Investigating perception of places of articulation in sign and speech

Stina Ojala 1, Olli Aaltonen 2 & Tapio Salakoski 1

1 Department of Information Technology, University of Turku, Finland
2 Department of Speech Sciences, University of Helsinki, Finland
stina.ojala@utu.fi, olli.aaltonen@helsinki.fi, tapio.salakoski@utu.fi

Abstract
Speech perception in field of phonetics is widely studied with behavioural testing based on the notion of categorical perception. Recently signed languages are also being studied within phonetic framework. The experimental design presented within this research project aims for analogous study design parameters for both speech and sign.

Index Terms: sign synthesis, sign perception

1. Introduction
The phenomenon of categorical perception has been widely studied in speech sciences over some decades now (e.g. [1]). In general, investigations have been made on various areas of human perception, such as object categorization [2]. As a basis for this particular study, studies that have looked at categorical perception of different speech sound continua are to be considered here. There is a discrepancy in results between consonant and vowel continua and their perception as identification and discrimination patterns are concerned. As consonants are usually perceived as being strictly categorical, the vowels are perceived as being items in a continuum of changing vowel parameters.

This study concentrates on investigating possibilities to research sign language phonetics within phonetic framework. This is a part of larger research project, which gathers information on Finnish Sign Language production and perception in relation to production and perception of Finnish as a spoken language. Some of earlier results within this research project have been previously presented e.g. in ICPhS [3], where we showed similarities in perception patterns between handshape and vowel continua.

2. Material and methods
In this study behavioural tests to informants are used to investigate the patterns of perception in sign and speech. Different characteristics of the senses (i.e. sight vs. hearing) have to be taken into account when designing the individual test batteries.

2.1. Speech sound synthesis
In order to study the perception of different places of articulation in speech, consonant continua have to be used as stimuli. Consonants as such are not suitable for stimuli, but they have to be incorporated within syllables in order to be heard and thus be subject to categorization. In this experimental design we used HLSyn® synthesis software. We designed a 7-step continuum /pa—ta/ with cascade synthesis paradigm.

2.2. Sign synthesis
In designing sign continua we treated the place of articulation in sign as analogous to consonant loci. We used Blender® 3D software to design the sign stimuli [4]. We designed a 42-step continuum, in which protruded index finger moved along the mandibular bone ridge from jaw to cheek near the ear lobe.

2.3. Behavioural study design
In designing the behavioural test sets we used PXLab software to present the stimuli in tests and to analyse the informants’ answers to the study questions and reaction times accordingly. The same software used for both test set stimuli continua.

3. Discussion
The study is performed within phonetic framework and looks at sign language as being analogous to spoken language. This similarity between signed and spoken languages as means of communication has also been suggested by studies from various fields of research (e.g. in brain evoked potential studies [5] and studies on sign language structure [6]). Within the project we have used the same design for handshapes, vowels and places of articulation both in speech and sign successfully and the preliminary results gathered have ensured us that this paradigm is suitable for studying sign language within the phonetic framework.

4. Acknowledgements
The authors like to thank Filip Ginter (Dept. of Information Technology, University of Turku, Finland) for speech synthesis and Janne Savela (Dept. of Information Technology, University of Turku, Finland) for sign synthesis.

5. References