

# Effects of Emotions on Configuration of the Speech Articulators

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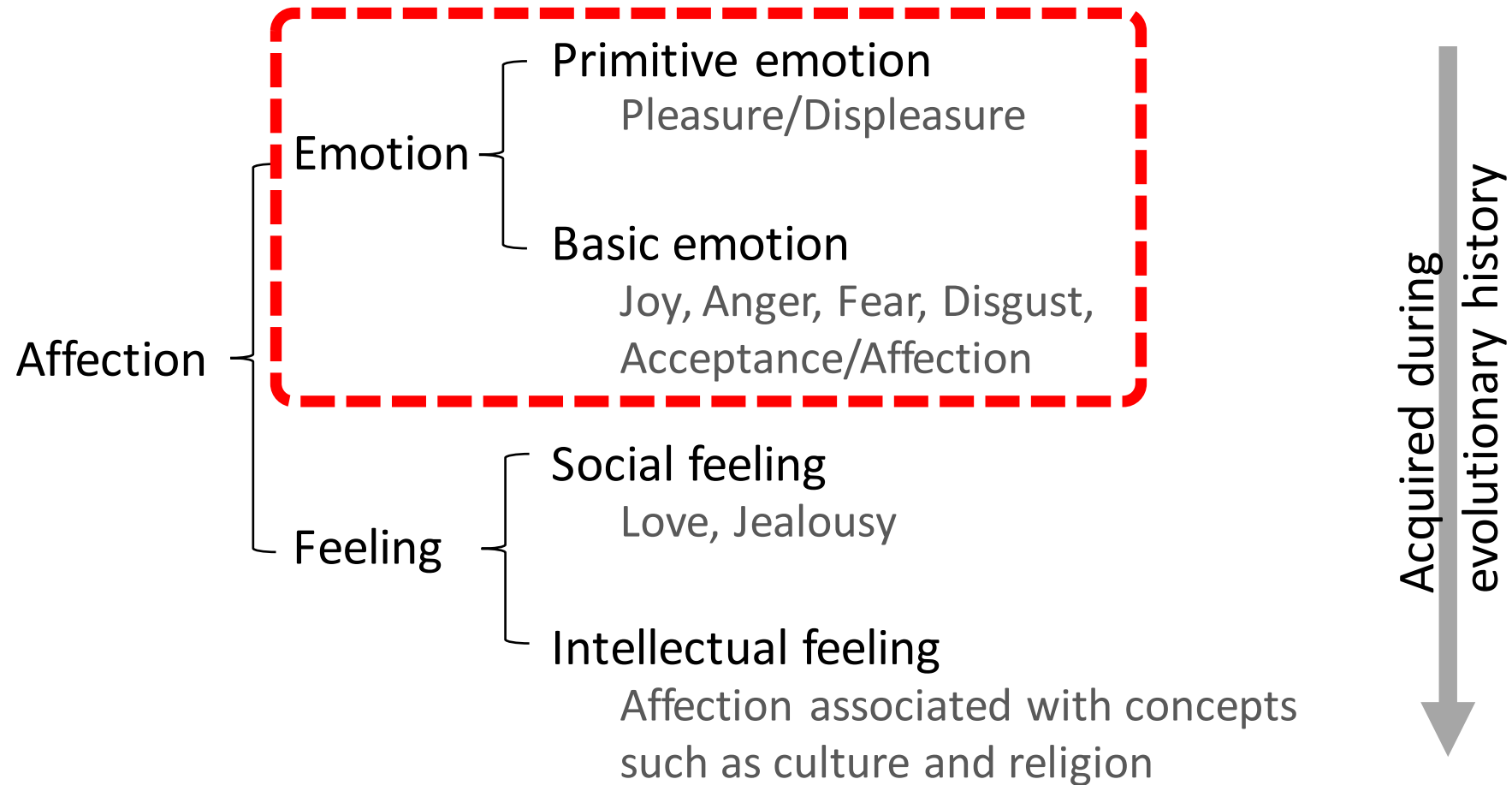
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# Background and Objectives

- Emotions are linked to various physical and physiological reactions.
- Such reactions affect the configuration and physical properties of the speech organs whether or not a person is speaking.
- The changes in the speech organs could contribute to the voice quality of emotional voice.
- We propose and verify a hypothesis on emotional speech production and verify by MRI measurements.
  - Side effect hypothesis of emotional speech production

