ASPECTS OF PHARYNGEAL COARTICULATION

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date of defence: February 27th, 2001

Summary

This investigation deals with pharyngeal articulation in general, with a focus on its dynamic aspects as observed in spoken contemporary Egyptian Arabic. Pharyngeal articulation as a linguistically distinct speech sounds is rarely used among the languages of the world. In Arabic, however, the pharynx is frequently used to produce distinct phonemes both as primary as well as secondary place of articulation, i.e., true pharyngeal and pharyngealized consonants, respectively. When designing the present study we aimed to resolve the confusion found in the literature concerning the phonetic description of pharyngeal and pharyngealized articulation. The following is an overview of the scope of the present study. This book comprises two parts which contain eight chapters. Part 1 includes an introductory chapter and three other chapters describing various experiments we conducted to investigate several aspects of pharyngeal articulation and coarticulation in Arabic. Part II comprises one chapter which presents a model of pharyngeal articulation, two other chapters which report two experiments intended to test the model and a final chapter for general discussion and a main conclusion.

Chapter 1 provides a general introduction to the structure of the Arabic language. We also search for a definition of pharyngeal articulation and give a brief account on the anatomy and physiology of the pharynx to substantiate that definition. In order to motivate the present study, we state some phonetic and phonological observations concerning pharyngeal articulation, nasalization and laryngealization. We relate, based on x-ray pictures available from some previous studies, the peculiar shape of the tongue and the relatively unusually large jaw opening associated with pharyngeal consonant production, to the complexity of pharyngeal consonant production. Our main hypothesis is derived from some anecdotal observations, both phonetic and phonological in nature, and are stated and are supported by basic knowledge about the acoustics of pharyngeal articulation. The way pharyngeal consonants are pronounced by bilingual speakers of Greek and Italian minorities in Egypt, by non-native speakers learning Arabic as a second language and by young native children, prompts us to examine the process of acquisition of pharyngeal consonants by native and non-native speakers of Arabic. In addition some phonological observations such as vowel lowering and vowel /a/ insertion before pharyngeal consonants are also stated. Perceptual judgement, when listening to utterances containing pharyngeal consonant, indicates a substantial degree of nasality associated with pharyngeal consonant
production. One of the aims of this study is to verify whether there exists a connection between nasal and pharyngeal articulation.

We address the questions: is pharyngeal articulation simple or complex? Does pharyngeal articulation involve only retraction of the tongue root in order to reduce the size of the pharyngeal cavity as it is implicitly understood according to some previous studies? The problem treated in the thesis are stated in chapter 1 together with our formulated hypothesis. A brief account on theories of coarticulation is also given in chapter 1.

Chapter 2 reports on the experiment we conducted to investigate the shape of the back cavity during pharyngeal consonant production. We use a video registration of motion pictures of the top view of the three pharyngeal compartments, i.e., naso-, oro- and laryngeo-pharynx using the fiber optic technique. The articulatory dynamics, associated with the production of a set of consonants that take place in the back cavity of the vocal tract, were monitored using a nasal fiberscope. The findings could provide a rigorous account on the nature of interaction between nasal, pharyngeal and laryngeal articulation. Also, the results revealed the mechanically complex process of pharyngeal consonant production which turned out to be an activity involving several other articulators than the tongue in their articulation.

Chapter 3 deals with the kinematics of the jaw trajectory. The movements of the mandible and the lips were studied in order to determine whether there is any specific movement pattern associated with the production of various pharyngeal consonants at different constriction locations in the pharynx. It is commonly known that during the production of most of the oral consonants the primary gesture is that made by the tongue. The role of the jaw is considered to be secondary in this case. The main question addressed in this chapter is whether the jaw is involved in pharyngeal consonants production. The behavior of the jaw indicated that pharyngeal consonants do involve the jaw in their production. Therefore we proceeded further to investigate the acoustical aspects of pharyngeal articulation.

Chapter 4 is devoted to the acoustic characteristics of pharyngeal articulation, particularly to provide support for the physiological and kinematics data collected and reported in the previous chapters. Acoustic analysis was carried out on the same set of pharyngeal and laryngeal consonants. The main findings show that the acoustic signal reflects, to a certain extent, some of the physiological features characterizing pharyngeal consonant production which were manifested as articulatory gestures. The acoustic and physiological data obtained from our experiments and from other studies, enabled us to construct a model of pharyngeal articulation.

Chapter 5 describes how we can dynamically model pharyngeal articulation to account for pharyngeal coarticulation. The findings gathered from the series of experiments we conducted were integrated in order to construct a dynamic model of pharyngeal coarticulation. The model was tested first by examining its ability to account for the delay observed in the acquisition of pharyngeal articulation by native speakers, and second by examining the model viability to predict the constraints on the distribution patterns in Colloquial Egyptian Arabic. A delay in the acquisition time of this set of speech sounds may also occur due to the excessive degree of jaw lowering which is a tedious act for children to acquire until a later period of time. The pharyngeal consonants are mechanically complex segments and they exert severe constraints on the co-occurrence restrictions among consonants in Arabic. This in turn affects the entire structure of Arabic language on various levels.
Chapter 6 investigates the acquisition of pharyngeal consonant production by bilingual children. Our previous findings on the characteristics of pharyngeal articulation gave rise to the question whether native and non-native speakers of Arabic may encounter any difficulty while acquiring pharyngeal consonants, and if so, why and in what way? We attempted to capture a solution for that problem by explaining the effect of the complex pharyngeal consonants on the development of the motor skills of native children in terms of the process of acquisition of pharyngeal articulation.

Chapter 7 examines the phonotactics of Colloquial Egyptian Arabic. We focused on the pharyngeal consonants distribution patterns and the type of restrictions imposed on this class of speech sounds. It appeared clearly that the mechanical factor has a severe impact on the production of the true pharyngeal consonants. The probable effect this factor might exert on the surrounding consonants in a word, made it worthwhile to examine the distribution of this class of speech sounds in relation to the overall structure of the language under investigation. Thus, the distribution patterns of the pharyngeal consonants were stated in terms of a set of rules governing the phonotactics of spoken Egyptian Arabic. The results of this investigation pointed out the predominant effect of the mechanical constraints, rather than the perceptual (acoustic) constraints, on shaping the overall structure of the entire language system.

A general conclusion is offered in chapter 8. In this final chapter, the main findings we obtained are discussed and gathered to support our definition of pharyngeal articulation/coarticulation and the innovated phonetic classification of Arabic consonants we offered. The limitations the present study suffered from, are stated and some suggestions for future research work evoked by our study, are presented.