CITY UNIVERSITY OF HONG KONG
香港城市大學

Acquisition and Evolution of Phonological Systems
音韻系統的習得及演化

Submitted to
Department of Chinese, Translation and Linguistics
中文、翻譯及語言學系
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

by

AU, Ching-Pong
區靖邦

November 2005
二零零五年十一月

Abstract

A dynamic computational model linking up the cognitive-developmental properties of the human beings (local mechanisms) and the transition patterns of sound changes (global phenomena) was built, in order to seek for possible solutions to resolve the controversial issues about the implementation of sound changes.

In the simulation results of the model, two controversial sound change transition patterns, Neogrammarian regularity and lexical diffusion, can both be found under different conditions. During a **shift** without fusion of sounds, the pronunciations of the lexical items change **regularly** as described in the Neogrammarian hypothesis; during a **merger**, the spoken forms display a **regular** pattern as in a shift at the beginning. Then the changing patterns become **irregular** lexically as described in lexical diffusion, when the two perceptual categories are fusing together. These conditions are primarily matched with the empirical data reported in literatures. Besides the coexistence of the two controversial patterns, the simulation results also support the existence of another controversial phenomenon, **near-merger**: individual speakers in the population cannot perceptually distinguish two sounds but can produce them differently.

The present model provides a reasonable explanation to the coexistence of Neogrammarian regularity and lexical diffusion. To build such a model, it is necessary to replace a few inveterate assumptions in phonology. They include: (1) symmetry between perception and production; (2) irrelevance of phonetics; and (3) discreteness of boundaries.

In the present model, perception and production develop individually in different cognitive subsystems in different time, so perception and production are not necessary to be the same. Moreover, instead of using abstract symbols to represent internal phonemes, the internal sound units are defined in two continuous cognitive domains: perceptual domain and articulatory domain. Thus some phonetic information can be retained internally in the two domains. Finally, no perceptual categories with infinitely sharp perceptual boundaries are assumed in the model. The formation of perceptual categories is driven by statistical distributions of sounds that the infants listened to.

Acknowledgement

This dissertation is the compilations of works for my PhD study during the year 2000 to 2005. First and foremost, I would like to thank my supervisor, Professor William S-Y. Wang, for his support, guidance, encouragement and positive advice throughout my present study. In addition, I would like to thank the examiners, Professor Thomas H-T. Lee, Professor Morten H. Christiansen and Professor Tom B. Y. Lai for their remarks, valuable suggestions and approval of the dissertation. Special thanks are also due to Professor Lee’s comments and advice regarding the issues of language acquisition on my work in a number of my earlier presentations.

I would also like to express my thanks and appreciation to the previous and current members and visitors of the Language Engineering Laboratory for giving useful comments to both my work and presentations. In particular, I would like to thank Dr. James Minett for both his advice to my work and his help on the technical problems in computer programming. Finally, but not least, I would like to thank Dr. Christophe Coupé and Dr. Wang Feng for sharing their knowledge on computational modeling and historical linguistics.

Table of Content: