

Title	歌声知覚・生成機構の解明に向けた歌声合成システム構築に関する研究
Author(s)	齋藤, 毅
Citation	
Issue Date	2006-03
Type	Thesis or Dissertation
Text version	author
URL	http://hdl.handle.net/10119/983
Rights	
Description	Supervisor: 赤木 正人, 情報科学研究科, 博士

Construction of Singing-Voice Synthesis System for Clarification of Singing-Voice Perception and Production Mechanism

Takeshi Saitou

Japan Advanced Institute Science and Technology

Abstract

In order to clarify the singing-voice perception and production mechanism, it is important to investigate a relationship between singing-voice perception and acoustical features peculiar to singing-voice. This paper has clarified acoustical features affecting singing-voice perception by constructing the singing-voice synthesis system which can transform from speaking-voice to singing-voice, and investigating following three problems.

1. What is an important acoustical feature in fundamental frequency for perceiving singing-voice?
2. What is an important acoustical feature in spectrum for perceiving singing-voice?
3. What is a most important acoustical feature for perceiving singing-voice?

To discuss the 1st problem, this paper has investigated a relationship between singing-voice perception and four F0 fluctuations: overshoot, vibrato, preparation, and fine-fluctuation, by synthesizing singing-voices that controlled each F0 fluctuation and doing psychoacoustical experiments using synthesized singing-voices. These experimental results quantitatively clarified the influence of each F0 fluctuation on singing-voice perception. Moreover, it was made cleared that overshoot was most important acoustical features for perceiving almost all kind of singing-voice and that vibrato was important factor for perceiving the difference of the singing skill.

To discuss 2nd problem, this paper has investigated a relationship between singing-voice perception and 2 kinds of spectral characteristics; singers' formant and amplitude modulation of formant synchronizing with vibrato, by synthesizing singing-voice that controlling each spectral characteristic and doing psychoacoustical experiments. These experimental results showed that both acoustical features not only affected singing-voice perception but also were important factors for perceiving a difference of singing- and speaking-voice.

To discuss 3rd problem, this paper investigated a relationship between singing-voice perception and all acoustical features mentioned above by constructing singing-voice synthesis system which can transform from speaking-voice to singing-voice. The result of psychoacoustical experiment using synthesized singing-voices controlling all acoustical features showed that F0 fluctuations were essential for perceiving singing-voice. Moreover, it was made cleared that spectral characteristics were important factors for perceiving a singing-voice including F0 fluctuations as better singing-voice.

The results mentioned above showed not only the relationship between singing-voice perception and acoustical features peculiar to singing-voice but also a part of the singing-voice perception mechanism. Achievements of this study contribute to development of high quality singing-voice synthesis system and clarification of the singing-voice perception and production mechanism.

Keyword : Singing-voice synthesis, singing-voice perception, F0 fluctuation, Singers' formant, Amplitude modulation of formant.