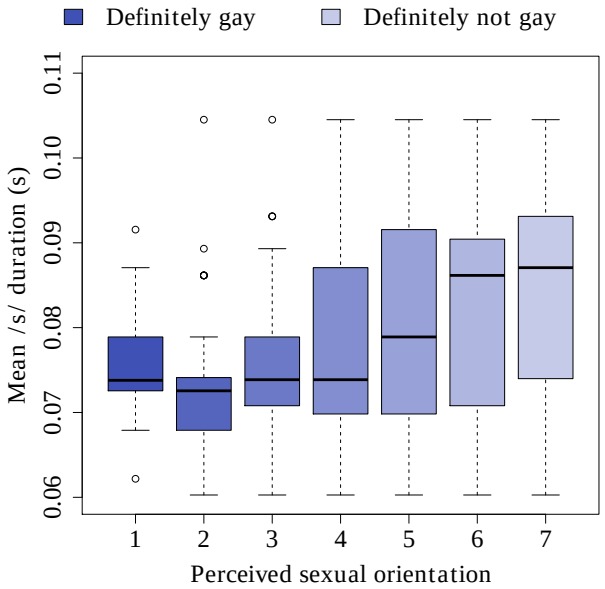
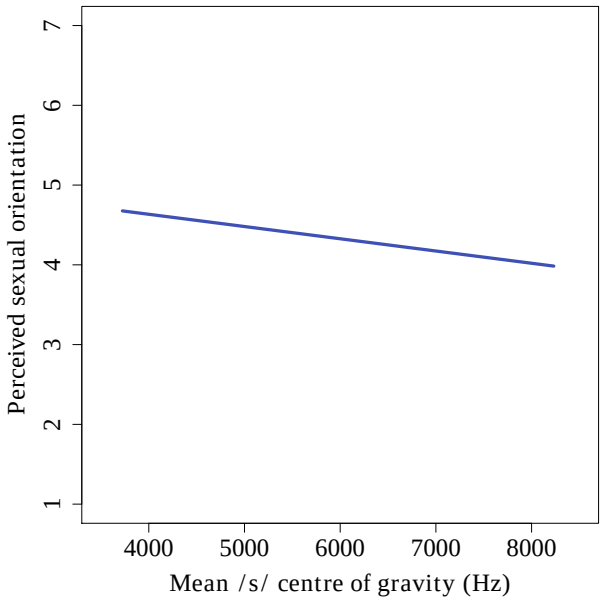


Figure: Mean /s/ duration by perceived sexual orientation

Hypothesis four: /s/ centre of gravity [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	5.248	2.285e-01	22.967	<2e-16
Mean /s/ centre of gravity	-1.535e-04	3.423e-05	-4.485	8.55e-06

Hypothesis four: /s/ centre of gravity [2]



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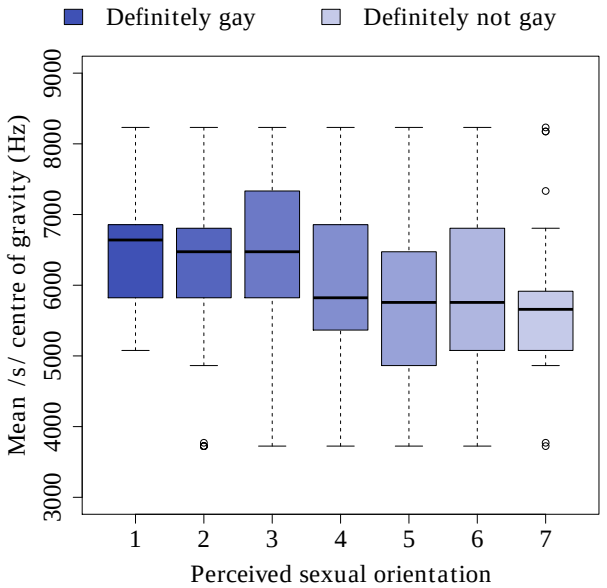
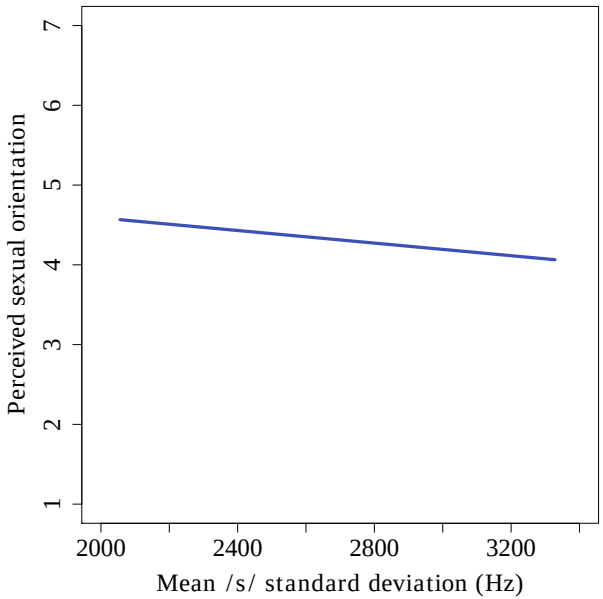


