COMPARISON OF HUMAN AND LOVEBIRD SPEECH

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Abstract

It is well known that parrots and lovebirds imitate the human words if they are trained well. The speech production systems of parrots and lovebirds are different from humans'. For example, the length of the vocal tract of a human is almost equal to the whole length of a lovebird. Therefore, it is expected that the time signal of word produced by a lovebird would be different from the time signal of the same word produced by a human. Although, the time signals for the same word produced by a human and a lovebird are different, we still could understand the word produced by a lovebird. It is important to determine the parameters of lovebird speech which cause us to understand the words spoken by a lovebird. Knowing those parameters will help us in the field of speech recognition. In this study, the speech produced by a lovebird and by its trainer is analyzed in the time and frequency domain and those properties of the lovebirds' speech which are similar with the humans' are discovered.

INTRODUCTION

In this study the speech produced by a lovebird trained by a teenage girl is recorded. Name of the lovebird is "Dilosh" and this word is analyzed in the time and frequency domain, and compared with the same word spoken by the trainer.

The vocal tracts of the humans and lovebirds are very different from each other. The length of the vocal tract of a human is almost equal to the whole length of a lovebird. Singing birds have pepulus which vibrates as the human vocal cords. A vibrating trachea and a beak replaces the resonant frequency vibrating cavities of a human vocal tract. The schematic diagram of the vocal tract of a lovebird is shown in Figure 1 [1].
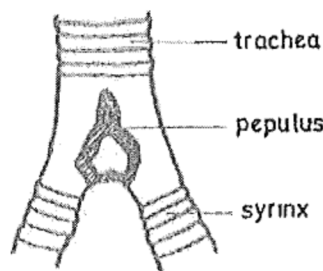

Figure 1. Schematic Diagram of the Vocal Tract of a Lovebird.

Time Analysis of the Word "Dilosh"

Since the speech production systems of a human and a lovebird are very different, it is expected that the word "Dilosh" produced by the lovebird and its trainer would be very different. This can be seen from Figures 2 and 3 which are the parts of the word "Dilosh" produced by human and lovebird, respectively. The periodic structure of the phonemes "d", "i", "l" and "o" of the human speech is not so obvious in the lovebird speech. The word produced by the lovebird has a shorter duration than the human word duration. But, average durations of each phoneme as the percentage of the whole word of lovebird and human speech are very close to each other as shown in Table 1 [2].

Table 1. The Average Durations of Phonemes

Phoneme	Human	Lovebird
D	0.050	0.055
I	0.250	0.210
L	0.076	0.060
O	0.320	0.250
Sh	0.270	0.345

Careful examination of "i" and "o" vowels of lovebird speech reveals that lovebird tries to imitate the pitch frequency of the human speech. The pitch frequency of the trainer is 350Hz on the average. Energy envelopes of the lovebird speech is almost periodic with the frequencies 280Hz and 350Hz for "i" and "o" vowels, respectively. The high frequency components are very effective in the lovebird speech which does not exist in the human speech.

Frequency Analysis of the Vowels of "Dilosh"

The 3-D spectrograms of the word "Dilosh" for the lovebird and its trainer are shown in Figures 4 and 5. In the bird speech, the high frequency components above 1500Hz seem to carry the whole information. The peak frequencies of the vowel "o" of the lovebird are between 1600Hz and 3500Hz. The formant frequencies of the vowel "o" of the trainer are 614, 1228 and 1848Hz. Although the lovebird speech seems to be the shifted version of human speech to the high frequencies, there is no one to one correspondence between high energy frequencies.

Modulation of the Vowels "i" and "o"

From the time and frequency domain graphics it seems that "i" and "o" vowels are modulated as DSBSC by the lovebird with carrier frequencies 2400Hz and 1600Hz, respectively. In order to generate those vowels, "di" and "losh" parts of the human speech are multiplied by sinusoidals of frequencies 2400Hz and 1600Hz, respectively [3]. To avoid overlaps human speech is filtered by a low pass filter with the cutoff frequency 700Hz. When the word is listened back a sound close to the bird speech is heard. 3-D spectrogram of this modulated wave is given in Figure 6.