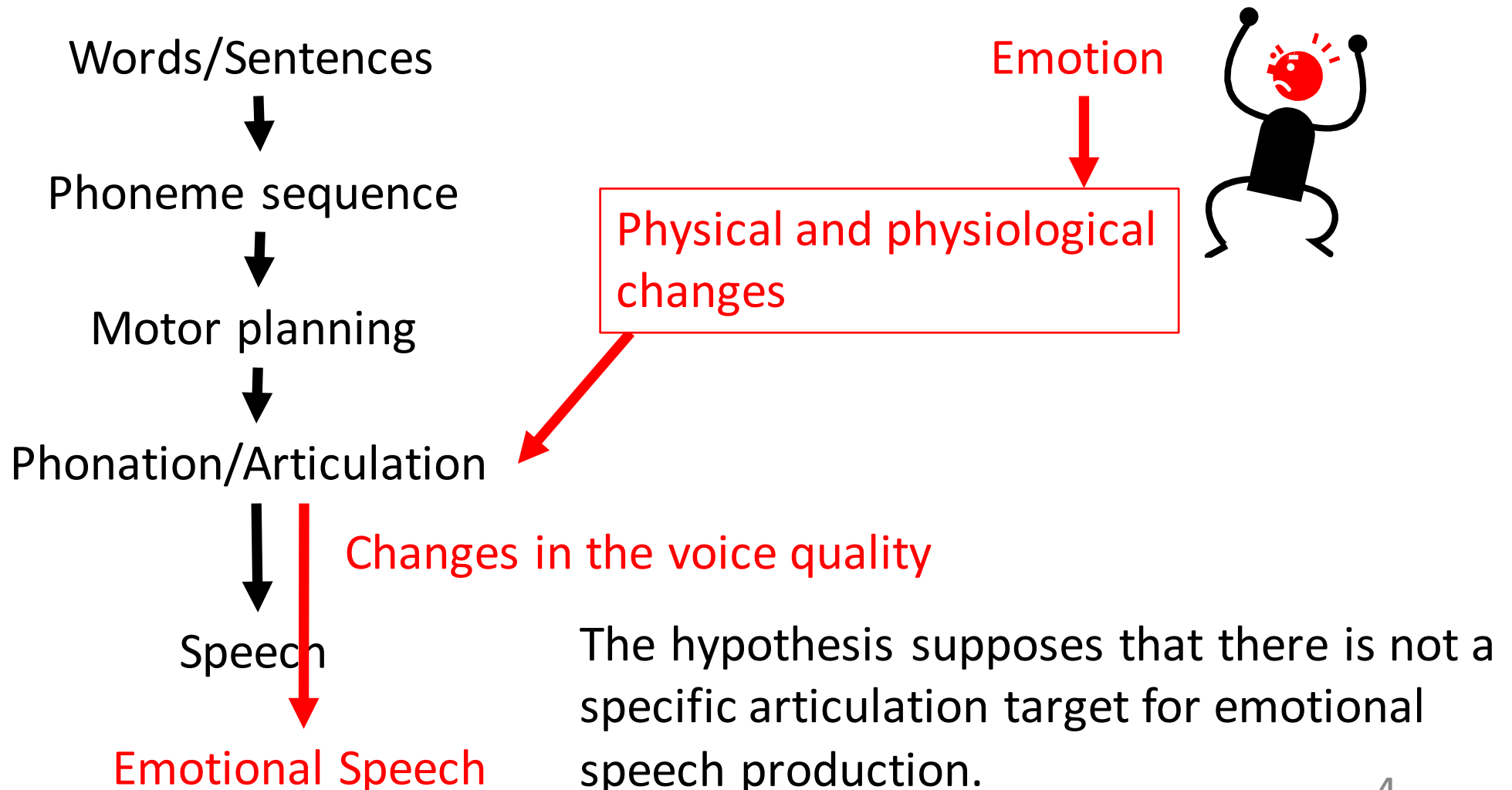
# “Emotion” in This Study



Hierarchical hypothesis of feeling based on the evolution of the brain (Fukuda, 2008)

# Side Effect Hypothesis of Emotional Speech Production

(Kitamura, 2010)