Figure: Mean /s/ centre of gravity by perceived sexual orientation

Hypothesis four: /s/ standard deviation [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	5.377	2.863e-01	18.79	<2e-16
Mean /s/ standard deviation	-3.946e-04	1.007e-04	-3.92	9.75e-05

Hypothesis four: /s/ standard deviation [2]



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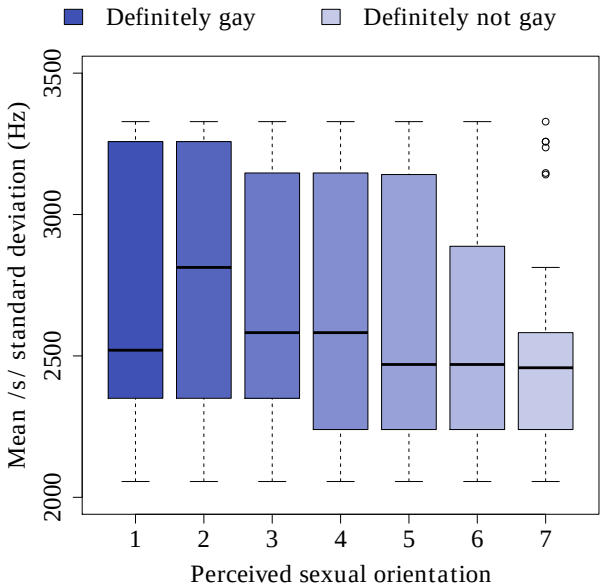

Figure: Mean /s/ standard deviation by perceived sexual orientation

Hypothesis four: /s/ spectral skew [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	4.15859	2.863e-01	18.79	<2e-16
Mean /s/ spectral skew	-3.946e-04	1.007e-04	-3.92	9.75e-05

Hypothesis four: /s/ spectral skew [2]

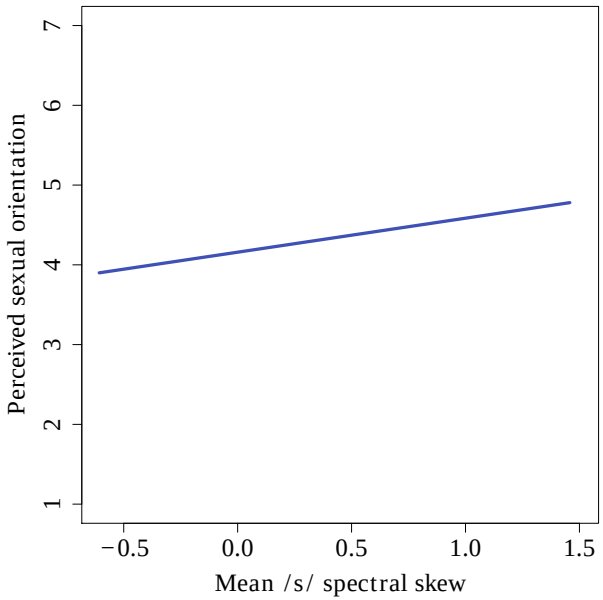

Figure: Perceived sexual orientation by mean /s/ spectral skew based on model prediction

