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# Child-directed speech of fathers

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## Research Questions

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

Are the descriptive 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 families with a preschooler of mean age ~30 months. All children were involved in larger longitudinal studies having to do with hearing loss.

### Materials

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

--Digital Language Processor (DLP)



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

--Automatic Speech Recognition (ASR)

Software that uses conventional probabilistic ASR techniques to classify family speech by speaker and other characteristics

2. Custom software for analysis of  $f_0$  developed using MATLAB.

### Procedure & Data Analysis

Each family contributed whole-day audio recordings during a typical family day. The DLP 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 used automatic speech recognition (ASR) software. Recordings were automatically segmented at centisecond resolution. The speech recognizer tagged each segment with one of about 60 system-defined labels. Labels include *adult male*, *adult female*, and *child vocalization*. Adult-child adjacencies are defined as CDS and non-adjacencies as ADS.  $f_0$  was extracted from mothers' and fathers' segments using a custom MATLAB pitch determination algorithm (PDA) based on Sun (2002).  $t$ -tests were used to evaluate difference between groups of interest.

## Results

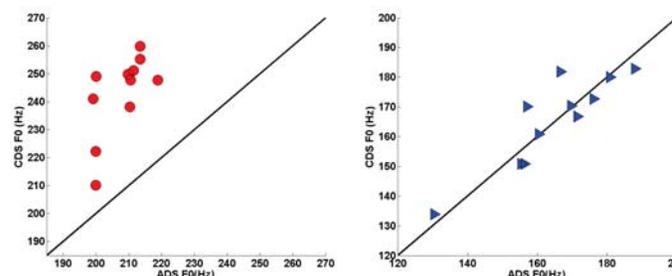


Figure 1. Mean  $f_0$  of child-directed versus adult-directed speech for mothers (left panel, red) and fathers (right panel, blue). The bisector shows the same  $f_0$  for each condition.

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

## Conclusions

1. During CDS, mothers increase mean  $f_0$ , and  $f_0$  range and variability. This was as expected.
2. During CDS, fathers here were not shown to alter mean  $f_0$ , and range and variability were not different between conditions.

**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 10,000 hours of family speech to resolve this. The ASR algorithms may systematically underestimate certain adult productions. The working definition of ADS and CDS has not been verified. Various family characteristics (SES, sex of child, siblings, etc.) have not been accounted for.

## Future directions

More than 1200 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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