IDENTIFICATION OF MALE AND FEMALE VOICE QUALITIES IN PRE-PUBESCENT CHILDREN

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ABSTRACT

This paper addresses the issue of gender-based language differences in children, specifically the ability of adult English and Finnish speakers to identify four to six-year-old Finnish children by voice samples alone. Four listener groups were presented two discrimination tests. All groups scored at or below chance level with shorter utterances (Test 1). The Finnish listeners' accuracy increased with longer utterances (Test 2), but even the best group mean scores (49-59% correct responses) were below levels reported in the literature for children speaking other languages.

INTRODUCTION

The differences between adult male and adult female voices are often easily recognized, due in part to vocal tract characteristics that develop after puberty. However, evidence collected from pre-pubescent children's speech suggests that certain aspects of voice quality may be learned--those which can not be attributed to larynx and vocal tract size-- and that girls and boys can be thus differentiated by speech long before biological changes occur [1 & 2]. This raises important issues for prosodic research, namely, how children learn to manipulate gender-related speech cues in their formative language-learning years. Moreover, if these gender cues are learned, one would expect a difference in the way they are manifested in various language and cultures.

In 1992, Karlsson and Rothenberg reported that in their study of Swedish, Finnish, and English boys and girls, the gender of Finnish children was most difficult to recognize from voice samples.[3]. Whereas their listener groups provided correct answers 70% of the time for the other languages, they were only able to correctly identify Finnish boys and girls at slightly better than chance and at chance levels respectively. Karlsson and Rothenberg conclude that this is evidence that at least part of gender-specific speech is learned, and that the Finnish language, with its lack of gender cues in Finnish pronouns, may reflect and reinforce lack of identification of gender at early ages in that culture.

The objective of this study was to conduct a follow-up study of the Karlsson and Rothenberg findings, and to test the degree of accuracy by American and Finnish speakers in identifying the sex of a four- to six-year-old child by voice samples alone. Furthermore, another aim was to determine if there are prosodic features of the children's voices that correlate with these gender judgments.

METHOD AND MATERIALS
Test material

Recordings of 13 pre-school Finnish children were taken from a larger data base of 80 pre-adolescent Finnish children living in Helsinki. Voice samples of these four-, five- and six-year old boys and girls were isolated for two discrimination tests. The first test included ten utterances, ranging from two to eight syllables; the second test, containing ten utterances of eight syllables or longer, was devised to determine if utterance length affected the accuracy of the listener's judgments. The subjects were balanced for sex; five boys' and five girls' voices were included in each test.

Subjects

There were three phases of the investigation, each with a different set of subjects as listeners. The adult listener groups were not balanced for sex. In the first phase of the study, 31 adult listeners--18 Finnish-speakers and 13 American-English speakers--gave their judgments on the first test. Of these adult speakers, 11 Finnish-speakers and 11 American-English speakers participated in the second test. In the second phase of the study, twenty-five Finnish kindergarten teachers gave judgments for the two tests. And, finally, in the third phase, 55 Helsinki grade school children (25 girls and 30 boys) between the ages of nine and twelve years old, provided judgments for both tests.

Reliability test

Written transcripts of Test 1 and Test 2 were presented to five native Finnish speakers to evaluate possible gender-specific vocabulary or phrases that could bias judgments (four Finnish language editors--two male and two female--and one male speech therapist). No test item was considered to be gender-biased by the five Finnish speakers.

Equipment

The subjects were recorded using a Sony Professional WM-D3 tape recorder with a Sony ECM-144 microphone. The tapes prepared for the adult listener discrimination tests were copied using two Sony Professional WM-D3 tape recorders. The two tests were played to the adults on a Sony Walkman cassette player. The comprehensive school children listened to the tests in groups.