CONCLUSION

Although the lovebird spends less time than the trainer to generate the word "Dilosh", duration ratio for each phoneme seems to be the same both for the lovebird and the trainer. The lovebird tries to imitate the pitch frequency by using energy envelopes. High energy components are highly effective in the lovebird speech. "i" and "o" vowels of the lovebird may be generated from the human vowels using DSBSC modulation technique. After examining other vowels generated by the lovebird, the lovebird speech may be synthesized and the synthesized words may be used to train the young lovebirds [3, 4].

REFERENCES

1. Öktay, Melekper, "Omurgalı Hayvanların Karşılaştırmalı Anatomisi," İstanbul, 1988.

2. Arslan, Beyhan, "Muhabbet Kuşu Konuşmasının Analizi," Bitirme Ödevi, Anadolu Üniversitesi, Elektrik-Elektronik Mühendisliği Bölümü, Eskişehir, 1991.

3. Kaya, Akile, "Muhabbet Kuşu Sesinin Sentezi," Bitirme Ödevi, Anadolu Üniversitesi, Elektrik-Elektronik Mühendisliği Bölümü, Eskişehir, 1992.

4. Hulse, Stewart H. et al., "An Integrative Approach to Auditory Perception by Songbirds," Comparative Perception, Volume II: Complex Signals, Edited by William C. Stebbins and Mark A. Berkley, John Wiley & Sons, 1990.
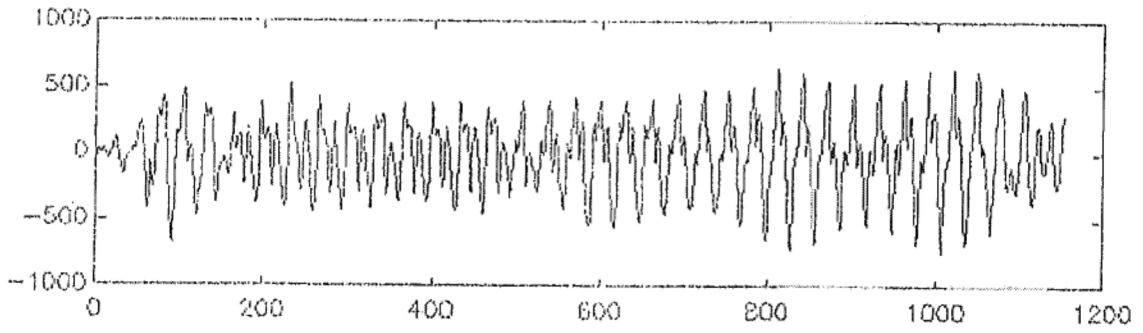
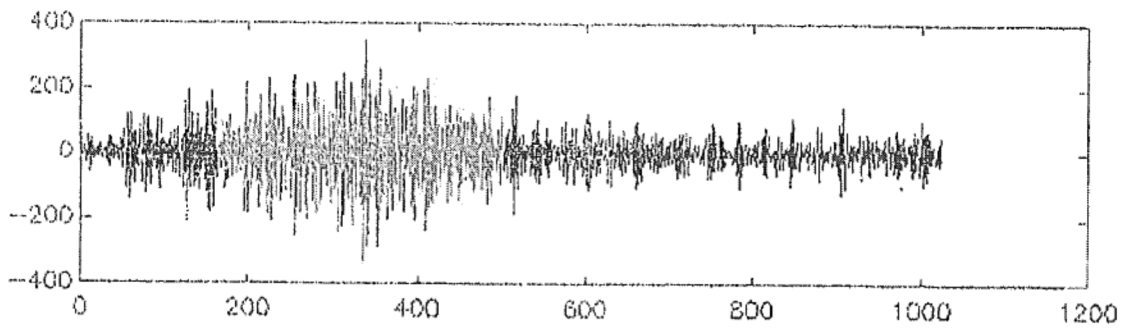Figure 2. Sample of "Dilosh" Produced by Trainer.

