Voice similarity among brothers: evidence from a perception experiment

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Introduction

In forensic cases, there are voices among suspects which are similar. It is often assumed that voices of family members are more similar than those of unrelated speakers (Nolan 2009). For example, Rose (2002) described an Australian case in which the voices of two brothers were perceptually hardly distinguishable; therefore, the perpetrator was not obvious. Feiser's (2009a, b) acoustic analysis of female and male voices has shown that there are spectral similarities between siblings (e.g. in long-term average spectrum (LTAS) or F4) as opposed to non-related speakers, but also differences. That means that voices of siblings need not be *per se* more similar than those of unrelated speakers and might be even very different. While there are numerous studies on twins' speech (e.g. Loakes 2006), there is little research regarding speaker identification among family members. The aim of the present perception study is to test whether naïve listeners are able to identify brothers and thus distinguish them from non-related male speakers.

Methods

Recordings were obtained from five pairs of brothers (ten speakers) between the age of 22 and 29 – all speakers of the Ripuarian variety of Central Franconian. The age difference between the brothers is one to three years. The speakers read the German version of the North wind and the sun text. The first part ("*Einst stritten sich Nordwind und Sonne, wer von ihnen beiden wohl der Stärkere wäre"*) was selected for presentation in an ABX discrimination test. The A and B stimuli were productions by non-related speakers and X was always produced by the brother of either A or B. The perception experiment was conducted using Praat's *ExperimentMFC script* and took about 30 minutes per subject. A total of 160 ABX triplets (no repetitions) were presented to 20 listeners (nine female and eleven male speakers of Standard German) between the age of 22 and 45. Most of the participants were phoneticians, however they were unfamiliar with the speakers and the task. Statistical analyses were carried out in the R-programming language.

Results

A one-sample proportions test with continuity correction showed that correct identification of brothers by their voices was significantly above chance ($\chi^2[1] = 1040.8$, $p < 0.001$). Listeners correctly identified the brothers in 78.5% of all instances (cf. Figure 1). A two-sample test for equality of proportions with continuity correction revealed no differences between male and female judgements ($\chi^2[1] = 0.084$, $p = 0.772$), i.e., male and female listeners correctly identified brothers to the same extent. A general linear mixed model with correct identification as the dependent variable, Brother as fixed factor (five levels: brother pairs 1-5) and listener as a random factor showed that brother pair M4 was significantly better identified than the other four pairs and that the number of false identifications was greatest for brother pairs M2 and M5.

Discussion and conclusion

Our findings clearly show that naïve listeners are able to distinguish between related and non-related speakers. Results indicate that siblings' voices are indeed more similar than voices of unrelated speakers and that listeners perceive this similarity. In the present study listeners had the opportunity to use all acoustic information available in the speech signal, since the stimuli consisted of a longer text of connected speech which was not manipulated. Results suggest that listeners rely on dialect features, as the brothers who showed more pronounced dialect features (M4) were better identified than the other pairs. To our knowledge this is the first perception experiment showing that naïve listeners are able to correctly identify male siblings who are not twins. Further investigations should now focus on the acoustic features that are responsible for correct identification.
Knowing the essential features of the perception of voice similarities is important for speaker identification. The future goal is not only to investigate similarities but also the differences between siblings. This will enable better comparisons of family members' voices in forensic cases and will help to establish the application of systematic *voice similarity settings*, which are of increasing importance to Forensic phoneticians.

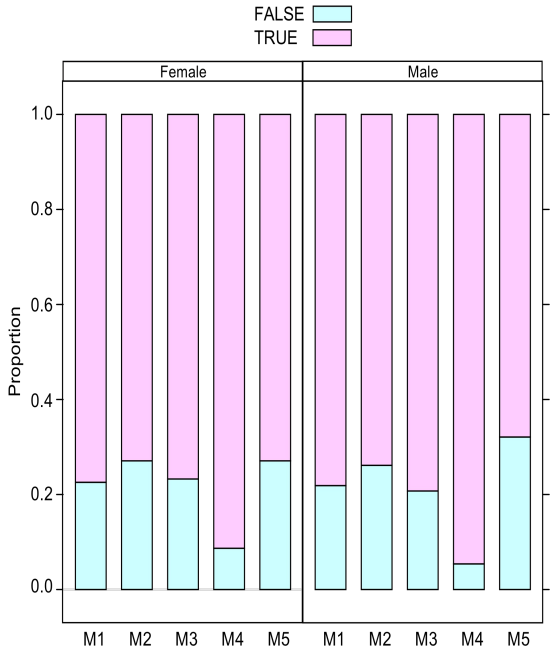

Figure 1 Proportion of true (pink) and false (turquoise) identifications of the five brother pairs (M1 – M5) shown separately for female listeners in the left panel and for male listeners in the right panel.

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