Research on the unvoiced fricative consonant by Computaional Fluid Dynamics

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1 Research background and purpose

The sound source of the voiceless fricative changes because of the narrowed area formed partially in the voice road the current of air and is generated. It is needed to pay attention to the sound source generation mechanism for the finezation of the sound source of the voice synthesis model and the investigation of an abnormal articulation. More detailed understanding of the generation mechanism of the sound source is requested.

2 Method

The vocal tract shape is reproduced based on MRI, and the unsteady flow body is analyzed.The magnetic resonance image is a voiceless fricative of one Japanese adult male. /s/、/sh/、/ϕ/The one that the continuation utterance was done by lie on one's back title was targeted. The picture processing was given from the magnetic resonance image respectively, and it overworked and Co row of teeth configuration used the row of teeth amends method for the magnetic resonance image that extracted the shape profile from the airway to the lip. The computation grid observed non-regular behavior of the flow-field where it suppressed to the number of lattices within the range of computable paying attention to the pipe geometry scale of the voice road and arranging a detailed lattice partially, it developed to the turbulent model made the lattice of about 25000$\sim$ 360000 until the flow in the voice road to use Smagorynsky-SGS became quasistationary, and about 30ms was calculated in addition.

3 Conclusion

In /sh/, big pressure difference is seen in the stricture by the point part of the above part gums and the tongue, and a high-speed current of air gushes.In between row of teeths and the neighborhood, the flow that concentrates on the stricture between upper and lower

row of teeths comparatively widely gives a high change of unsteadiness to the space in the downstream. A high flow of unsteadiness is caused by the discharge jet between upper and lower row of teeths in the space put forward of the row of teeth on the oral vestibule and the lip in /s/. In /ϕ/, peculiar shape that influences the flow in the narrowed area etc. is not seen in the upstream between row of teeths. A peculiar flow to the discharge jet between lips is caused by the influence of the narrowed area between upper and lower row of teeths and the narrowed area of an upper and lower lip.

It paid attention to the vortex motion about the sound source, it examined, and it was guessed that the dilution zone of the discharge jet between row of teeths was an existence region in the keynote source in neighborhood between row of teeths and/s/in/sh/ A double ultra sound source was given to the keynote source position as this verification, and the acoustic analysis was done. As a result, it resembled a sound feature of an actual voice in/sh/model. A similar tendency was seen in 4kHz or more though there was a remarkable difference in the low in/s/model.