#### ETAP4@UMass

# **Prosodic Features of Newscaster Intonation:** Production, Perception, and Communicative Use

Emily Gasser, Byron Ahn, Z.L. Zhou, & Donna Jo Napoli







#### 1. What does a newscaster sound like?

- Speed & loudness
  - syllables/second, total duration, intensity range
- Pitch
  - max, min, mean, distributions
- Prosodic targets
  - use of pitch accents
- Phrasing
  - phrase breaks, boundary tones

## 2. Why do newscasters sound that way?

- Gain listeners' trust?
  - authority, impartiality, believability

- Keep listeners' attention?
  - charisma, likeability, investment

(Ask about our follow-up survey of newscaster goals!)

#### 3. Can we tell the difference?

• Can listeners distinguish newscaster from non-newscaster speech based solely on prosody?

• What features do they use to do so?

# **Experiment 1: Production**

How is newscaster speech (measurably) different from non-newscaster speech?



- 12 target sentences
  - from WBUR (BU Radio News Corpus; Ostendorf et al 1995)
- 3 conditions
  - original/newscaster (News) (<u>audio</u>)
  - original script/volunteer (Non-fiction) (<u>audio</u>)
  - modified script/volunteer (Fiction) (audio)



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(audio) – News (audio) **1** Nor No

(audio

Non-News



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#### • 18 readers

- 9 male, 9 female
- 12 volunteers: post-college adults from Philly/Swarthmore area

(audio) – News

(audio

Non-News

• two sentences from each

### X1: Results: Speed & loudness

- *slower* speech rate
  - o **p=0.007**
  - (pace Cotter's 1993 findings based on a small scale study)
- smaller range of intensity
  p=.003



- *lower* minimum F0
  - M: p=.001, F: p=.005



- *lower* maximum F0
  - F only, p=.025



BUT newscasters have:

• no difference in pitch ranges



- *larger* standard deviation of F0
  - F only; p=.021



### **X1: Results: Distribution in pitch range**

Newscasters spend:

- *less* time in Q1
  p=.0042
- *more* time in Q3
  p=.0023
- *more* time in Q4
  *p*=.0035



#### X1: Example dip into Extra Low



15

(audio)

#### X1: Results: Pitch accents

Newscasters use:

- higher number of L+H\*s
  p=.018
- *fewer* (n=0) L\*+H
  p=.002
- equal number of total PAs (contra suggestions in literature)
  - NB: we control for content!
  - o **p=0.43**



#### X1: Results: Phrase breaks

Newscasters use:

more intonation
 phrase breaks
 p=.002

• No differences for intermediate phrases or boundary tones



#### **X1: Conclusions**

- Yes, newscasters do speak differently!
  - Previously observed for Spain, Brazil, Australia, Britain, Finland, Germany...
- Characterized particularly by:
  - $\circ \quad \text{ slower speed} \quad$
  - brief extra-low targets
  - more large-sized breaks

### Why are they different?

- wide pitch excursions, lower boundary tones convey authority (Gussenhoven 2006, Vermillion 2004, 2006).
- slow speed, L+H\* pitch accents and IPs support attention & comprehension (Pierrehumbert & Hirschberg 1990, Schafer 1997).
- conflicting goals of authority, listener engagement, and comprehensibility
- "But I'm just speaking naturally!"
- (Previous work on prosodic correlates of relevant personality traits credibility, authority, charisma mostly from non-linguistic fields.)

# **Experiment 2: Perception**

Can listeners tell the difference? How?



- Same 36 sound clips from X1
  - 12 sentences x 3 conditions
- Low-pass filtered (audio)
  - Means no lexical or segmental information available!
- Forced choice + confidence rating
- Each subject heard half (18) of the clips

loes this record	ling sound like a newscaster's report	rt, or everyday speech?
Newscaster		
Everyday speech		
)n a scale of 1-5 1 Not at all	with 1 being not confident at all, and 5	being very confident.
2		
3 – Neutral		
4		



- 481 subjects (Amazon Mechanical Turk)
  - $\circ$  (who provided 9,090 observations)
- Age:
  - Range: 18-79 years old
  - Mean: 35.7
  - SD: 12.8
- Gender:
  - M: 45.9% (n=221)
  - F: 53.8% (n=259)
  - Other: 0.02% (n=1)
- Language:
  - Native English: 97.7% (n=470)
  - Monolingual: 81.3% (n=391)