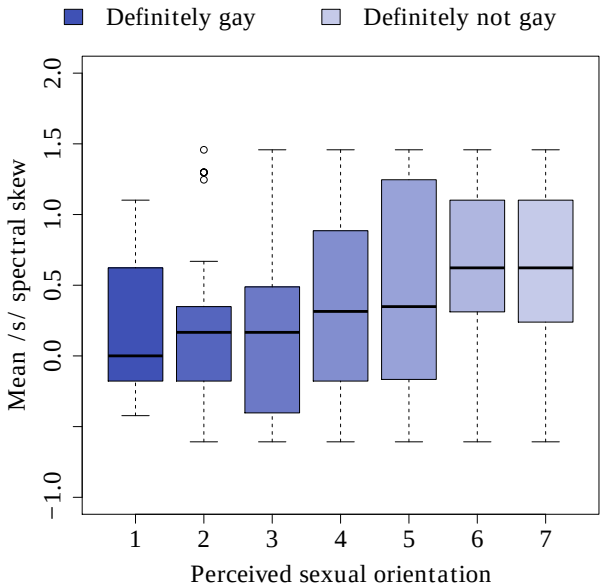

Figure: Mean /s/ spectral skew by perceived sexual orientation

Hypothesis four: /s/ kurtosis [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	4.12870	0.11154	37.016	<2e-16
Mean /s/ kurtosis	0.10388	0.02683	3.872	0.000118

Hypothesis four: /s/ kurtosis [2]

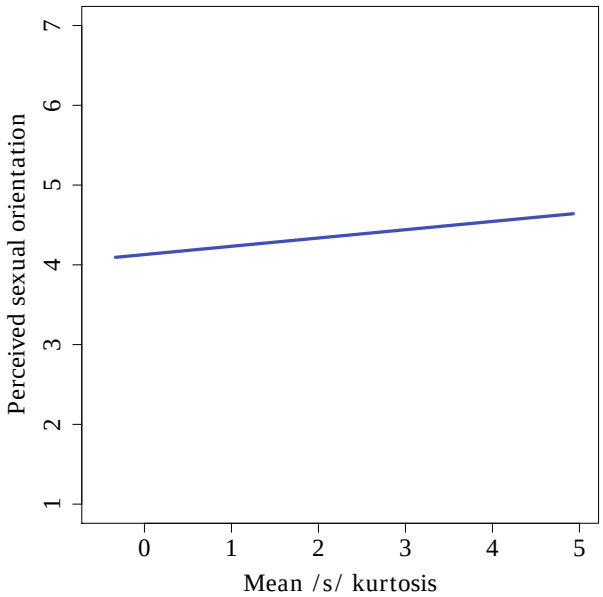

Figure: Perceived sexual orientation by mean /s/ kurtosis based on model prediction

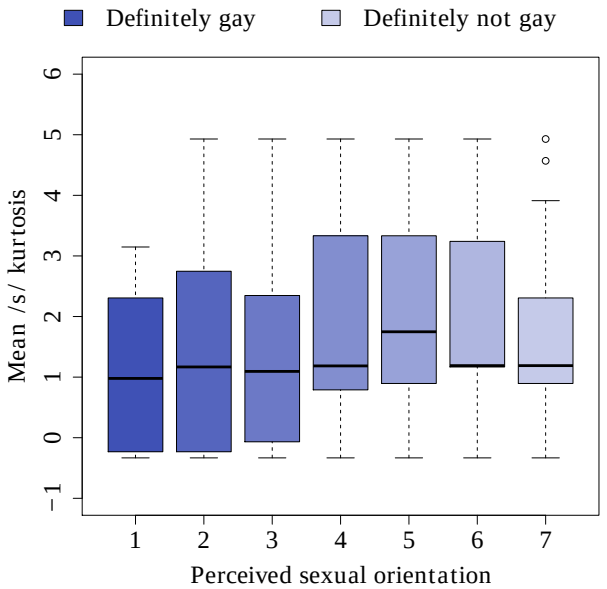

Figure: Mean /s/ kurtosis by perceived sexual orientation

Hypothesis four: /s/ peak frequency [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	6.834	3.468e-01	19.70	<2e-16
Mean /s/ peak frequency	-2.719e-04	3.602e-05	-7.55	1.41e-13

