



**Errata throughout!**

# Speech Characteristics of Gender-Nonconforming Boys

**Laura Crocker**

Program in Linguistics  
University of Minnesota, Twin Cities

**Benjamin Munson**

Department of Speech-Language-Hearing Sciences  
University of Minnesota, Twin Cities

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NWAV 2006, Columbus OH

## A Cast of Thousands

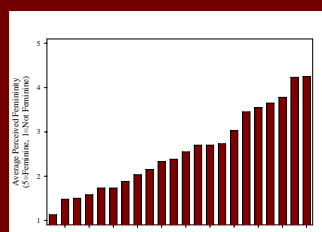
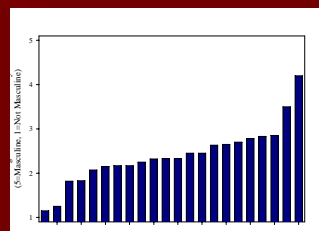
- **Janet Pierrehumbert** (Northwestern) was a co-PI on the grant that funded the data collection for the production study (from the Northwestern University Vice President for Research), and she assisted in the design of the data-collection protocol.
- **Ken Zucker** (Centre for Addiction and Mental Health, Toronto, ON) coordinated data collection, and provided lots of insights into children's gender development.
- **Karla McGregor** (University of Iowa) contributed to the development of the data-collection protocol
- **J. Michael Bailey** (Northwestern) was a co-PI on the grant that funded the data collection for the production study
- The **Clark D. Starr fund** in the Department of Speech-Language-Hearing Sciences funded the data collection for the perception studies
- *The opinions in this presentation do not necessarily reflect the views of all of the people on this slide.*



## Gender Typicality in Adults' Speech

- Adults vary in the extent to which listeners rate their speech as conforming to social expectations for how someone of their biological sex should sound

- Avery and Liss (1994)
  - Men only
- Munson (in press)
  - Men and women



## Sexual Orientation and Speech

- One way to examine sex typicality indirectly is to compare the speech of adults who identify as gay, lesbian, or bisexual (GLB) to those who do not
- Quite a bit of research on this topic recently
  - Gaudio (1994), Crist (1997), Linville (1998), Smyth, Jacobs, and Rogers (2003, and related papers and presentations), Carahaly (2000), Podesva et al. (2001, and related papers and presentations), Waksler (2001), Pierrehumbert et al. (2004), Levon (2006), Babel and Johnson (this conference) and various works by Munson and colleagues
    - Apologies for omissions
- A working hypothesis: these are learned, socially and culturally conventional ways of speaking



## Development

- There is quite a bit of speculation on the development of this style. How could we study this?
- It would be logistically challenging—nearly impossible—to study this longitudinally
- However, we could determine...
  - (a) the point in development at which children produce sex-specific ways of speaking, and
  - (b) Whether there is an association in the extent to which children conform to cultural expectations for their gender in their nonspeech behavior, and the extent to which their speech sounds like their biological sex



## Sex Typicality and Children's Speech

- Perry, Ohde, and Ashmead (2001) found that 4-year-old children's gender could be ascertained at greater-than-chance levels from audio-only speech samples
  - Vowels' formant frequencies predicted listener ratings
  - Munson and Baylis (in prep) replicated this (this is the paper I referred to when answering Penny Eckert's question—BRM)
- Work by Docherty, Foulkes, Watt, and colleagues has found that children's use of a sex-typed feature (preaspiration in Tyneside English) was evident in 3.5 to 4 year old children, but not in younger children



## Variation in Gender Expression

- Children vary in the extent to which they conform to cultural expectations for their gender in their nonspeech behavior
- Children who are extremely transgressive can be given the label *Gender Identity Disorder (GID)*
  - This can be identified in very young children



## Variation in Gender Expression

- Children with GID are more likely than their gender-role conforming (GC) peers to adopt a GLB identity as an adult, to be transgendered, or to elect to have gender reassignment surgery
- These kids are a model for studying the development of GLB speech styles, at least for the population of adults who displayed gender nonconforming behavior in childhood.