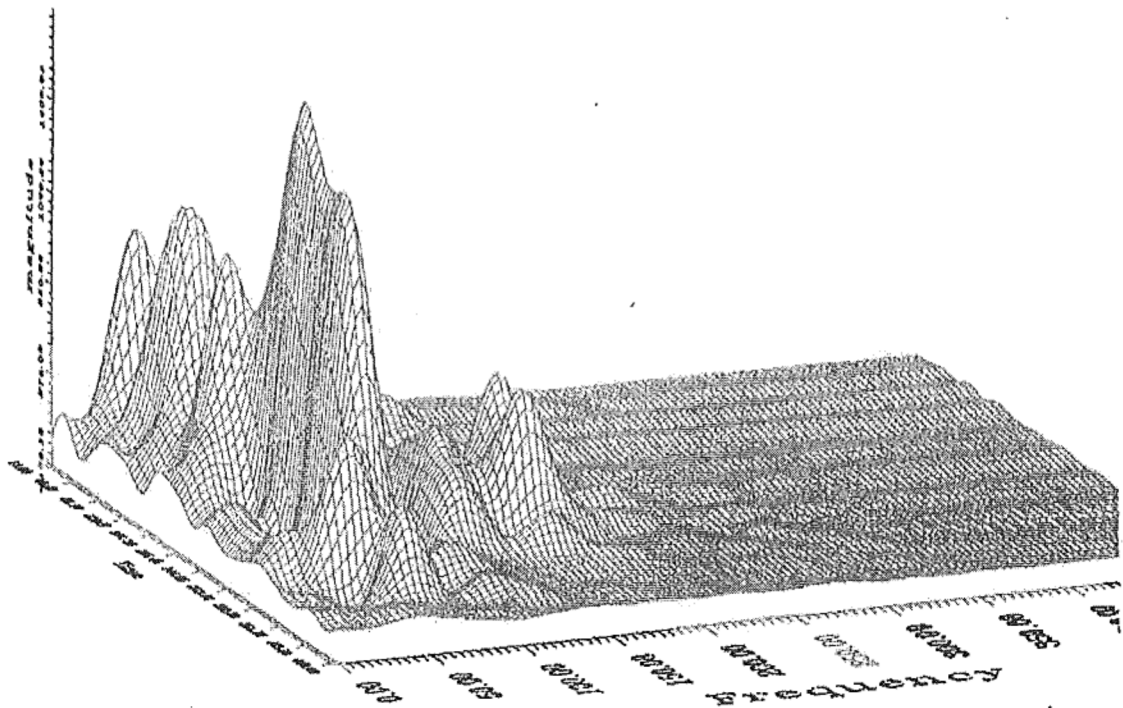Figure 3. Sample of "Dilosh" Produced by Lovebird.

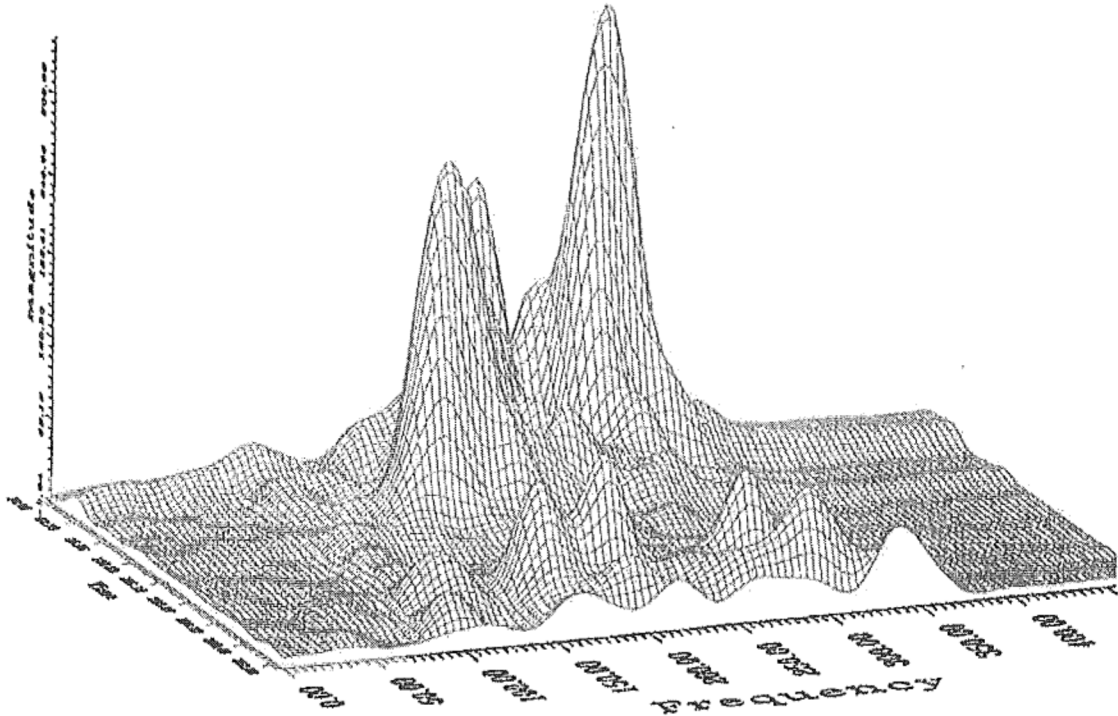Figure 4. 3-D Spectrogram of "Dilosh" Produced by Trainer.