Hypothesis four: /s/ peak frequency [2]

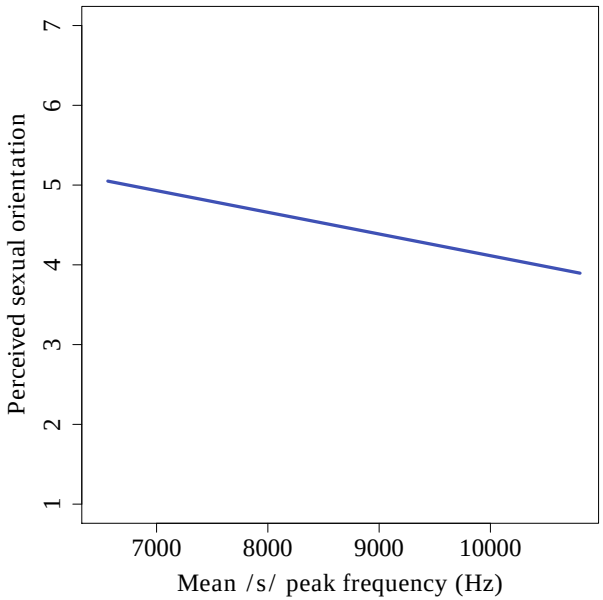

Figure: Perceived sexual orientation by mean /s/ peak frequency based on model prediction

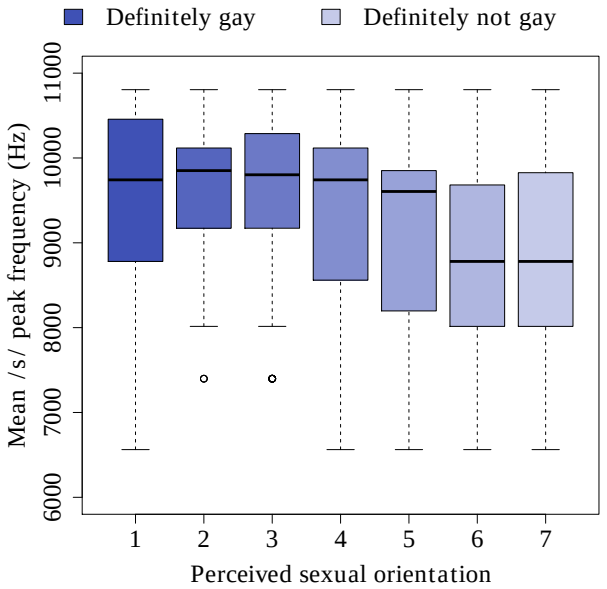

Figure: Mean /s/ peak frequency by perceived sexual orientation

Hypothesis four: global pitch [1]

	Estimate	Std. error	t-statistic	p-value
(Intercept)	6.39745	0.38176	16.758	<2e-16
Global pitch	-0.01861	0.00331	-5.622	2.76e-08

Hypothesis four: global pitch [2]