## Whose Disorder? Who's Disordered?

- Why the “D” in GID?
- Among the cast of thousands, there is disagreement on this topic.
- Children who demonstrate gender-atypical aggression are at risk for more negative social consequences than kids with gender-typical aggression patterns (Nicki Crick and colleagues)
- We (Crocker and Munson) can only speak for ourselves. We (Crocker and Munson) see the problem as one of societies' reactions to gender transgression; however, we concede that functioning in a diverse society means being flexible
  - Analogous to how we view AAE
- In the rest of this presentation, we use the neutral label *Gender Nonconforming* (GN) to refer to boys with GID.



## A Few Working Hypotheses

- ‘Broad’, system-wide variation is likely to develop earlier than phoneme-specific variation
  - i.e., vowel-space dispersion is likely to show up before differences in /æ/ tensing or /s/ skewness
- Differences are more likely to show up in less constrained speaking tasks.
- Differences will be constrained by the physiology of the developing vocal tract
  - f0 is not a likely candidate in prepubescent children



# The Larger Project

## ■ Participants

- GN Boys
- GC Boys and Girls
  - Important Erratum: these children were not tested in the clinic at the Centre for Addiction and Mental Health. They were recruited from a variety of sources in the Toronto, ON community.

## ■ Four samples

- Single-word naming
- Sentence repetition
- Narrative production
- Color naming



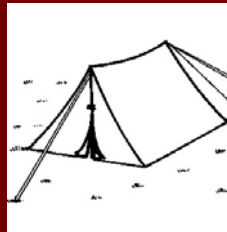
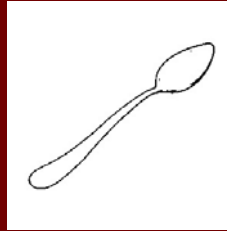
# This Talk

- 15 GN Boys , 15 GC boys
- Age range: 5-13
- Matched for chronological age, full-scale IQ
- From Toronto, Ontario
- Divided into 7 pairs of older boys (average age=10.2 years) and 8 pairs of younger boys (average age=6.9 years)



## Single-Word Naming

- *bee, bird, boot, bus, cake, fish, foot, hat, rope, ship, sock, spoon, sun, tent*
- A variety of vowels and consonants
- Picturable objects
- Five repetitions each
- High-quality recordings, made in a quiet space



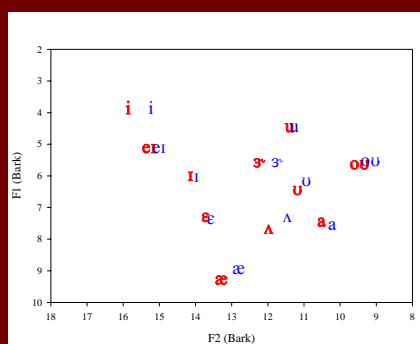
## Acoustic Analyses

- Vowels: F1, F2, average f0, duration of individual vowels
- Overall vowel-space dispersion
- Stops: VOT
- Fricatives: Duration, first and third spectral moments



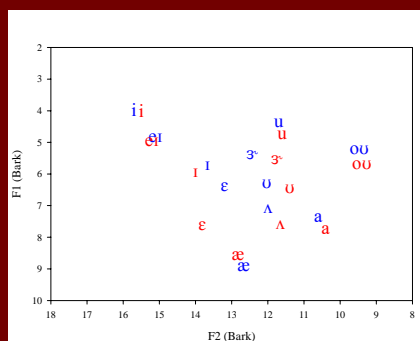
## Vowel Spaces: Younger Children

- Blue=GC boys,  
Red=GN boys
- Vowel spaces of the two groups of younger children are extremely similar



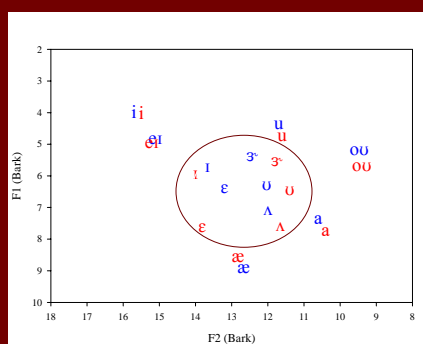
## Vowel Spaces: Older Children

- Blue=GC boys,  
Red=GN boys
- Vowel spaces of older children show a little more differentiation
  - The GC boys reduce their lax and central vowels more than the GN boys



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## Consonants

- No group differences in VOT or in fricative spectra



## Perception Study

- Can listeners detect differences between the two groups of children?
- If so...
  - Is this mediated by age? Are there bigger differences between older groups of children?
  - What are these group differences due to?
    - Specific acoustic features
    - Clearer speech, sounding ‘taller’ or ‘shorter’?



