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Research on Effects of Linguistic Information on Phonemic Restoration

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1   Introduction

This research aims at clarification of the cognitive mechanism of human through investigation of phenomenon called phonemic restoration. The phonemic restoration is one of the excellent capabilities of human, and pronoun of the aural illusion in the noise environment. The phonemic restoration is a phenomenon in which human perceives phoneme, when phoneme information was lost by accidental noise. Human can perceive a lot of unstable phonemes in daily life because of this capability. If such a human capability can be made good use of speech-recognition system, high recognition rate in a real environment can be expected, and it becomes big advancement for advanced man-machine interface. As a first step, it is necessary to clarify the cognitive mechanism of the phonemic restoration.

  The research on the phonemic restoration has been done in since 1970's. Majority of researches paid attention to the effect of insertion of noise on the occurrence condition of the phonemic restoration, especially about deficit section. However it is difficult to explain the robustness of such process because this amount of the feature doesn't guarantee matching to the expression in our perception system well, though the clue of the

phoneme perception pays attention to the feature of psychoacoustic based on a time transition of the spectrum. Many researches have focused on its relation to language including English, and suggested that linguistic information also improves the effect of the restoration. However, finding about sound and perceiving in English doesn't apply to Japanese because phonemes contiguration and utterence are different from those of English. This research paid attention to perception (aural) process. Because the phonemic restoration is not only a sensory process, and exists also during the cognitive process of the speech. In the latter case, it is necessary to think what human make a clue and how linguistic information and knowledge was used when the lost phoneme can be restored.

2   Comparison of phonemic restorations by native speaker and other linguistic speaker

Linguistic information between the native speaker and non-native speaker is greatly different The effect of linguistic factor on phonemic restoration was investigated by using the Japanese speech sample with periodic blank/noise sections of 100ms was inserted in the experiment with different language speaker. The result indicated that the native speaker had higher rate of correct answer to prolonged sound, a double consonant, and a particle. This suggests linguistic information is gratelly useful for native speaker.

3   Sound information and linguistic information

In this chapter, the experiment was conducted to see the differentiation of the use of sound information and linguistic information . The effect must be showed only of the use of linguistic information. However, previous experiment had the problem with incleasing the correct answer rate when the no sound section was set. The loss section is increased from 100ms to 150ms, and amount of phoneme information has been decreased. Consequentially, the correct answer rate at both language speaker with blank has decreased. However the correct answer rate of the latter half of sentences

was increased by the native speaker with noise inserting. On the other hand, only a samll improvement was confirmed on correct answer rate of the other linguistic group. This difference seems to be due to the subject has linguistic information. The result implies that linguistic information contributes greatly for phonemic restoration.

4   Amount of linguistic information and phonemic restoration

We paid attention to change recognition of the same speech under diferent condition when amount of linguistic information was changed. The reason that became the correct answer rate and cognition was investigated. We did the experiment which amount of linguistic information of the sample was changed by combining segments in dividing the sentence into some segments. The understanding of sentences was investigated according to a specific factor. Results, answer rate increased by giving more connections of segments, especially influenced by precedent segments. In addition, understanding rate of sentence increased by giving similar connections. As a result, the role of these linguistic information in phonemic restoration was suggested acutely as promoting forecast of sentences.

5   Linguistic acquisition level and sentence forecast

It is thought that forecast of the word by understanding of the context exists when the phoneme is restored for subject who have linguistic information to some extent even if he is an other linguistic speaker. Therefore the relationship between a Japanese acquisition level and phonemic restoration rate was investigated, by using two kinds of speech data concerning the forecast. The restoration rate that can be forecasted easily increased as the word acquisition level increased, and in sentences not be forecasted easily, has not changed so much.

6 Summary

In this paper, it showed the influence of linguistic information in japanese concerned linguistic foctor and linguistic acquisition. Through four experiments, phonemic restoration was done according to a Japanese language background by native speaker who have much linguistic infomation. In addition, it suggested linguistic information has promotive role forecast of sentences.