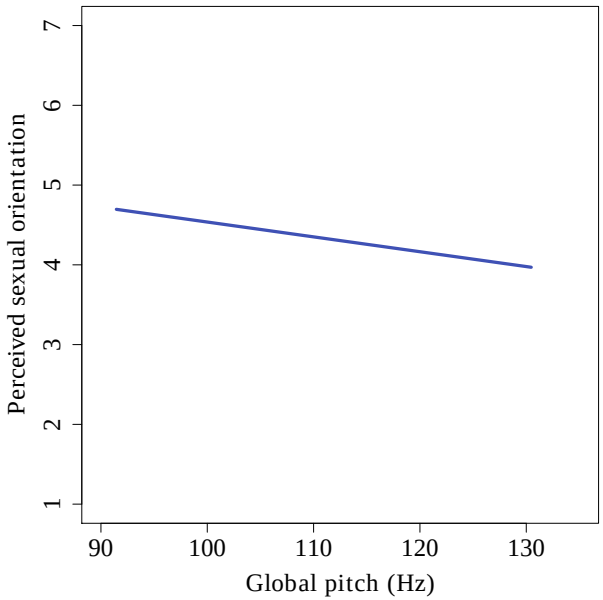

Figure: Perceived sexual orientation by global pitch based on model prediction

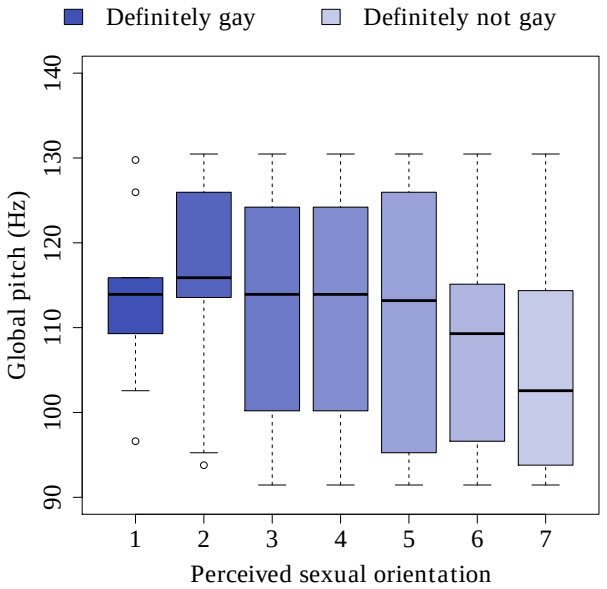

Figure: Global pitch by perceived sexual orientation

Hypothesis four: non-significant results

All other variables were non-significant

Hypothesis four: significant correlates

	Estimate	Std. error	*t*-statistic	*p*-value
Mean /s/ centre of gravity	-2.790e-04	1.254e-04	-2.226	0.0264
Mean /s/ standard deviation	-2.312e-04	2.257e-04	-1.024	0.3061
Mean /s/ spectral skew	-2.933e-01	2.944e-01	-0.996	0.3195
Mean /s/ kurtosis	8.028e-02	5.875e-02	1.366	0.1723
Mean /s/ peak frequency	-1.412e-04	7.125e-05	-1.982	0.0479
Global pitch	-2.055e-02	4.384e-03	-4.687	3.36e-06

Hypothesis five

Perceptions of sexual orientation will correlate with actual sexual orientation, but with overlap; accuracy will be greater for straight speakers

Hypothesis five: actual-perceived correlation

	Estimate	Std. error	t-statistic	p-value
(Intercept)	4.0250	0.1081	37.248	<2e-16
Straight	0.6000	0.0850	7.059	4.18e-12

Hypothesis five: perceptual accuracy

	Estimate	Std. error	t-statistic	p-value
(Intercept)	0.49578	0.01278	38.782	<2e-16
Straight	0.10792	0.01564	6.899	1.21e-11

Hypothesis five (cont.)