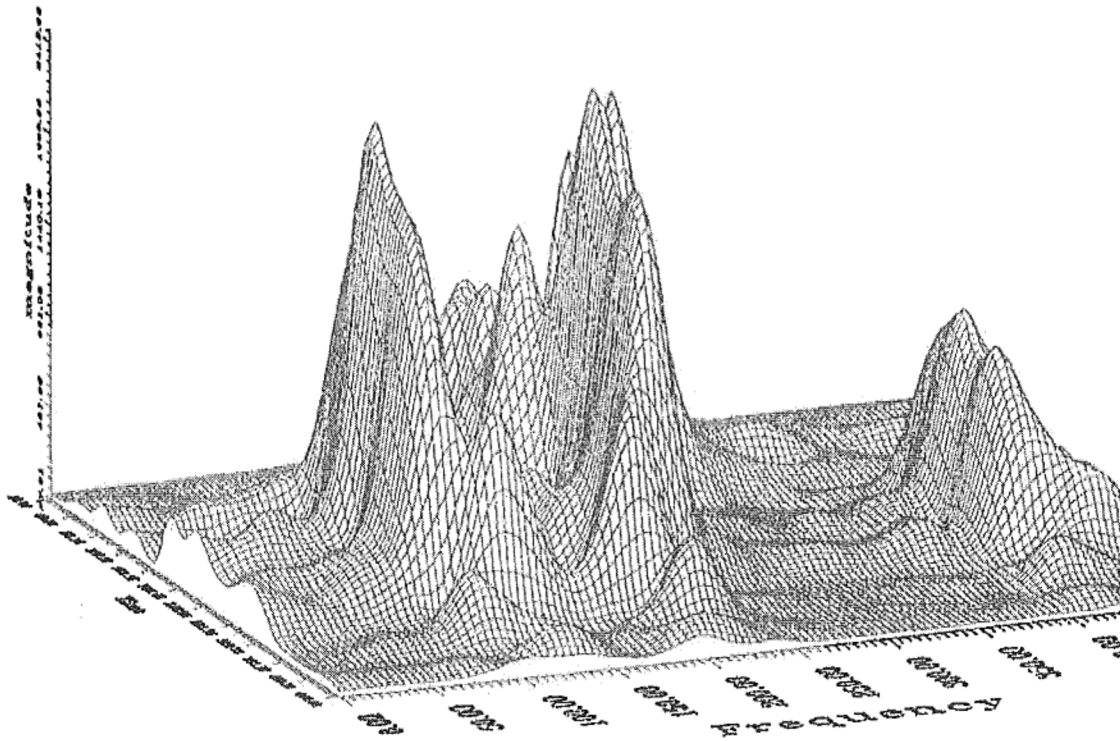Figure 5. 3-D Spectrogram of "Dilosh" Produced by Lovebird.

Figure 6. 3-D Spectrogram of the Modulated "Dilosh".

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