

# The peril of sounding manly: A look at vocal characteristics of lawyers before the United States Supreme Court

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## Style and the construction of personae

- The way one speaks can reveal a lot of about that person's ethnic, socio-economic, geographic, and sexuality backgrounds.

## Style and the construction of personae

- Individuals make use of all aspects of the speech signals to construct personae and to project potential hidden desires to the external world.
  - Falsetto → a “gay diva” persona (Podesva, 2007).
  - The use of rhotacization as an index of the ‘Beijing Smooth Operator’ style (Zhang, 2008).
  - Gay men tend to have more acute sounding /s/ (i.e. are more negatively skewed /s/ spectra) than heterosexual men (Munson et al., 2006).

## Perceptual evaluations of vocal characteristics

- Judgments of vocal characteristics are related to production differences between groups.
  - Men with lower  $f_0$  and  $F_2$  frequency are considered more masculine (Munson, 2007).
  - Women with higher  $f_0$ ,  $F_2$  frequency, vowel-space dispersion, and average /s/ center of gravity are rated as more feminine (Munson, 2007).
  - Talkers with non-canonical /s/ are rated as more younger-sounding and gayer-sounding (Mack and Munson, 2012).

## Perceptual evaluations of vocal characteristics

- Judgments of vocal characteristics are related to production differences between groups.
  - Lower F1 frequencies for high vowels is a good predictor of male vocal attractiveness while lower f0 and breathier voice quality are predictors of female vocal attractiveness (Babel et al. 2014; cf. Hodges-Simeon et al. 2010).
  - Vocal attractiveness have been found to be relatively consistent across geographic regions (at least in North America),
    - the acoustic features that listeners attune to for such evaluation seem to differ quite drastically (Babel and McGuire, 2013).

## Broad research questions

- What are the acoustic correlates for other types of perceptual assessments of vocal characteristics?
- Do vocal characteristics and the perceptual evaluation of them exert an influence on listener behavior?

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- Do vocal characteristics and the perceptual evaluation of them exert an influence on listener behavior?
  - Physical attractiveness is predictive of perceived expertise (Patzner, 1983) and of actual success of marketers in a study that randomized attractiveness and accent (DeShields et al., 1996).

## Broad research questions

- Do vocal characteristics and the perceptual evaluation of them exert an influence on listener behavior?
  - Purnell et al. (1999) found evidence of linguistic profiling in the housing market, suggesting that housing administrators might redline prospective clientele by auditory cues (from telephone conversations) alone.



## Specific research questions

- What are the vocal characteristics of lawyers arguing in front of the Supreme Court of the United States (SCOTUS) and how are they evaluated perceptually?
- Are the linguistic practices of the SCOTUS lawyers predictive of the Court's decision outcomes?

# Stimuli

- The Oyez archive: Oral arguments at the Supreme Court of the United States (SCOTUS) have been recorded since the installation of a recording system in October 1955.

# Stimuli

- The recordings and the associated transcripts were made available to the public in electronically downloadable format by the Oyez Project (<http://www.oyez.org/>), which is a multimedia archive at the Chicago-Kent College of Law devoted to the Supreme Court of the United States and its work.

# Stimuli

- The current project is part of a larger joint project between the Chicago Phonology Lab and the Center for Law and Economics at ETH Zurich looking at acoustic characteristics of participants in oral arguments at the SCOTUS longitudinally.

## Procedure

- Stimuli: 60 excerpts of lawyers' Supreme Court oral argument's introductory sentence, which is identical across cases (i.e. "Mister Chief Justice, may it please the court.") from 30 cases.
- 200 listeners on Amazon's Mechanical Turk rated the voice sample in terms of masculinity, attractiveness, confidence, intelligence, trustworthiness, and educatedness, as well as the probability of win, on a 7-point scale.

## Acoustic analysis

The following phonetic attributes were measured

- Formant frequencies (F1, F2) for five stressed vowels (/i, ɪ, ɔ, eɪ, ʌ/;
- Formant dispersion (average vowel distance from a central point per talker per sound clip)
- Spectral tilt (H1-H2, H1-A1, H1-A2, H1-A3),
- Sibilant's duration, four spectral moments, and peak frequency,
- Speaking rate (phonemes per second),
- Rhythm (Pairwise Variability Index; Low et al. 2000),
- F0 mean and standard deviation.