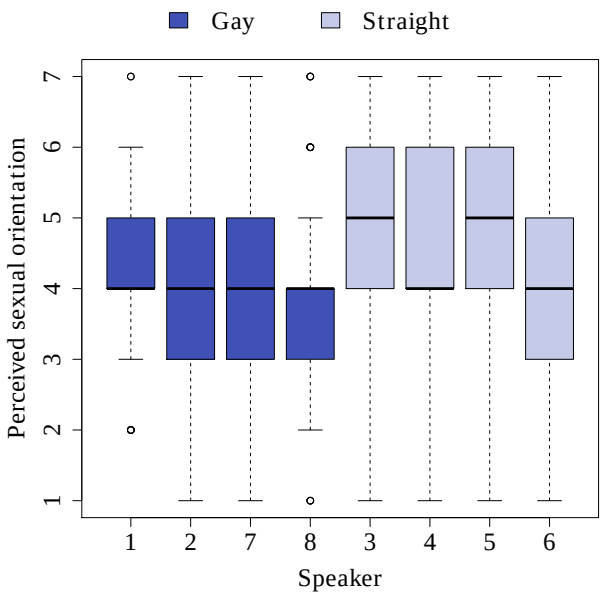

Figure: Perceived sexual orientation by speaker

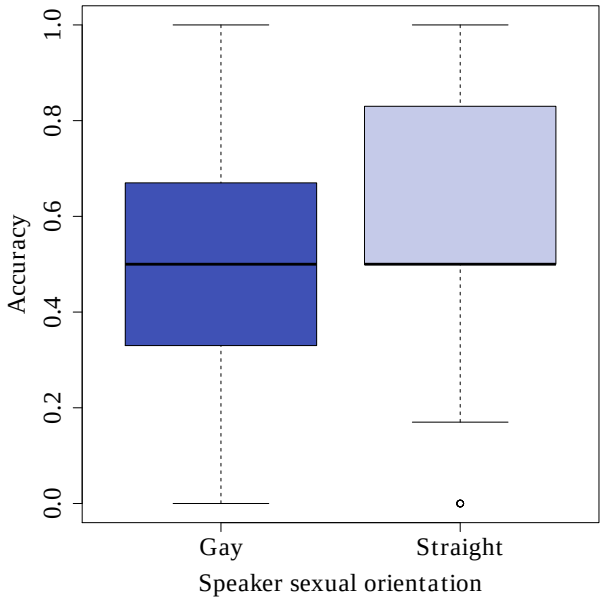

Figure: Perceptual accuracy by speaker sexual orientation

Hypothesis six

Accuracy will be greater in conversation

Non-significant

Hypothesis seven

Perceptions of sexual orientation will correlate with speakers' exposure to LGBT people

Hypothesis seven: early [1]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	4.2500	0.1083	39.245	<2e-16
Medium	0.4722	0.1056	4.474	9.02e-06
High	-0.1722	0.1056	-1.632	0.103

Hypothesis seven: early [2]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	4.7222	0.1243	38.002	<2e-16
Low	-0.4722	0.1056	-4.474	9.02e-06
High	-0.6444	0.1219	-5.287	1.68e-07

Hypothesis seven: current

	Estimate	Std. error	t-statistic	p-value
(Intercept)	4.42500	0.10861	40.743	<2e-16
High	-0.20000	0.08774	-2.279	0.023

Hypothesis seven (cont.)