- Model: logistic regression; R-squared = 0.94, F(6,30)=113.1; p<0.001
- Yes, listeners can differentiate!
- But not very well.
  - Accuracy: 57.83%
  - Standard deviation: 11.13%.
  - **Recall: 67%** (of all actual newscasters, what % were correctly ID'd as newscasters?)
  - **Precision: 42%** (of all things ID'd as newscasters, what % in fact were newscasters?)
  - F<sub>1</sub>: 0.51





Low-Pass-Filtered Results

#### Rating Proportions, by Condition (Low-Pass-Filtered)

#### **X2: Results: The Good**

Based on this model, listeners are correctly using:

- lower minimum F0
  - M&F: p<0.01
- increased time in middle 50% of range
  - o p<.001

#### X2: Results: The Bad

Based on this model, listeners are ignoring:

- decreased speed
- less variable intensity
- more IPs
- more L+H\*, no L\*+H
- increased time in Q4
- higher max and SD of F0 in F speakers

#### **X2: Results: The Worse**

Based on this model, listeners are incorrectly using:

- length of clip (in seconds!)
  - positive, p<0.001
- time in Q1
  - positive, p<0.001
- number of H\* pitch accents
  - negative, p<0.05

#### **X2: Conclusions**

- Yes, listeners can distinguish newscaster prosody!
  - Newscasters have a constellation of conversational goals that guide their speech.
  - Consistent with Escudero et al's (2017) findings for Iberian Spanish.
- But they're not very good at it.
  - Their accuracy is above chance, but still not very high
  - They apparently attend to the wrong set of features (at least sometimes)

#### **X2: Conclusions**

- There's a clear mismatch between actual newscaster speech and our mental model of it.
  - Perhaps related to lack of segmental/lexical material; that does help, but people are still not great. (*Appendix!*)
  - Perhaps because how people conceive of newscasters' conversational goals does not match the goals they do have.
    - (Likely related to the fact that listeners have attended to the wrong set of prosodic features)



- 1. Competing demands of authority, clarity, and listener engagement shape newscaster speech
  - a. Newscasters share common prosodic features, because of the type of communicative acts that they are engaged in
    - i. Lack of face-to-face audience
    - ii. Delivering news confidently
    - iii. etc.
  - b. "Newscaster" is not indexical of any "identity" (cf. second-wave sociolinguistics)
    - i. NPR newscasters likely have a shared set of conversational goals (to the exclusion of non-newscasters) that drives certain style-shifts
    - ii. Some newscasters report feeling that they don't shift their voice



- 2. How newscasters' speech differs is not necessarily how one might expect, based on the literature or anecdotal impressions
  - Perhaps this is a result of the fact that this study has controlled for lexical/sentential content
- 3. Newscasters are different; listeners can tell
  - Listeners might be identifying speech as "newscaster-y" best when it aligns with how they conceive of a newscaster's conversational goals
- 4. Sub-phonemic differences (in prosody too!) are exploited by speakers and listeners for situational performances
  - Speakers' models of conversational goals must include sub-phonemic <u>prosodic</u> features



- 1. Competing demands of authority, clarity, and listener engagement shape newscaster speech
- 2. How newscasters' speech differs is not necessarily how one might expect, based on the literature or anecdotal impressions
- 3. Newscasters are different, listeners can tell
- 4. Sub-phonemic prosodic differences are important for situational performances

#### Thanks!

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Sound files & annotations: <u>http://bit.ly/ETAP4newscasters</u>

#### **Selected references**

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#### **Experimental/Annotation materials**

- All sound files used in experiments (LP filtered or not) are available online
  - <u>http://bit.ly/ETAP4newscasters</u>
- Praat TextGrid files are also available there
  - Containing ToBI transcriptions, as agreed upon by two different labellers
  - Containing force-aligned text, created by the Montreal Forced Aligner