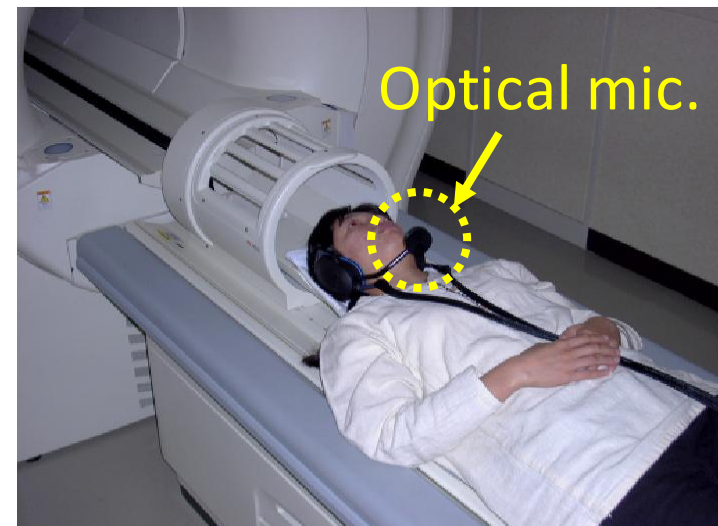


# How to Verify the Hypothesis

- Measure the speech organ configuration **with and without speaking** under certain emotions.
- Examine the similarity between the deformation of the speech organ configuration.
- If the deformation has the same tendency for the emotions, the articulation could be affected by the emotions directly.
  - The results can be interpreted as indirectly verifying the hypothesis

# Methods

- MRI scanner: Shimadzu-Marconi MAGNEX ECLIPSE 1.5 Power Drive 250 (ATR BAIC)
- Participants: 2 Japanese professional actors (1 male & 1 female)
- Emotions: **Neutral, Hot anger, Joy, and Sadness**



# Dialogues

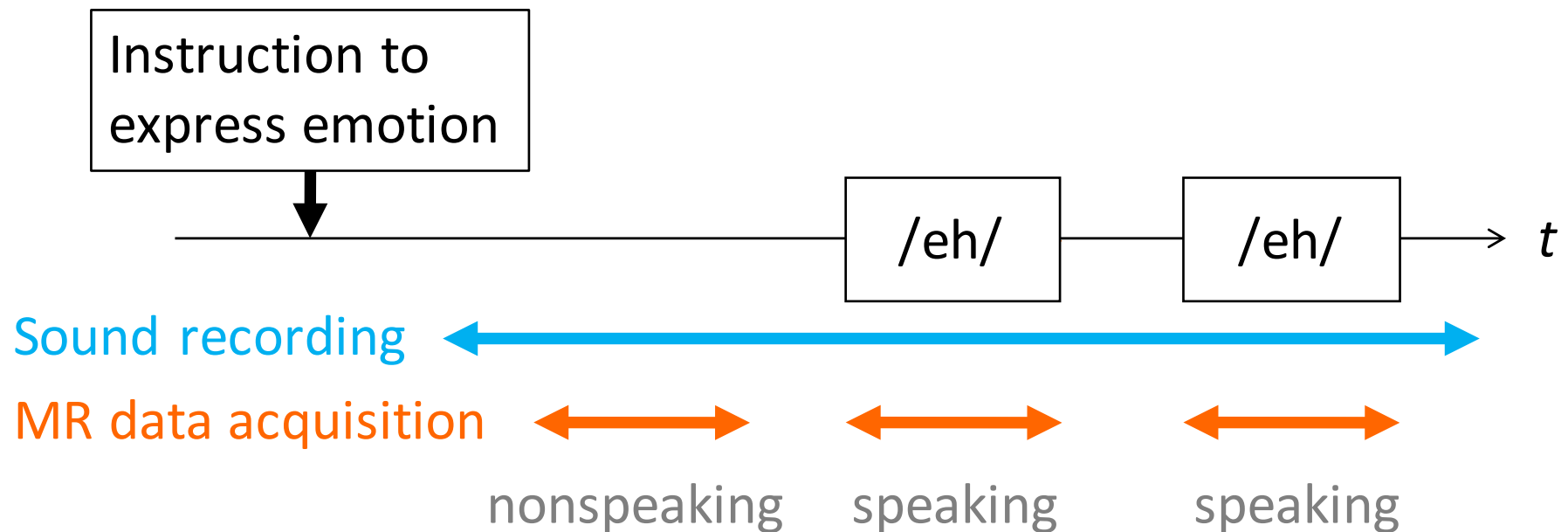
The participants were asked to take on the role of Speaker B and utter /eh/.