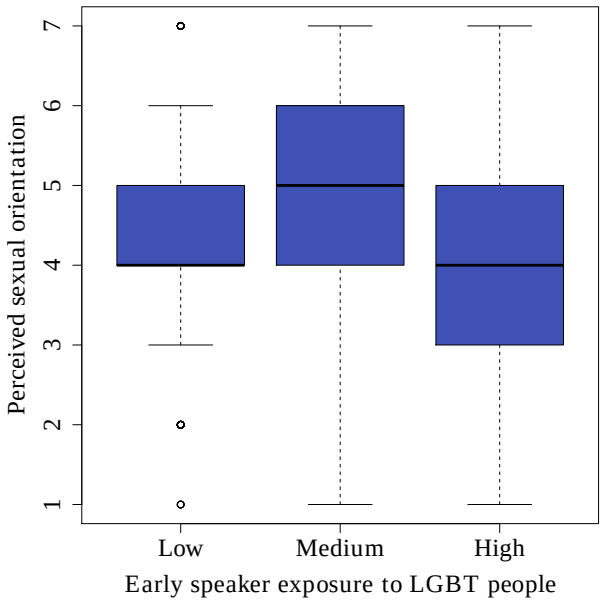

Figure: Perceived sexual orientation by early speaker exposure

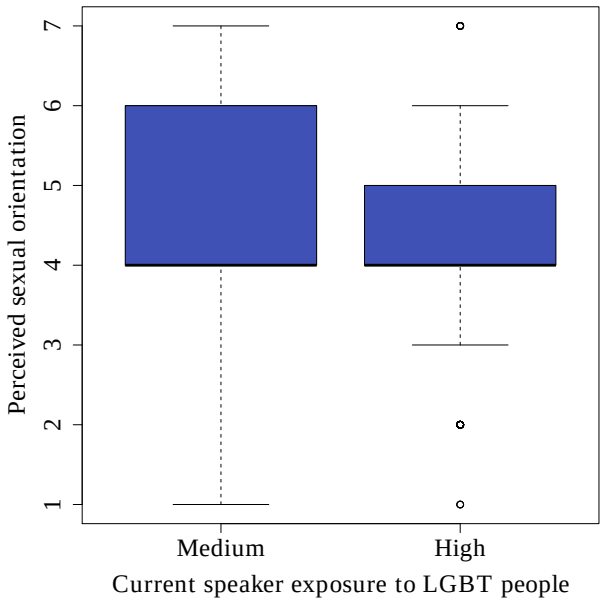

Figure: Perceived sexual orientation by current speaker exposure

Hypothesis eight

Accuracy will be greater for listeners with higher exposure

Hypothesis eight: total [1]

	Estimate	Std. error	t-statistic	p-value
(Intercept)	0.51257	0.02201	23.293	<2e-16
3	0.02759	0.03208	0.860	0.3949
4	0.05338	0.02671	1.998	0.0525
5	0.01368	0.03967	0.345	0.7320
6	0.07656	0.03682	2.079	0.0441

Hypothesis eight: total [2]

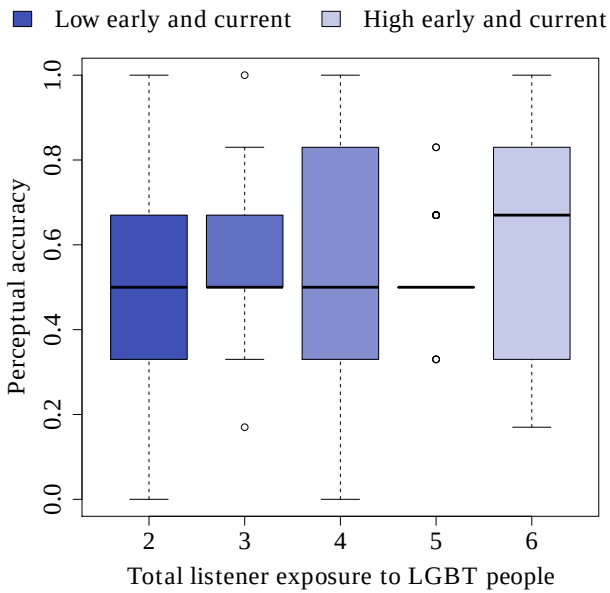

Figure: Perceptual accuracy by total listener exposure

Hypothesis nine

Accuracy will be greater for listeners who are LGB and/or from the United Kingdom and/or have lived in the United Kingdom and/or speak English as their first language

Non-significant

Hypothesis ten [1]

Accuracy will be greater with segmental information, but a positive correlation will be present even without

Hypothesis ten [2]

	Estimate	Std. error	*t*-statistic	*p*-value
(Intercept)	0.55469	0.01176	47.154	<2e-16
Low-pass filtered	-0.05408	0.01664	-3.251	0.0012

Hypothesis ten [3]

