DEVELOPMENT OF CANTONESE SPEECH AND TONE VIEWER

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ABSTRACT

Modelling and practice are important in for good results in articulation/speech therapy. This paper describes the development of a Cantonese speech and tone viewer (CSTV). In the construction of this training tool, Cantonese phonology has been taken into account. This speech training tool allows clients to practise speech production at their own pace and supports their improving the accuracy of their Cantonese tones.

INTRODUCTION

In articulation/speech therapy, modelling and practice are essential for good results. Scarce clinic time often means clients may not have as much therapy time as the therapists might like to give to them. Very often, clients may achieve more in practising on their own at home with some speech aid. Relatives may be able to help too. A speech training tool which provides models and increasing steps in practice will be useful and important for articulation practice. Cantonese is a tonal language and to learn it one has to learn the articulation of Cantonese consonants, vowels and tones. Speech training tools such as speech viewer are now available for English but not yet for Cantonese. This paper describes the development of a Cantonese speech training tool, Cantonese speech and tone viewer (CSTV). Such a tool can help clients with articulation disorders such as dysarthria, tonal problem and functional speech disorders. The CSTV consists of a personal computer running a multimedia application. Natural sound output, high quality graphics and animation of articulation of Cantonese speech sounds and tones constitute the tool.

CANTONESE PHONOLOGY

The tones in Cantonese have lexically significance, realised through contrastive and relative pitch on each syllable. In a Cantonese syllable, tone is an obligatory element. Tone is a suprasegmental feature superimposed on the segmental units of a syllable. A Cantonese syllable can be as: $\underline{\quad T \quad}$
(C)(G)V(C/G)

There are nine tones in Cantonese and six are contrastive. Tone carries lexical meaning and is represented by a specific fundamental frequency pattern which is perceived as a pattern of varying pitch. The relative height of the "tonemes" (contrastive tone units) is important for lexical identification. In Cantonese, there are both level and contour tones (Hashimoto 1972, Cheung 1986).

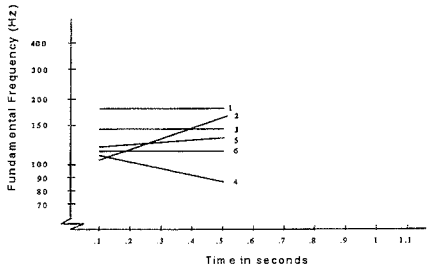

Figure 1. Simplified Cantonese tone patterns diagram (male)
(Similar pattern for female but with higher fundamental frequency)

Consonants

There are 17 contrastive consonants and two consonant clusters in the Cantonese phonemic system: six plosives, three nasals, three fricatives, two affricates, two glides, a lateral and two labialized velar clusters. The sounds are /p, p^h, t, t^h, k, k^h, f, s, h, m, n, ŋ, w, l, j, ts, ts^h/.

Vowels

There are eleven vowels /i, y, e, ɛ, ɔ, œ, ɐ, a, u, ʊ, ɪ/ in Cantonese and ten diphthongs /ai, ɐi, au, ɐu, ei, ey, ɔi, ui, iu, ou/. (Zee 1991).

THE CANTONESE SPEECH AND TONE VIEWER

The CSTV is developed using the Hypercard and the Chinese Language Kit. The hardware used is a Macintosh computer with a multimedia monitor, a key board and a mouse.

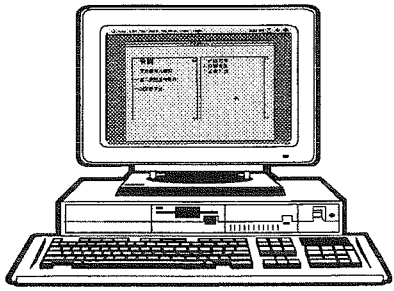

Figure 2. Cantonese Speech and Tone Viewer

RECORDING PROCEDURE

The project employed recorded speech to give high-quality voice output. All sound recordings were digitised on an Macintosh PowerPC computer with an Audiomedia interface. Sound Designer II version 2.8 was used for sound digitisation with 48KHz sampling rate and a 16 bits digitised voice channel was used. A B&K Microphone type 4003 with preamplifier type 2812 MKII was used to achieve high quality recordings. All digitised sounds were stored as binary files for used by the Hyper Card. The Multimedia Monitor of the PowerPC with amplified speakers is used for sound output.

Hyper Card was used for rapid prototyping and testing for this multimedia project. Chinese Language Kit was required for displaying Chinese characters in the computer.