Hot anger      A: That was a complete lie.  
                  B: *Eh*, I can never forgive you.

Joy             A: You've got a job offer?  
                  B: *Eh*, yes, I have.

Sadness       A: You broke that expensive dish?  
                  B: *Eh*, yes, I did.

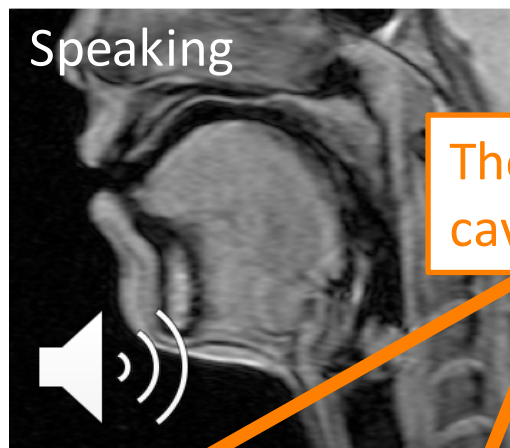
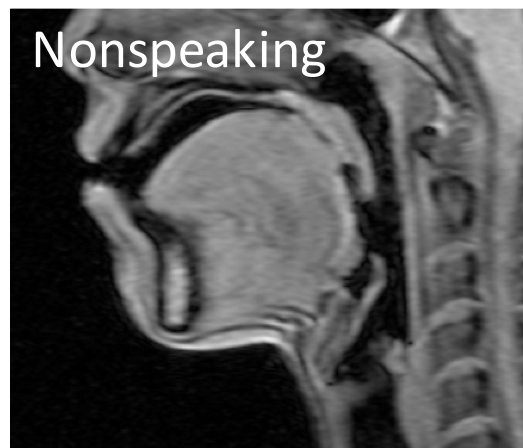
# Data Acquisition



The participants were instructed NOT to prepare for the articulation while expressing the emotions silently.

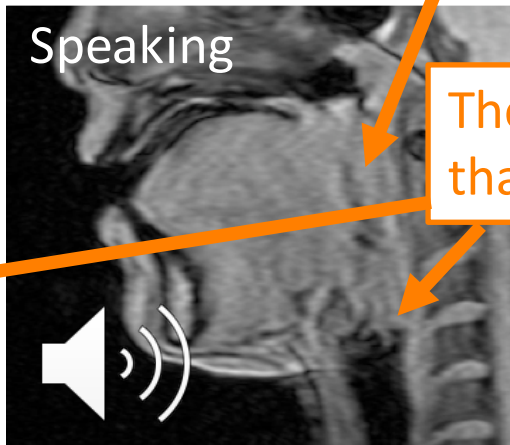
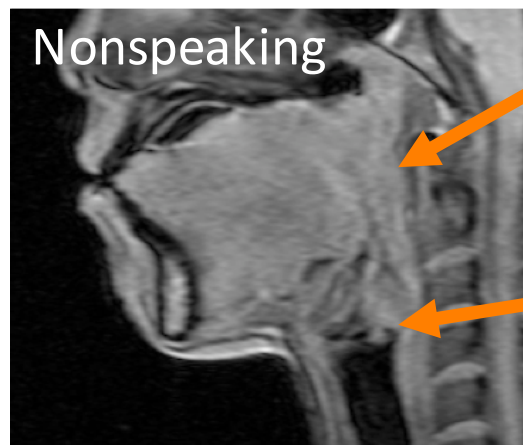


# Results: Neutral and Hot Anger (Female Actor)



The pharyngeal and laryngeal cavities are narrowed.

