



Gender Typicality in Children's Speech 2: Acoustic, Structural, and Perceptual Correlates of Gender Typicality in Children's Oral Narratives

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Gender Differences in Children's Speech

- Adults perceive boys and girls to sound different from one another well in advance of the marked sex differentiation in the speech-production mechanism that occurs at puberty (Perry, Ohde, & Ashmead, 2001 *inter alia*).
- Gender differences in children's pronunciation are not 'across the board'. As with adults, boys and girls' speech differs more in some sounds and sound classes than others.
- Sex differences in speech likely represent learned behaviors, which perhaps result from selective attention to and emulation of specific models in the ambient language.
- In our laboratory, we have studied gender typicality in children's speech by comparing the productions of 5-13 year old boys with GID (i.e., boys whose gender expression has been deemed not to meet cultural expectations, Zucker, 2005) to children whose gender expression is deemed to meet cultural expectations (henceforth Expected Gender Development [EGD], Crocker & Munson, 2006). This provides us with an opportunity to study gender in speech without the confounding influence of biological sex. We refer to the children with GID as gender non-conforming (GNC).
- Our previous research on this topic has examined acoustic differences between GID and EGD boys' single words (Crocker & Munson, 2006) and sentences (Kaiser & Munson, in preparation). We observed larger differences in perceived gender typicality in sentences than in words.
- The results of this research inform models of language acquisition that posit a strong role for selective attention to different models in the input during language acquisition.

Purposes of the Current Study

1. To examine acoustic and perceptual characteristics of EGD and GID boys' spoken narratives, and to compare them to previously made measures of single-word and sentence productions by the same boys. This will allow us to assess the influence of linguistic complexity on the expression and perception of gender in children's speech.
2. To examine whether objective and subjective measures of narrative complexity influence independently made judgments of the gender typicality of children's narratives. This will allow us to assess whether judgments of gender typicality of children's speech are influenced by tactic expectations that girls produce more-complex language than boys.

Speech Samples

- The recorded spoken narratives used in this experiment were elicited by asking each child to tell a story about a picture (the alien picture from the *Test of Narrative Language*, Gillam & Pearson, 2004). Narratives were elicited as part of a larger data-collection protocol that included measures of single-word productions and sentence repetitions.
- Data from 28 children was used. Each speaker was categorized as either younger (average age = 7 years) or older (average age = 10 years) and as either GNC or EGD. The children who we refer to as GNC received a diagnosis of GID were from a psychologist with expertise in children's gender development. Narratives varied in length from about 30 seconds to 1 minute.

Perception Tasks

Perceived Gender

- Twenty-five adult participants were asked to listen to each narrative and provide a rating of gender on a 6-point scale, where 6 indicated "definitely a boy", 1 indicated "definitely a girl", and 2 through 5 indicated various degrees of uncertainty (see Figure 1). They also provided an estimate of the child's age in years. The order of presentation was fully randomized. The task took place in a sound-treated booth. Responses were logged using the E-Prime software.
- Listeners were unaware that they were listening to children with GID and children with EGD. They were also not told that all of the children were boys.

Perceived Narrative Quality

- Thirty different adult participants were asked to listen to each narrative and to rate its quality. The narrative-quality experiment was based on work by Newman and McGregor (2006). Adults were instructed as follows: "You will be presented with language samples. Each of these samples contains the telling of a story. Your task is to judge the quality of information conveyed in the samples by assigning numbers to them. By quality, we mean three things: the amount of information conveyed, the ease of understanding of the story, and, finally, the ease of presentation on the part of the speaker. By ease of understanding, we mean how well you get the gist of what they are saying, not how well you can hear it or how well they articulate" (Newman & McGregor, 2006:1027)
- Unlike Newman and McGregor, we elicited narrative ratings using a visual analog scale anchored by two endpoints, "high quality" and "low quality." After each narrative, listeners clicked on the line and their click location was logged automatically.

Acoustic and Narrative Quality Measures

Acoustic Measures

- The acoustic analysis was conducted with the Praat signal-processing program (Boersma & Weenink, 2008). We analyzed vowels' fundamental frequency, vowels' formant frequencies, and two consonants found previously to relate to the perception of gender, /s/ and /ʃ/ (e.g., Munson et al., 2006).

Narrative Quality Measures

- Objective measures of narrative quality were made by the second author from transcripts of the children's stories. These included the number of different words in the story, the number of C-Units, and the mean length of C-Units in morphemes. The story grammar was also calculated using the scoring guidelines for the TNL.

Figure 1. Perceived Gender Typicality

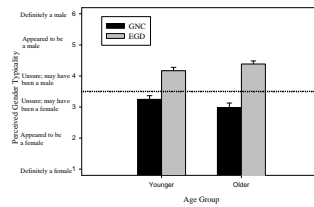
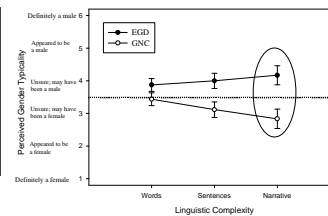


Figure 2. Perceived Gender Typicality based on Single Words, Sentences, and Narratives



Results: Perceptual Measures

Perceived Gender: Figures 1 and 2

- A two-factor within-subjects ANOVAs examined the influence of gender typicality (GNC vs. EGD) and age group on perceived gender. There was a significant main effect of gender group, $F(1,24) = 118.2, p < 0.001, \text{partial } \eta^2 = 0.83$. This interacted significantly with age, $F(1,24) = 4.6, p = 0.042, \text{partial } \eta^2 = 0.16$. Figure 1 shows that the interaction occurred because the older GNC boys sounded less boy-like than the younger EGD boys, while the older EGD boys sounded more boy-like than the younger GNC boys.
- A comparison with previous acoustic and perceptual analyses of these children's single word and sentence productions data showed that the ratings of the gender typicality of the narratives better differentiated between the two groups than the ratings gender from words or sentences.
- However, the correlation between acoustic measures and the perceptual measures was weaker for the narratives than it was for the single words or the sentences in Crocker and Munson and Kaiser and Munson.