## Statistical analysis

- Because many of these measures may be highly correlated with each other and in order to reduce dimensionality, principal component analyses (PCA) were calculated for the sibilant, vowel quality, and voice quality measures.

## PCA results: Sibilant measures

	PC1	PC2	PC3
Standard deviation	896.157	212.061	161.429
Proportion of Variance	<b>0.918</b>	0.051	0.030
Cumulative Proportion	0.918	0.969	0.999
Duration	0.000	-0.040	0.028
<b>Centroid Frequency</b>	<b>0.419</b>	-0.660	-0.624
Standard Deviation	0.001	0.686	-0.726
Kurtosis	0.000	-0.002	0.004
Skewness	-0.001	0.000	0.001
<b>Peak Frequency</b>	<b>0.908</b>	0.304	0.289
Amplitude Ratio	-0.001	-0.008	0.009



## PCA results: Spectral tilt measures

	PC1	PC2	PC3	PC4
Standard deviation	7.353	3.715	2.778	2.202
Proportion of Variance	0.672	0.172	0.096	0.060
Cumulative Proportion	0.672	0.844	0.940	1.000
H1H2	0.241	-0.049	0.498	0.832
H1A1	0.361	-0.855	0.230	-0.293
H1A2	0.561	-0.072	-0.771	0.295
H1A3	0.705	0.512	0.324	-0.369

## PCA results: Vowel formant measures

	PC1	PC2	PC3	PC4
Standard deviation	242.025	99.125	88.355	70.118
Proportion of Variance	0.645	0.108	0.086	0.054
Cumulative Proportion	0.645	0.753	0.839	0.894
f1.ah	0.059	-0.072	0.156	-0.063
f2.ah	0.242	-0.047	-0.443	-0.729
f1.ey	-0.022	-0.200	0.088	-0.126
f2.ey	0.642	0.716	0.036	0.179
f1.ih	0.026	0.002	-0.028	-0.017
f2.ih	0.363	-0.163	-0.313	-0.193
f1.ao	0.040	0.002	-0.077	0.063
f2.ao	0.068	-0.230	-0.715	0.593
f1.iy	-0.003	-0.010	-0.054	-0.050
f2.iy	0.622	-0.600	0.390	0.146

## Regression models

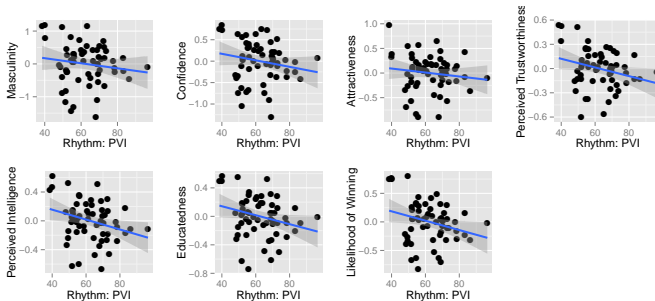
- Rating responses were modeled using linear fixed effects models with by-subject random intercepts and by-subject random slope for trial order with the 11 main predictors:
  - 1 Trial order
  - 2 Gender of the participant
  - 3 The role of the lawyer (Petitioner vs. Respondent)
  - 4 The 1st component the sibilant measures
  - 5 The 1st component the spectral tilt measures
  - 6 The 1st component the vowel formant measures
  - 7 speaking rate (phonemes per second)
  - 8 Pairwise Variability Index
  - 9  $f_0$  mean
  - 10  $f_0$  variance
  - 11 formant dispersion

## Summary of the acoustic correlates of perceptual assessments

- There are no gender difference in any of the perceptual ratings.
- Lawyers for the petitioners are rated as less masculine in general.
- Rhythm, mean  $f_0$ , and the 1st component of the sibilant, spectral tilt, and vowel formant measures are most relevant to perceptual assessments.

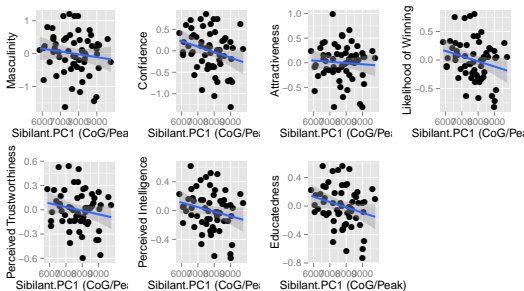
# Rhythm (PVI)

- Lower PVI (less duration variability) correlates with better perceptual assessment in all perceived attributes investigated.