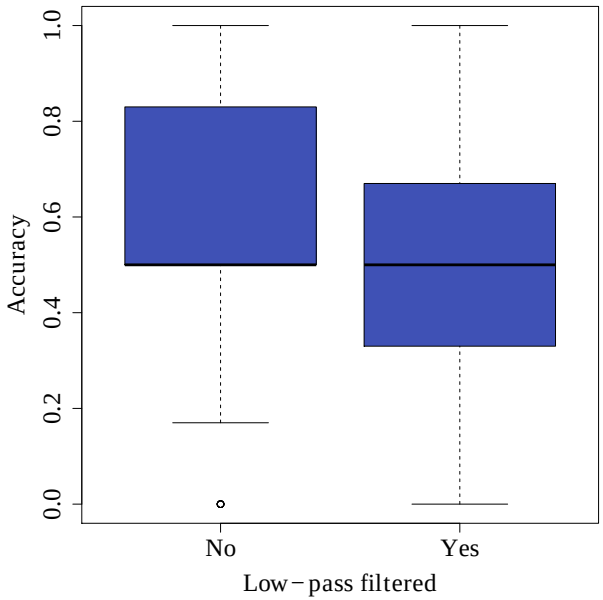

Figure: Perceptual accuracy by low-pass filtration

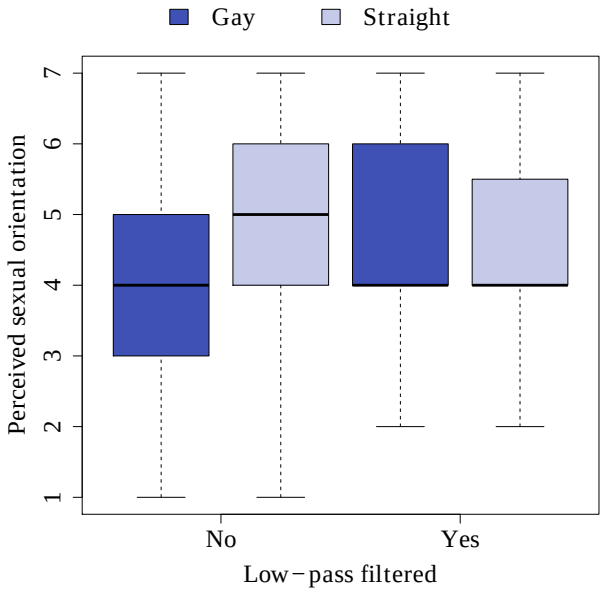

Figure: Perceived sexual orientation by actual sexual orientation and low-pass filtration

Hypothesis eleven [1]

Accuracy will be greater in a forced-choice scenario

Hypothesis eleven [2]

	Estimate	Std. error	t-statistic	p-value
(Intercept)	5.334e-01	9.548e-03	55.858	<2e-16
Forced choice	2.055e-01	2.104e-02	9.771	<2e-16

Hypothesis eleven [3]

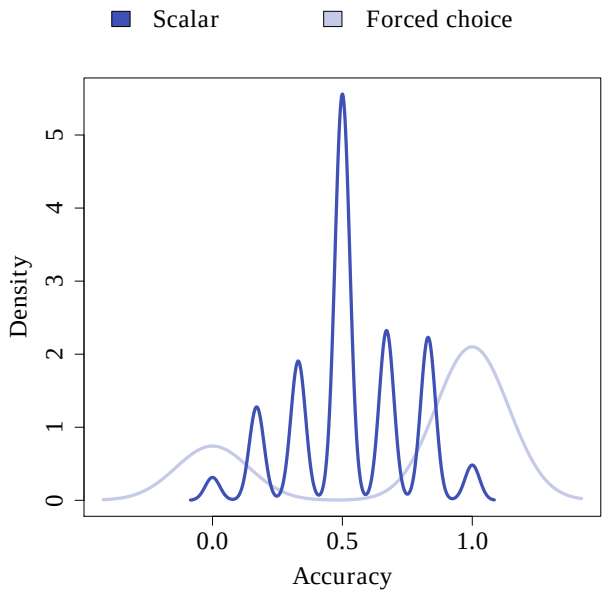

Figure: Perceptual accuracy by question type

Discussion and conclusion

Research questions

1. How does sexual orientation affect phonetic variation in Northern England English and how does this interact with style and exposure to LGBT people?
2. How accurate are perceptions of sexual orientation based on Northern England English speech and how does this interact with phonetic variables, style, speaker and listener exposure to LGBT people, listener linguistic and cultural background, segmental features and judgemental constraints?

Phonetic variation

- Sexual orientation does affect phonetic variation in Northern England English:
  - Supporting USA findings: /s/ peak frequency effect
  - Contradicting USA findings: lack of /s/ duration and /s/ spectral skew effects; presence of global pitch effect
  - Novel: /s/ standard deviation a good correlate
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Perceptual accuracy:

- Greater than chance
- Greater for straight speakers
- Greater with high judgemental constraints
- Segmental features key
- Inconclusive evidence of speaker and listener exposure effect
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Implications and future research

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- Revisit speaker and listener exposure
- Interactions
- More studies with novel ethnolinguistic subjects

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