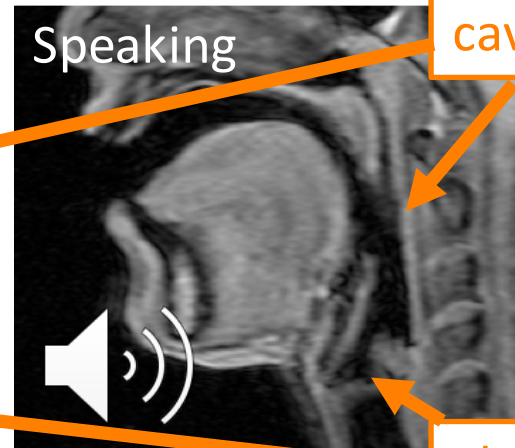
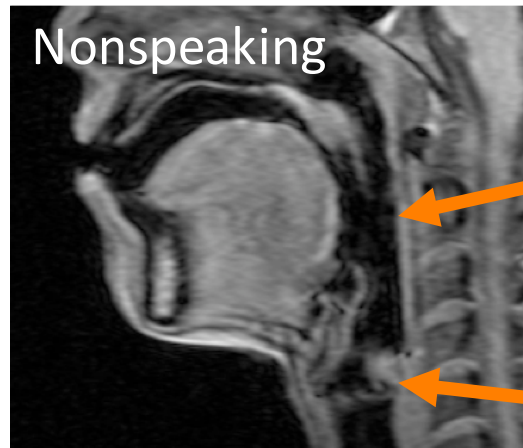
Neutral



The laryngeal height is higher than that for neutral.

Hot anger

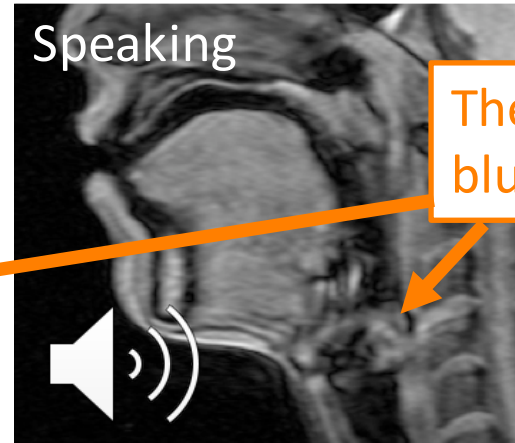
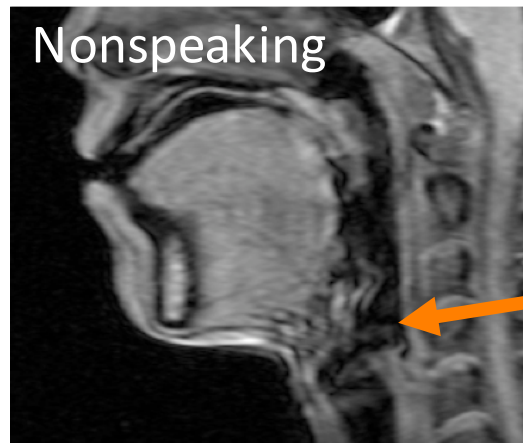
# Results: Joy and Sadness (Female Actor)



The pharyngeal and laryngeal cavities dilate.

Joy

The laryngeal height is lower than that for neutral.



The pharynx and larynx are blurred.

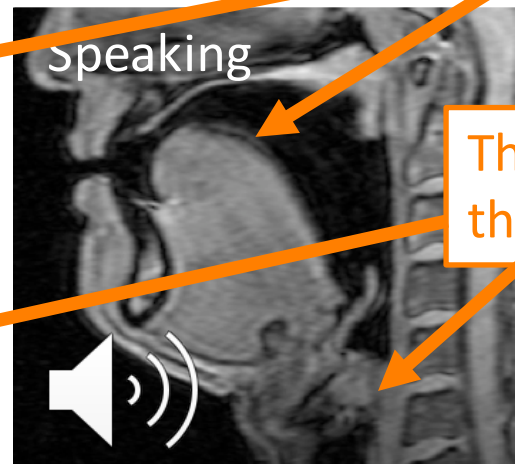
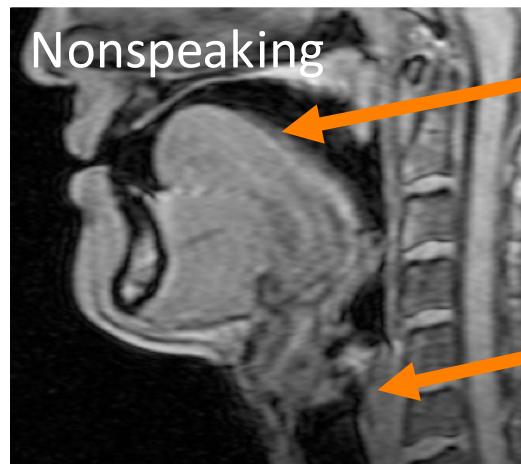
Sadness