## Gender Perception

- Listeners (native, monolingual speakers of English from the North Central dialect region) were presented with individual words and were asked to rate the child's gender on a six-point scale, taken from Perry et al.

(2001) Important Erratum: I neglected to mention that we had foils that were girls. They were not included in the analysis because they were not age-matched to the GC and GN boys.

- 1 *positively a female*
- 2 *appeared to be a female*
- 3 *unsure; may have been a female*
- 4 *unsure; may have been a male*
- 5 *appeared to be a male*
- 6 *positively a male*



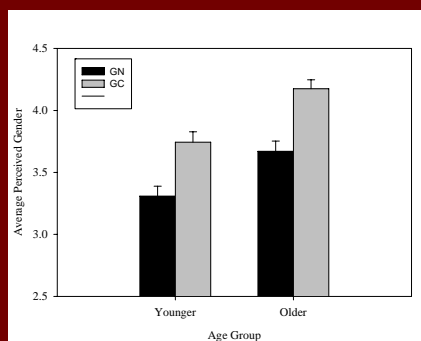
## Gender Perception

- Average gender perception ratings were calculated separately for older and younger children GC and GN boys.
- These were submitted to a two-factor (2 age group x 2 gender group) within-subjects ANOVA
- (The same pattern of results was obtained with median ratings and nonparametric tests)



## Gender Perception

- Significant main effect of age: older boys sound more boy-like than younger ones
- Significant main effect of gender conformity: GN boys sound less boy-like than GC boys
- No interaction



## What were Listeners Listening for?

- Examined three ways:
- 1. Using hierarchical multiple regression to predict listeners' ratings from selected acoustic measures of the stimuli
- 2. Examining whether listener ratings varied significantly as a function of the phonemic composition of the stimulus to which they were listening
- 3. Examining associations between gender perception ratings and ratings of another perceptual parameter



## Regression

- In a regression predicting average ratings (pooled across the 14 words) from average acoustic measures, about 15% of the variance was accounted for by F2 frequency
  - Clarification: if age is forced as the first variable in the regression, 14% of the variance is accounted for; if it is not, 18% of the variance is accounted for.



## Regression

- In separate regressions by word, F2 frequency accounted for a significant proportion of ratings in 10 words. Variance accounted for ranged from 10% to 42%. F1 frequency accounted for an additional proportion of variance in 4 of these words, and accounted for variance in one other word in which F2 variance wasn't a significant predictor
  - Important clarification: higher formant-frequency values were associated with less-boy-like-sounding speech.
- Vowel acoustics didn't predict variance in ratings of *spoon*, *sock*, or *fish*

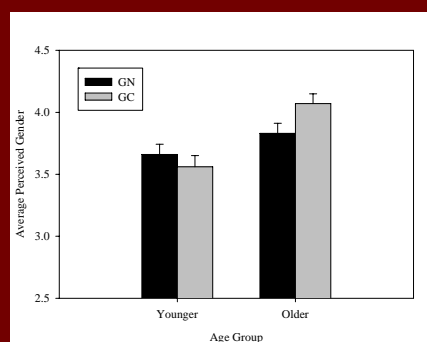


## Regression

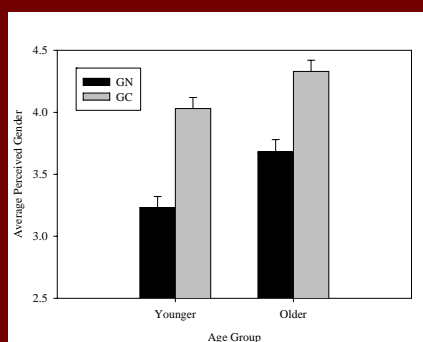
- /s/ spectra accounted for about 30% of the ratings of gender in the word *sock*; /ʃ/ spectra predicted 42% of the variance in *ship* ratings
  - Important clarification: higher peak frequencies were associated with less-boy-like-sounding speech
- No significant predictors for ratings of *fish* or *spoon*
- We examined the role of fricative production on ratings by examining separately listener ratings for words containing stops and words containing fricatives