The recording equipment used was as follows:

- Tascam DAT recorder DA-30 MKII
- B & K Microphone type 4003 with preamplifier type 2812 MKII
- Audiomedia Interface for Macintosh
- Sound Designer II version 2.8
- PowerPC 6100/66 with 16MB RAM 500MB Hard drive
- Mac OS System 7.5.1

Development Tools:

- Hyper Card version 2.2 for Macintosh
- Macintosh Chinese Language Kit

FEEDBACK

Animations to accompany the tones and speech sounds were made to maintain clients' attention and generate greater motivation and interest. The CSTV gives feedback to clients on whether they have made a correct choice or not. For example, in an exercise on tone height recognition and discrimination, clients are presented with different level tones, high level, mid level and low level tones for familiarisation. Audio and visual stimulation are given to the clients simultaneously. Then the clients are presented with different level tones randomly one by one and asked to decide their relative heights. To do so, the client clicks on pictures of men of different heights; the tallest man picture stand for the high level tone, the middle height man stands for the mid level tone and the shortest man the low level tone. Feedback given by CSTV to the clients indicates whether he or she has made the correct choice or not.

Different feedback modes can be used for different clients according to their age and needs.

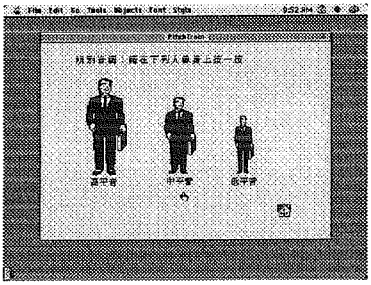

Figure 3. Picture of men of different heights to give feedback to clients on tone choice.

USING THE CSTV

As mentioned, CSTV is designed to help clients to learn the discrimination and production of Cantonese tones and speech sounds on his own or with minimal help from clinicians or relatives. The system is user friendly. The client can start by choosing the appropriate task to do. For example if the client chooses to learn about Cantonese tones, then the page for tones shown below appears and the client chooses which of the three categories to practise upon, e.g. tone explanation, tone discrimination and tone production exercise (Fig. 4). The choice is made by highlight, the task to do and then the exercises are done step by step. The exercises are designed for clients to practise Cantonese tones and speech sounds on their own. Diagrams of lip shapes and tongue positions are illustrated on the screen for the clients to imitate (Fig. 5).

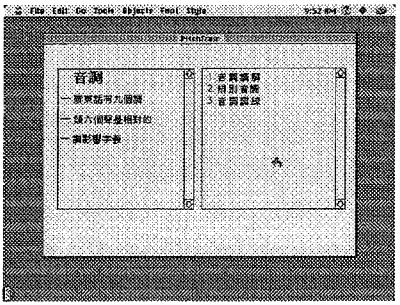

Figure 4. Main menu for tone exercises.

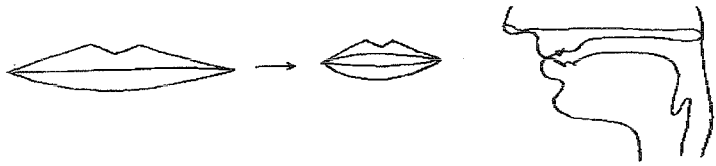

Figure 5. Diagram of lip shapes and tongue position for the production of /p/.

ADVANTAGES OF CSTV

CSTV assists speech therapy work and saves clinicians' time in supervision of drill work for other goal planning and hence be available for a greater case load. Clients can practise at their leisure and comfort and with consistent input; a computer is always consistent and never gets tired. CSTV is flexible with the programme design and tailored programmes for different clients can be made and installed for use easily. CSTV is useful to different clients including dysarthric clients, cleft-palate clients, hearing-impaired clients, etc. It is also useful for clients who would like to learn Cantonese.

FURTHER DEVELOPMENT

At present, CSTV is able to teach clients the production of Cantonese tones and the articulation of Cantonese speech sounds. Future development on automatic judgement on the correctness of the clients' speech production will further allow clients to practise sounds on their own.

REFERENCES

B.M. Chen, D.J. Calder & G. Mann (1994) Computer-based multimedia speech training tool for dyspraxic clients. In Roberto Togneri (ed) *Proceedings of the Fifth International Conference on Speech Science and Technology, 215-220.* Perth: University of Western Australia Printer.

Cheung, K.H. (1986) The phonology of present day Cantonese. Unpublishedral doctoral thesis. University of London.

Ching, T. (1984) Lexical tone pattern learning in Cantonese children. *Language Learning and Communication*, 3, 243-414.

Hashimoto, A. (1972) *Studies in the Yue Dialect.* Cambridge: The University Press.

Zee, E. (1991) Chinese (Hong Kong Cantonese). *Journal of the International Phonetic Association*, 21, 46-48.

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