RESULTS
Gender judgments

All listener groups had difficulty differentiating Finnish girls' from Finnish boys' voices in the two tests. Results of the first phase of the study are presented in Table 1:

Table 1. Mean number of correct identifications (out of ten) with standard deviations indicated in parentheses:

Voice Discrimination Tests Phase I		
Listeners	Test 1	Test 2
Finnish adults	4.06 (1.47)	4.91 (1.68)
American adults	5.08 (1.27)	4.64 (1.77)

As is shown in the table above, American speakers were slightly better in identifying Finnish boys' and girls' voices on Test 1 than were Finnish listeners. The Americans scored a mean of 5.08 correct answers out of 10, (SD 1.27, Range 3-7), whereas the Finnish listeners' mean was 4.06 correct answers (SD 1.47, Range 2-7). While the English listeners' scores were at chance level, the Finnish speakers did not achieve a 50/50 split in judgments. For the American listener group, an increase in utterance length (Test 2) did not lead to better performances; on the contrary, they achieved a mean score of 4.64 (SD 1.77, Range 2-9) on Test 2, in comparison to Finnish listeners, whose Test 2 accuracy slightly increased over their Test 1 results, with a mean of 4.91 correct identifications (SD 1.68, Range 3-9) for Test 2. Figure 1 is an illustration of the Finnish adult speakers' success in identifying boys and girls voices in Test 2:
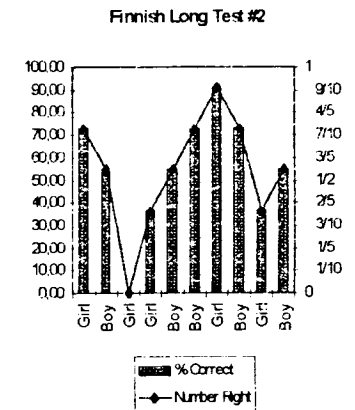
Finnish Long Test #2

Figure 1: Percentage of correct identifications by Finnish speakers for Test 2. The horizontal axis represents (from left to right) the order and the gender of the ten voice samples. The vertical axis presents the percentage of correct identification for each test voice.

Phase II of this study dealt with testing Finnish-speaking kindergarten teachers. This group was selected because it was on the other end of the

scale of listeners than the American English listeners who did not understand Finnish. The kindergarten teachers communicated daily with Finnish preschoolers, and would thus be the most familiar with children's speech. Nevertheless, familiarity or expertise in relating to young Finnish children did not seem to be an advantage for Test 1. In fact, the kindergarten teachers had the fewest correct identifications of all listener groups on Test 1. Scores for these teachers are shown in Table 2:

Table 2. Finnish-speaking Kindergarten teachers' mean number of correct identifications (out of ten), with standard deviations indicated in parentheses:

Voice Discrimination Tests Phase II		
Listeners	Test 1	Test 2
Kinder-garten teachers	3.2 (1.33)	5.92 (1.67)

The Finnish kindergarten teachers had the lowest mean score of all listener groups for Test 1 with a mean of 3.2 correct identifications (SD 1.33, Range 0-6). The teachers' accuracy improved significantly on Test 2, attaining a mean score of 5.92 correct responses (SD 1.67, Range 0-8), the highest mean number of correct identifications for all listener groups.

Another listener group selected for familiarity with children's voices was comprehensive school children between nine and twelve years old. Again, here the assumption was that children who are sure of their own gender identification, and who are in daily contact with child-ren, would themselves be able to correctly identify voice qualities that differentiate boys from girls. At least for Test 1, this did not prove to be case, as is evident in Table 3:

Table 3. Finnish School children's mean number of correct identifications (out of ten), with standard deviations indicated in parentheses:

Voice Discrimination Tests Phase III		
Listeners	Test 1	Test 2
Finnish children	3.93 (1.48)	5.67 (1.50)

An examination of the data in Table 3 suggests that Finnish children of this age group had similar scores on the first test to Finnish adults, correctly identifying the gender of children 39 % of the time (Mean 3.93, SD 1.48, Range 1-7). The children's mean score improved, however, on Test 2 to 56% correct judgments (Mean 5.67, SD 1.50, Range 2-8) The listener groups of Phase II and III (kindergarten teachers and comprehensive school children) had a significant increase in correct identifications in Test 2. Thus, teachers and children found longer utterances easier to judge correctly, suggesting that Finnish intonational or prosodic patterns that are associated with gender require longer utterances than eight syllables for correct identifications. A summary of the four listener groups that participated in this study's three phases are shown in Table 4.

