

Introduction

• Across languages, there are characteristic changes in fundamental frequency (f0) when speaking to infants

• **Infant-directed speech (IDS)** involves:

- **Higher f0 max, mean**
- **More variability** in f0 contour
- **Shorter prosodic units** (F&S84, F&a89)

• Recent evidence from Thai, Mandarin, and Japanese suggests that this **f0 variation is constrained by lexical tone/pitch accent phonology** (K&a02, L&a07, I&a13)

• We investigate the extent to which **f0 variation in IDS is constrained by intonational phonology** in two typologically-divergent lgs: **English, Bengali**

1. Can **IDS intonation** be described using intonational models from non-IDS?
2. Do **tone choice, frequency change** in IDS?
3. What **linguistic meanings** might be conveyed by the choices of particular tones?

Mainstream American English intonation

MAE_ToBI model (P80, P&H90, L96, B&AE97)

• **Pitch accents (PAs)** mark stressed syllables of prominent words

- H*, L* default
- Rising L+H*, L*+H non-default (see below)

• Words group into **intermediate phrases (ips)**, which group into **intonation phrases (IPs)**

- ips end in L-, H-
- IPs end in L-L%, H-H%, L-H%, H-L%, !H-L%, reflecting sentence type, nonfinality (L-H%), etc.

• **Focus** typically marked by **L*+H** or **L+H*** followed by **deletion/compression** of PAs

Bangladeshi Standard Bengali intonation

B-ToBI model (K08, K14)

• **Repeating rising sequences** of low PAs and high accentual phrase (AP) boundary tones (L*...Ha)

- L*...Ha default
- H*...La sarcasm, surprise
- L*+fH, fH*, L*...fHa mark focus (see below)

• APs group into **ips**, which group into **IPs**

- ips end in L-, H-
- IPs end in L%, H%, LH%, HL%, HLH%, reflecting sentence type, topicalization (HL%), etc.

• **Focus** marked by **fH***, **L*+fH**, or **fHa**, followed by **deletion/compression** of PAs and AP tones

Methods

• For each lg., **10 spkrs (5 F, 5M)**

- Lived w/ young (grand)child(ren)
- English: had infant child at time
- Bengali: had young (grand)child and worked in children's lg school

• **Read "North Wind and Sun" fable:**

- >3x "at a comfortable pace" (**non-IDS**)
- >3x "as if speaking to a 4mo-old" (**IDS**)
- **Simulated IDS** rather than having an infant present, to prevent distractions/interruptions
- Toys, illustrations helped encourage register
- 3 most fluent rep. of each condition used

• 2-4 transcribers per lg, trained on data from other work

• **Preliminary analysis** from 1 transcriber per lg shown here



Results: English IDS

Phonetic

- f0 max, mean higher
- f0 min not sig different

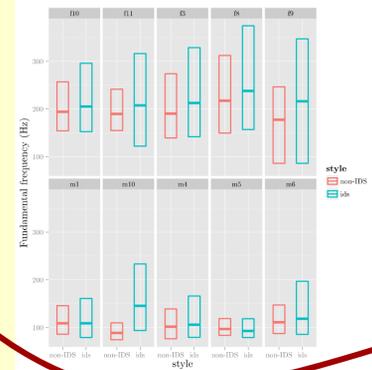
Phonological: pitch accents

- No sig change in # of pitch accents ($t(8)=-1.8, p=0.11$)
- **Increase in L*+H** proportion ($\beta_{IDS}=1.9, p=0.003$)
- **Increase in L+H*** proportion ($\beta_{IDS}=1.44, p=4.17e-5$)
- No sig change in L* or H* proportion

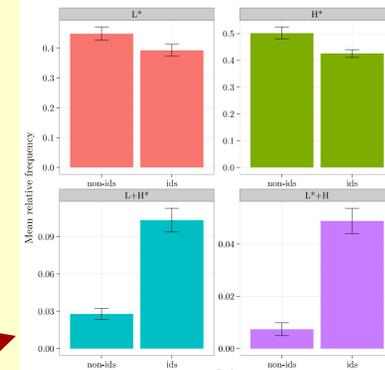
Phonological: phrasing, boundary tones

- **Overall 32% increase in ips** ($t(8)=3.4, p=0.01$)
- **Overall 35% increase in IPs** ($t(8)=4.8, p=0.001$)
- No sig change in proportions of boundary tones

f0 range, mean across conditions



PA use across conditions



Results: Bengali IDS

Phonetic

- f0 max, mean higher
- f0 min not sig different

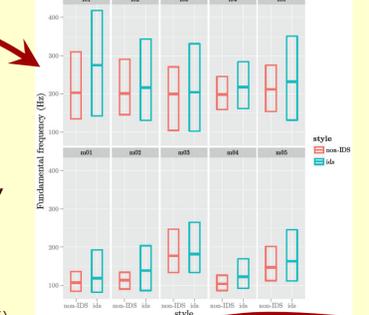
Phonological: pitch accents

- New PA found (L+H*) in both conditions
- Use still unclear; only seen on *Sôb* 'all'
- Overall 7% fewer pitch accents ($t(9)=3.1, p=0.01$)
- Decrease in L* proportion
- **Increase in H*** proportion
- **Increase in fH*** proportion ($\beta_{IDS}=2.1, p=2e-6$)
- **Increase in L*+fH** proportion