## Stimulus Composition



Words without /s/ and /ʃ/



Words with /s/ and /ʃ/



## Age Perception

- Munson et al. (2006): Male GLB adults are rated as speaking more clearly than heterosexual adults; the opposite pattern is observed in lesbian women
- We tried to replicate this experiment, but nobody wanted to rate the clarity of children's speech



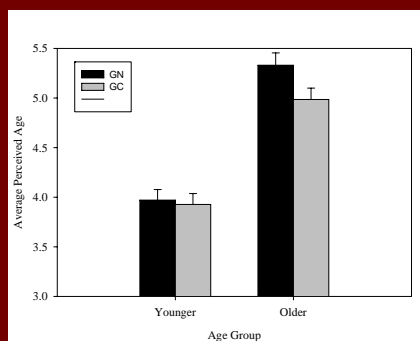
# Age Perception

- We decided to use age perception instead as a proxy for perceived clarity
  - i.e., we presumed that listeners would judge children's age using the same parameters that they use to judge other adults' clarity.
- Nine-point scale
  - 1 4 years
  - 2 5 years
  - 3 6 years
  - 4 7 years
  - 5 8 years
  - 6 9 years
  - 7 10 years
  - 8 11 years
  - 9 12 years or older



# Age Perception

- Significant main effect of age group: older kids are rated as sounding older than younger ones
  - *Guh*
- Significant main effect of gender conformity: GN boys were rated as sounding older than chronologically age-matched GC boys
- Significant interaction: the difference was only significant in the older group



## Age Perception

- Average vowel-space expansion (an index of speech clarity) predicted ratings of age.
  - Important erratum: both average vowel-space expansion and vowel duration predicted age ratings, accounting for a combined 22% of the variance in ratings. Boys were rated as sounding older if they produced an expanded vowel space and had shorter vowels.
- Last, we ran a hierarchical multiple regression examining the association between perceived gender and perceived age.



## Age Perception

- Perceived gender was the dependent measure
- Chronological age was entered into the regression model first; it accounted for 30.6% of the variance
- Perceived age was entered next; it accounted for an additional 11% of the variance
- A binary variable dummy-coding group accounted for an additional 13.5% of the variance in perceived gender
- Perceived age accounts for variance in perceived gender, but the groups still differ from one another beyond this



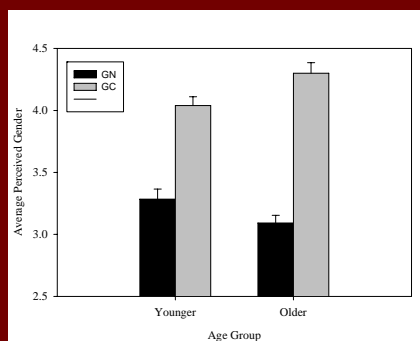
## So, what did we learn?

- It's all a work in progress.
- We established a relationship between gender conformity and gender expression through speech
- We identified some parameters that might convey this, and showed that the expression of gender through speech has a developmental trajectory
- We presented some evidence here that the use of clearer speech to convey gender typicality emerges late in the first decade of life



## A Look at Work in Progress...

- These are ratings from sentences, rather than words
- Look at the whoppingly big group differences
- Moreover, the older GN boys sound less boy-like than the younger ones.
- This is really, really nifty. Indeed, more speech the listeners have, the bigger the group differences are
- We can't wait to look at the ratings for the narratives, especially because Karla McGregor and Amanda Nematbakhsh found some differences in measures of narrative complexity in the entire sample, with GN boys performing intermediate between CG boys and girls (at least on some measures)



This was done by Eden Kaiser at the U of MN



## Time for Questions

- Let me catch my breath...