Table 4. Mean number of correct identifications (out of ten) with standard deviations indicated in parentheses:

Voice Discrimination Tests Phases I, II, and III		
Listeners	Test 1	Test 2
Finnish adults	4.06 (1.47)	4.91 (1.68)
American adults	5.08 (1.27)	4.60 (1.77)
Kinder-teachers	3.2 (1.33)	5.92 (1.67)
Finnish children	3.93 (1.48)	5.67 (1.50)

DISCUSSION

The data collected for this study suggests that pre-pubescent Finnish children's voices do not provide prosodic cues to identify gender, and is a corroboration of Karlsson and Rothenberg's findings that Finnish children's voices carry less gender-specific information than do children's voices in other languages. However, there are so many variables yet unaccounted for concerning Finnish children's prosodic patterns, that stronger generalizations and conclusions about Finnish children's gender recognition and speech patterns would be at this point premature. In fact, very little is known about male versus female voices in Finnish.

Karlsson and Rothenberg discuss whether the construction of the particular language influences the child in learning to speak in a more gender-specific way. In the case of Finnish, the authors point to the lack of the he/she distinction of the third person pronoun in Finnish as a possible contributing factor. Here, the implication is that categories in language at the lexical level affect our classification and conceptualization of people, and in turn this classification is reflected in voice quality. While this should not be ruled out *a priori*, proving the connection is far from realized at this point. Since, as Karlsson and Rothenberg point out, there are many other ways to indicate gender, ranging from the frequent use of gender-specific personal names, dress, gestures, play interests, and other non-verbal behavior, we do know enough about the total picture of gender-specific awareness as reflected in speech, to make valid correlations.

As a native English speaker living in a Finnish-speaking environment and studying Finnish children's speech, I would like to make one general cultural observation that could affect these results, and which had not been mentioned in previous studies: the tendency of Finns to avoid interacting with strangers. Finns are often judged by members of other cultures to be withdrawn, shy, or reticent (the "silent Finn"), when in fact, this type of behavior in Finland is most predominant in public behavior amongst unfamiliar people. Testing young children thus presents a problem, as the voices reflect the interview situation: unknown adults question, observe and record, and the children, responding to the video-cameras and tape recorders and to the new people, interact shyly. I am currently trying to determine if there is a prosodic profile in Finnish that reflects this attitude, and that does not differentiate along gender lines. In fact, as partial verification of this, adult Finnish speakers were asked to describe the children's voices in Tests 1 and 2. The most frequent adjectives provided were "shy", "cautious", or "scared" for the first discrimination test, and this is precisely the test where all the Finnish listener groups had the most difficulty making gender identifications.

My conference paper will present more information on the prosodic variables in Finnish children's speech that could possibly skew the data to draw conclusions that gender information is not carried by Finnish children's voice quality.

REFERENCES

[1] Weinberg, B. and Bennett, S. (1971), "Speaker Sex Recognition of 5- and 6-Year-Old Children's Voices," *J. Acoust. Soc. Am.,* vol. 50, pp.1210-1213.

[2] Weinberg, B. and Bennett, S. (1979), "Sexual characteristics of preadolescent children's voices." *J. Acoust. Soc.Am.,* vol. 65, pp. 179-189.

[3] Karlsson, I. & Rothenberg, M. (1992), "Intercultural variations in gender-based language differences in young children," *STL-QPSR* No. 1, pp. 1-17.