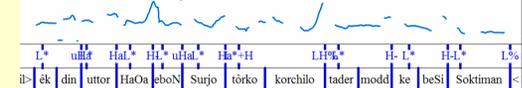
Phonological: phrasing, boundary tones

- New tone found (M%) in both conditions
- Overall 10% decrease in APs ($t(9)=3.5, p=6.5e-3$)
- Decrease in Ha proportion ($\beta_{IDS}=-0.64, p=7e-8$)
- **Increase in fHa** proportion ($\beta_{IDS}=0.79, p=2e-8$)
- **Overall 21% increase in ips** ($t(9)=3.5, p=0.006$)
- **Overall 49% increase in IPs** ($t(9)=5.5, p=3.8e-4$)
- Decrease in L% proportion ($\beta_{IDS}=-0.31, p=7.2e-3$)
- Decrease in LH% proportion ($\beta_{IDS}=-0.58, p=3.9e-6$)
- **Increase in HL%** proportion ($\beta_{IDS}=1.2, p=3.1e-4$)
- **Increase in HLH%** proportion ($\beta_{IDS}=0.80, p=1.9e-5$)

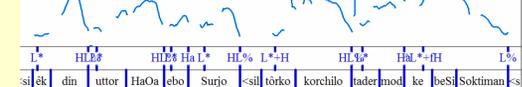
f0 range, mean across conditions



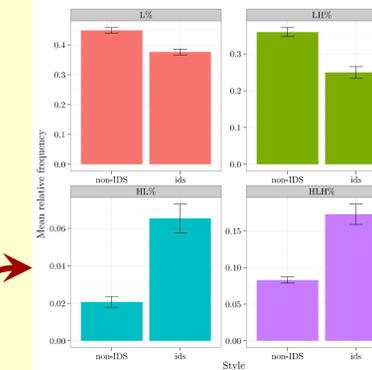
non-IDS example



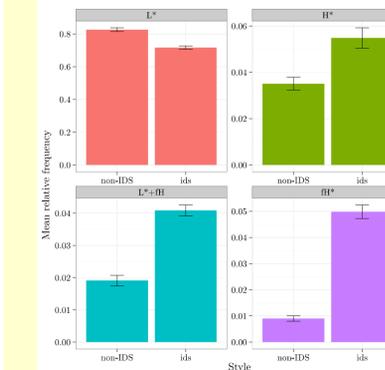
IDS example



IP tone use across conditions



PA use across conditions



Discussion and conclusions

• We find that many of prosodic changes seen in IDS are **mediated by the lg-specific intonational grammar**

• All IDS tones are seen in non-IDS intonation

• **Higher f0** induced by tones that **raise f0 max, mean**

- Bengali H*, fH* proportions increase, while L* proportion decreases
- Bengali HL%, HLH% proportions increase, which expand f0 range over large domain
- English L+H*, L*+H also expand f0 range

• **Greater f0 variability** induced by more **bitonal PAs** and **complex boundary tones**

- English L*+H, L+H* proportions increase
- Bengali L*+fH proportion increases
- Bengali HL%, HLH% proportions increase

• **Shorter units: more ips, IPs**

Current extensions

1. **More transcribers** for each lg
2. **Phonetic investigation** of f0 contour
3. Is **linguistic information** being conveyed by greater use of certain intonational tones? (see below)

• Why are **HL%**, **HLH%** used more in Bengali IDS (while L%, LH%, H% are not)?

- Phonetic use: **increase both f0 max, variability**
- Phonological use: HL% conveys **topicalization**, HLH% conveys **non-finality**

• Why are **L*+H**, **L+H*** used more in English IDS and **fH***, **H*** used more in Bengali IDS?

- Phonetic use: **increase f0 max**
- Phonological use: mark **focus**

• Are these tones used for their **phonetic properties** or their pragmatic **meaning associations**?

• Preliminary investigation suggests **both**: tones are used where **pragmatically felicitous**

• Further supports that **prosodic manipulation for IDS is governed by the lg-specific grammar**

Acknowledgments and references

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