Perceived Narrative Quality: Figure 3

- A similar two factor ANOVA examined perceived narrative quality. There was a significant main effect of gender group, $F(1,29) = 15.5, p < 0.001, \text{partial } \eta^2 = 0.35$. There was also a main effect of age, $F(1,29) = 227.3, p < 0.001, \text{partial } \eta^2 = 0.89$. These interacted significantly, $F(1,24) = 90.7, p < 0.001, \text{partial } \eta^2 = 0.76$. Figure 1 shows that the interaction occurred because the narratives of the older GNC boys were rated to be higher in quality than those of the older EGD boys, while an opposite, smaller difference was found for younger boys. Both differences were significant in post-hoc testing.

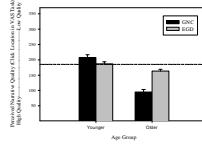


Figure 3. Perceived Narrative Typicality

Results: Acoustic and Narrative Quality Measures

Acoustic Measures

- When the average acoustic characteristics of vowels were submitted to a 2-factor MANCOVA with gender group (GNC vs. EGD) and age group (younger vs. older) as between-subjects factors, the only difference to approach statistical significance was average F1 frequency, with the GNC boys having a higher F1 than the EGD boys.

Narrative Quality Measures

- A similar design two-factor MANCOVA found no influence of gender group or age group on any of the objective measures of narrative quality.

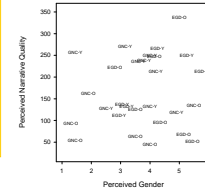


Figure 4. (Non-)Relationship between mean perceived narrative quality and mean perceived gender typicality for individual younger (-Y) and older (-O) GNC and EGD children

Results: Regression Analyses

- Regression analyses predicting perceived gender typicality from average acoustic variables found a significant relationship between $F2/\text{a}x$. This is consistent with previous work on perception of gender in adults' speech by Munson et al. (2006).
- Regression analyses predicting perceived narrative quality from objective measures of narrative quality found that approximately 69% of the variance in perceived quality could be accounted for by number of different words (partial $R^2 = 53\%$) TNL story grammar (partial $R^2 = 9\%$) and mean length of C-Units in morphemes (partial $R^2 = 6.5\%$).
- Critically, perceived gender typicality was uncorrelated with perceived narrative quality, as shown in Figure 4.

Discussion

- As expected, children with GID were rated as sounding less boy-like than their EGD peers. This tendency was stronger in the groups of older (~10 year old) boys than in the younger (~7 year old) boys. In fact, the older boys with GID were rated to sound less boy-like than the younger boys.
- When compared with previous perceptual data, stronger differentiation between groups was found for the narratives than for the single word productions or the sentences. This suggests that the less-structured task of narrative production gives children more opportunities to use permissible linguistic variation to convey gender.
- There was a complex influence of age and gender group on subjective measures of narrative quality. Though the subjective measures were well-correlated with objective measures of narrative quality, these did not differentiate between the groups. The factors that differed between the groups that led the talkers to label the narratives differently is currently being investigated. We can conclude that **perceived gender typicality of spoken narratives is not affected by the linguistic quality of those narratives and perceived narrative quality is not mediated by the gender typicality of the child producing the narrative.**

Acknowledgements

The research on the acoustic and perceptual characteristics of the speech of children with Gender Identity Disorder was completed in collaboration initiated by J. Michael Bailey of the Northwestern University Department of Psychology. The funding for the data collection phase of this project was provided by a grant to Isaac Perlmutter (Department of Linguistics, Northwestern University) and J. Michael Bailey from the Northwestern University Office of the Vice President for Research. The data collection protocol was designed by Isaac Perlmutter, Benjamin Munson, and Karla K. McGregor (Department of Speech-Language Pathology and Audiology, University of Iowa). Data collection was supervised by Karla Zickler (Clark Institute for Mental Health, Toronto, Ontario). The acoustic analysis protocol was developed by Benjamin Munson and Isaac Perlmutter. The perceptual analysis protocol was developed by Benjamin Munson. All of the acoustic and perceptual analyses described herein were conducted at the University of Minnesota. The authors of this poster take sole responsibility for the interpretation that are presented herein, and acknowledge the different contributions to the project might impact these conclusions differently. Parts of this project contained Heather Bauer's 2008 summer research thesis from the University of Minnesota, Department of Speech-Language-Hearing Sciences. We thank Mary Kennedy for her input on this project. Additional funding for this project was provided by two University of Minnesota Undergraduate Research Partnership Program grants awarded jointly to the three authors.

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