Fathers' use of fundamental frequency in motherese

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Research Questions

Do fathers use raised fundamental frequency (f_0) during child-directed (CDS) speech?

Are characteristics of f_0 comparable between mother- and father- CDS?

Background

Studies of **child-directed speech** (**CDS**) have shown that when talking to children parents systematically use altered linguistic forms: simplified syntax, elided morpho-phonological forms, and exaggerated duration and prosody. Notable among these is increased fundamental frequency (f_0, Ferguson, 1964; Fernald et al, 1989; Fernald & Mazzie, 1991; Kuhl et al, 1997). There is little research on fathers' speech production to children.

CDS-like speech has been shown (a) in pet-directed speech (Burnham et al, 2001), (b) across cultures and languages (Fernald et al, 1989; Kuhl et al, 1997), (c) from talkers who are themselves children (Dunn & Kendrick, 1982), and (d) between romantic partners (Dressler & Merlini Barbaresi, 1994). CDS is contrasted with **adult-directed speech** (**ADS**).

There is evidence that fathers talk to children less frequently and for shorter duration than mothers (Davidson & Snow, 1996; McLaughlin et al, 1983; Rondal, 1980), and that fathers may use fewer pitch fluctuations than mothers (Mannle & Tomasello, 1987; Tennenbaum & Leaper, 1998).

The **Bridge Hypothesis** (Gleason, 1975) suggests that fathers' language is more similar to 'public' (versus 'domestic') language and may be less 'tuned,' thus giving children a bridge to the world outside the familiarity of the domestic.

Method

Participants

Eleven traditional, two-parent families with a preschooler of mean age ~30 months participated. All families were involved in larger longitudinal studies.

Materials

1. Audio was collected using the LENA system (Language ENvironment Analysis; LENA foundation, Boulder, CO):

A small acoustic recording device which records up to 16 hours of raw audio on a solid state drive.

Automatic Speech Recognition (ASR):

1. LENA software using conventional probabalistic techniques to segment and classify audio by talker or acoustic environment (TV/radio, silence, etc.)

2. Custom software for analysis of f_0 developed using MATLAB using pitch determination algorithms (PDA) adapted from Sun (2002).

Procedure & Data Analysis

Each family contributed whole-day audio recordings during a typical family day. The recorder was placed in a chest pocket at a fixed position from the child's mouth (7-10cm). About 150 recorded hours were collected and processed using ASR software above. The ASR software tagged each segment with one of about 60 a priori labels such as *adult male*, *adult female*, and *child vocalization*. Vegetative/cry vocalizations are independently labeled and not used here.

Adult-child adjacencies are defined as CDS and non-adjacencies as ADS. f_0 was automatically extracted from all mothers' and fathers' segments in the day-long recording. *t*-tests were used to evaluate difference between groups of interest.

Results

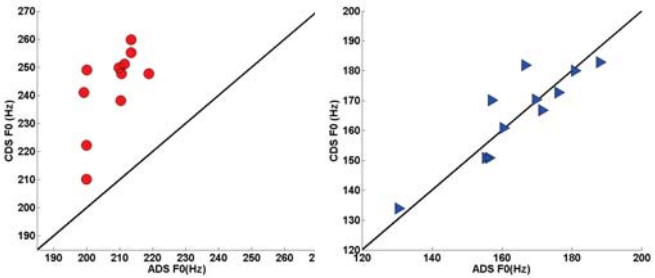

Figure 1. Mean f_0 of child-directed (CDS) versus adult-directed speech (ADS) for mothers (left panel, red) and fathers (right panel, blue). The bisector shows the same f_0 for each condition.

comparison	*t (10)*	p
mother, f_0 (CDS, ADS)	**10.03**	**$<10^{-3}$**
mother, f_0 range (CDS, ADS)	**16.42**	**$<10^{-5}$**
mother, f_0 variability (CDS, ADS)	**4.33**	**$<10^{-3}$**
father, f_0 (CDS, ADS)	**0.02**	**$>10^{-1}$**
father, f_0 range (CDS, ADS)	**0.28**	**$>10^{-1}$**
father, f_0 variability (CDS, ADS)	**0.39**	**$>10^{-1}$**

Conclusions

1. During CDS, mothers increase f_0 mean, range, and variability. This was expected.

2. During CDS, fathers were not shown to alter f_0 mean, range, or variability.

To our knowledge, this asymmetry between the parent sexes has not been demonstrated previously.

Limitations

The present work relies on a relatively small sample. We are currently analyzing over 20,000 hours of family speech to resolve this. The ASR algorithms may systematically underestimate certain adult productions. The working definitions of ADS and CDS have not been verified. Various family characteristics (SES, sex of child, number or presence of siblings, etc.) have not been accounted for.

Future directions

More than 1500 samples have been collected, including about 1000 from families with a hard-of-hearing preschooler. It is of interest to examine potential difference between adult speech addressed to boys versus girls.

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