### X2: Addt'l subject demographics

- Other childhood languages:
  - French, Japanese, Vietnamese (n=2 each);
    ASL, Arabic, Chinese, German, Hebrew, Hindi, Indonesian, Khmer, Malayalam, Muscogee (Seminole), Portuguese, Russian, Tagalog, Tibetan, Tsalagi Gawonihisdi (Cherokee), unspecified (n=1 each)
- L2s:
  - Spanish (n=28); Chinese (n=3); German (n=8); French (n=7); Italian (n=5); Korean (n=4); Japanese, Russian, ASL, Arabic, Russian (n=2 each); Farsi, Greek, Hindi, Igbo, Lao, Malay, Swahili, Tagalog, Tamil, Ukrainian (n=1 each)
- Musical training or experience: 43% (n=207)
- Respondents with hearing loss and/or who use an assistive hearing device: 1.2% (n=6)

- Highest degree achieved or in progress:
  - Some high school: 1% (n=5)
  - High School graduate: 21.6% (n=104)
  - Associate's or 2-year college degree: 21.6% (n=104)
  - Bachelor's degree: 40.1% (n=193)
  - Master's degree: 21.6% (n=104)
  - Professional (MD, JD, etc.): 2.7% (n=13)
  - PhD: 1.7% (n=8)
  - Other/unspecified: 1.2% (n=6)
- Frequency of listening to or watching news broadcasts:

0	1 - Daily:	33.1%	(n=159)
0	2:	17.9%	(n=86)
0	3 - Weekly:	24.9%	(n=120)
0	4:	7.1%	(n=34)
0	5 - Monthly:	6.9%	(n=33)
0	6:	7.5%	(n=36)
0	7 - Never:	2.5%	(n=12)

• Unspecified: 0.2% (n=1)

# **Speaker & clip features**

Variable	Different between N and non-N		Effect on newscaster-ness
speaker gender		(matched)	t(34)=0.51; p=0.610
length	t(34)=1.46	p=0.15	positive, p<0.001
syl/sec	t(34)=-2.83	p=0.007	p>0.05
intensity range	t(32.1)=-3.10	p=0.003	p>0.05

### **FO of female speakers**

Variable	Different between N and non-N		Effect on newscaster-ness
minimum	t(16)=-3.22	p=0.005	negative, p<0.01
maximum	t(13.7)=-2.50	p=0.025	p>0.05
range	t(16)=0.86	p=0.40	p>0.05
mean	t(14.7)=-1.57	p=0.13	p>0.05
standard deviation	t(16)=2.55	p=0.021	p>0.05

### FO of male speakers

Variable	Different between N and non-N		Effect on newscaster-ness
minimum	t(16)=-3.76	p=0.001	negative, p<0.01
maximum	t(16)=-1.05	p=0.30	p>0.05
range	t(16)=-0.20	p=0.83	p>0.05
mean	t(16)=-0.55	p=0.58	p>0.05
standard deviation	t(16)=-0.49	p=0.62	p>0.05

## **Distribution over pitch quartiles**

Variable	Different between N and non-N		Effect on newscaster-ness
% time spent in Q1	t(34)=-3.06	p=0.004	positive, p<0.001
% time spent in Q2–3	t(34)=2.45	p=0.019	positive, p<0.001
% time spent in Q4	t(34)=3.13	p=0.003	p>0.05
% time spent in lowest 10%	t(33.8)=-3.25	p=0.002	p>0.05

#### **Use of pitch accents**

Variable	Different between N and non-N		Effect on newscaster-ness
# of pitch accents	t(34)=0.78	p=0.43	p>0.05
# of H*	t(34)=-0.28	p=0.77	negative, p<0.05
# of L*	t(34)=1.22	p=0.23	p>0.05
# of !H*	t(34)=-0.41	p=0.68	p>0.05
# of L+H*	t(34)=2.46	p=0.018	p>0.05
# of L*+H	t(23)=-3.39	p=0.002	p>0.05
# of H+!H*	t(34)=-0.55	p=0.58	p>0.05
% L+H*	t(34)=1.57	p=0.12	p>0.05

#### **Phrase breaks & boundary tones**

Variable	Different between N and non-N		Effect on newscaster-ness
# of intermediate phrases	t(34)=0.48	p=0.62	p>0.05
# of intonation phrases	t(34)=3.33	p=0.002	p>0.05
# of (!)H-	t(34)=1.18	p=0.24	p>0.05
# of L-	t(34)=-0.64	p=0.52	p>0.05

#### **X2: Disentangled Non-News types**

N-Rating, by Condition (Low-Pass Filtered)

N-Rating, by Condition (Non-Low-Pass Filtered)



condition 🔁 MV 喜 OV 喜 NC



#### **X2: Disentangled Non-News types**



Non-Low-Pass-Filtered Results (Each Dot is a Within-Recording Average)



### Why are they different?

• Cotter (1993, 2010): Newscasters must simultaneously convey authority and impartiality while keeping their listeners engaged.