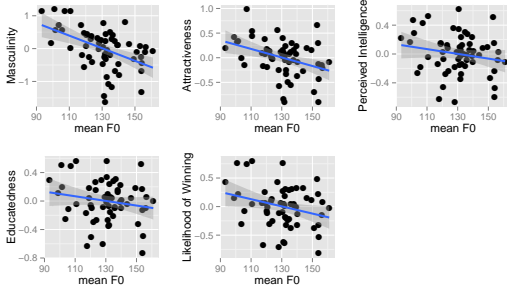
## Sibilant PC1: Centroid and peak frequencies

- This is true for centroid and peak frequencies (sibilant.PC1), where lower sibilant spectral values correlate with higher ratings in all perceived attributes.



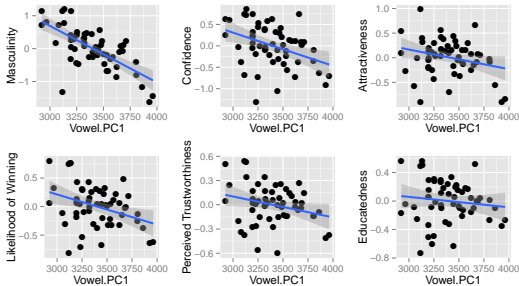
# Mean f0

- Lower f0 mean correlates with higher masculinity, attractiveness, intelligence, educatedness, and winnability ratings.



## Backness of front vowels

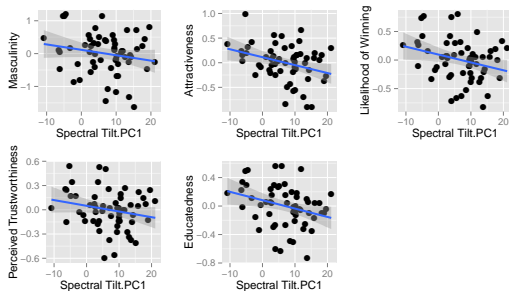
- Backer front vowels (i.e Vowel.PC1) correlate with higher masculinity, confidence, attractiveness, trustworthiness, educatedness, and winnability ratings.





# Spectral Tilt

- Breathier voice quality (i.e spectral tilt.PC1) correlates with higher confidence, attractiveness, trustworthiness, intelligence, educatedness, and winnability ratings.



## Voice samples

- Most masculine and confident voice
- Most attractive
- Least masculine, least attractive
- Least confident

# Statistical Analysis

Court decision outcome was modeled in terms of mixed effects logistic regression

- Fixed effects:
  - The role of the attorney: Petitioner vs. Respondent
  - By-subject normalized ratings of
    - Masculinity
    - Confidence
    - Trustworthiness
    - Attractiveness
    - Educatedness
    - Intelligence
    - Likelihood of winning
- Random effects
  - Case

## Results

	Coef ( SE )	z-value
Intercept	0.002 ( 0.031 )	0.07
Attorney Role=Petitioner	<b>0.702</b> ( 0.022 )	32.45 ***
Masculinity	-0.434 ( 0.028 )	-15.51 ***
Confidence	0.087 ( 0.030 )	2.91 **
Attractiveness	-0.049 ( 0.027 )	-1.81 .
Educatedness	0.050 ( 0.034 )	1.49
Trustworthiness	-0.035 ( 0.027 )	-1.29
Intelligence	0.028 ( 0.035 )	0.79
Winnability	-0.042 ( 0.031 )	-1.38

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## Implications and discussion

- Many perceptual attributes share similar acoustic profiles, at least based on the MTurk cohort we sampled.
- There are strong correlation between attributes.
  - More investigation is needed to examine the source of these correlations.
  - It does not appear to be related to the design of the survey itself.

## Implications and discussion

- The effects of perceived vocal characteristics are pervasive.
- Biases introduced by prejudices regarding certain vocal characteristics are found even in as solemn a setting as the U.S. Supreme Court oral arguments.
- Potential biases do not stem from all perceived vocal characteristics; the relevance of a perceptual attribute is likely to be highly contextual.

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