# Results: Neutral and Hot Anger (Male Actor)



Neutral

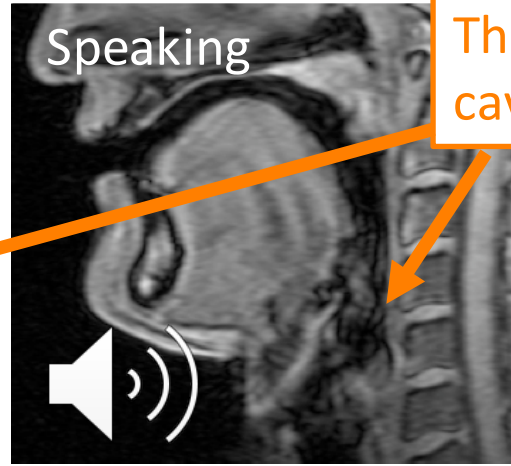
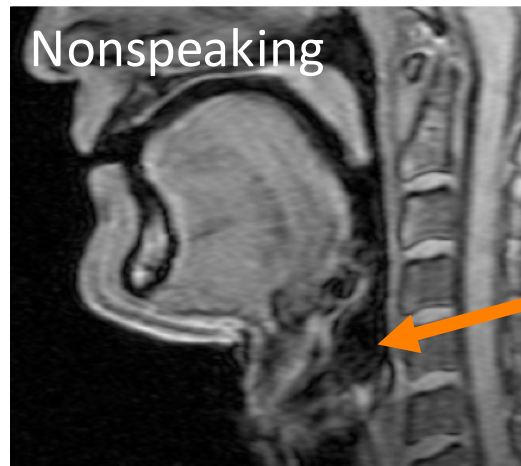
The front of the tongue dorsum up and forward.



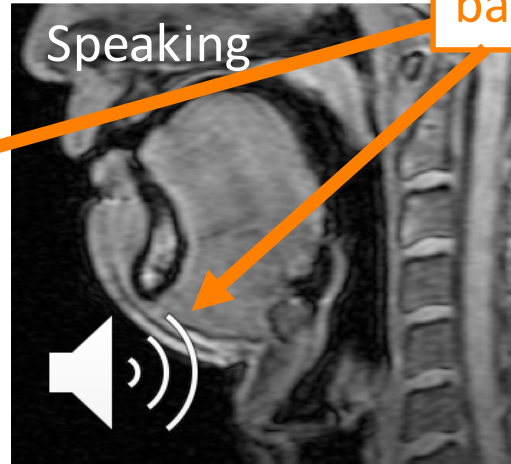
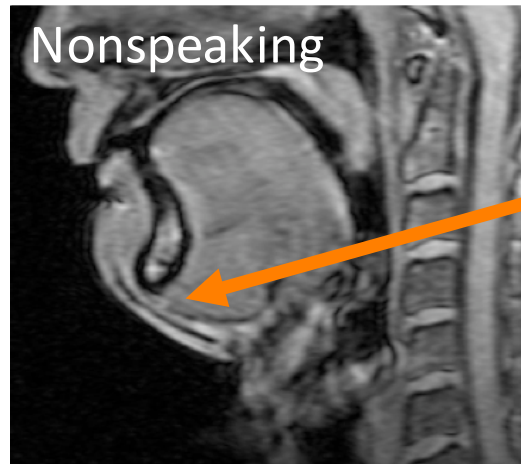
Hot anger

The laryngeal height is lower than that for neutral.

# Results: Joy and Sadness (Male Actor)



The pharyngeal and laryngeal cavities dilate.



The lower jaw is pulled backward.

# Discussion

- Emotions affect the speech organ configuration regardless of whether or not the person is speaking.
  - Same tendency of changes in the speech organ configuration for the four emotions.
- Limitations
  - We measured simulated emotional states.
  - We could not exclude the possibility that the participants prepared for the articulation during the nonspeaking states.

# Conclusions

- We proposed the side effect hypothesis of emotional speech production and evaluated it by MRI experiments.
- The effects on the speech organ configuration in the speaking and nonspeaking states were similar for emotions.
- The hypothesis was supported indirectly.

## Acknowledgements

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