• Comprehension is key.

## Why are they different?

Survey of newscasters (n=12):

- likeability, relatability, friendliness
- intimacy, empathy
- trustworthiness, honesty
- authority, knowledgeability

"I work very hard in not sounding like I'm reading the news.... I imagine telling my story to a friend or family member in a conversational & colloquial manner."

#### **X3: "Newscaster-ness" of Speech with Segments**

- Same design as X2 but without low-pass filter
- Clips were processed to obscure quality differences
  - News clips had noticeably lower sound compression quality
  - To avoid this as a confound, all clips were compressed to the same (lower) level of quality
- 58 subjects via MTurk
  - 19-67 y.o. (mean age: 37.2)
  - US residents, native English speakers
  - 55% female, 45% male
- 69% accuracy
  - better than X2 (p<.001), but not great

#### **X3: "Newscaster-ness" of Speech with Segments**



#### Rating Proportions, by Condition (Low-Pass-Filtered)

#### X3: "Newscaster-ness" of Speech with Segments



#### **Target Sentences**

- 1. Price was making his third start for Boston since he was signed as a free agent last month. (f1as30p5)
- 2. The Red Sox beat the first place Baltimore Orioles five to three this afternoon at Fenway Park. (f1as41p6)
- 3. Grilsh says he's a product of the hearing world and it's frustrating to no longer be able to participate fully. (f2bs30p1)
- 4. Grilsh hasn't learned sign language because everyone he knows can hear. (f2bs30p1)
- 5. You've never seen or heard of the victim but you know the punishment is death in the electric chair. (f3asx4p1)
- 6. Randall Adams spent twelve years in prison before Texas finally overturned his conviction two years ago. (f3asx4p1)
- 7. Hack is studying the effect these sounds could have on insects which can hear the noises. (m3bs02p4)
- 8. No one is sure how the insects figure out which trees are withering. (m3bs02p4)
- 9. And his administration has not exactly welcomed the parking tax proposal either. (m4bs60p6)
- 10. But the T apparently knows that parking is a lucrative source of income. (m4bs60p6)
- 11. The legislature authorized a four hundred twenty-million-dollar reduction in Medicaid's account but left it to Weld to decide which services must go. (m4bs62p1)
- 12. Weld has also warned that he'd veto any changes to local property tax laws which do not allow for a voter referendum. (m4bs62p1)

# **Unmodified script (excerpt)**

Bolber says the parking tax will be an administrative nightmare. Instead, he supports Conservation Law Foundation's second Mass Transit revenue proposal to raise the gas tax and other auto fees. Those revenues are more broad based, Bolber says and easier to collect. But registry fees were the only ones exempt when governor William Weld ordered an across-the-board increase in government user fees. And his administration has not exactly welcomed the parking tax proposal either. Transportation secretary, Richard Taylor, who also is chairman of the M.B.T.A., declined to be interviewed for this story. A spokesman said the administration is analyzing a number of options for financing the M.B.T.A. and that Taylor, quote, is just not ready to talk about these things. But the T. apparently knows that parking is a lucrative source of income. Although its foray into that business is not what environmentalists expect of a mass transit system, the M.B.T.A. is building a forty-five million dollar garage at North Station, arguing that it will make money from the steady stream of Boston-bound commuters who need a place to park their cars.

# Fictionalized script (excerpt)

Bolber says the parking tax will be an administrative nightmare. He's gotta be right - I mean, who can keep track of it all? There's been resistance to all of the governor's fee proposals. You should see, even his buddies are against him. And his administration has not exactly welcomed the parking tax proposal either. No one's talking about it, but we all know what's happening. We've gotta support the MBTA if we want a city that isn't all backed up with traffic all the time. The problem is money, of course. But the T. apparently knows that parking is a lucrative source of income. So get this: they want to build a new parking garage at South Station.