Regional linguistic variations in Canadian French: Do they affect performance on speech perception in noise?

Josée Lagacé*, Stephanie Breau-Godwin and Christian Giguère

*Corresponding author's address: University of Ottawa, Ottawa, K1H8M5, Ontario, Canada, josee.lagace@uottawa.ca

Many audiologists working with a Canadian French population use word recognition tests to measure speech perception abilities in noise. The TMB test ("Test de Mots dans le Bruit") includes four lists of 35 words presented in babble noise. The test is intended to measure the pre-cognitive perceptual stage of auditory processing and does not require understanding of the phonetic differences between speech sounds at a cognitive level. Previous studies examining performance on auditory tests similar to the TMB showed differences between populations speaking the same language but with different accentuations, such as the English spoken in the United States versus the United Kingdom. Variations in performance were attributed to accentuation differences between the speaker and the listener. To the authors' knowledge, no study appears to have investigated the effect of regional linguistic variations of Canadian French on word recognition in noise. Normative data for the TMB are being collected in three regions of Canada: Moncton, Montréal and Ottawa. Participants are all native speakers of Canadian French, but there are important linguistic variations across the three regions. Knowledge of the effect of regional linguistic variations on the TMB performance will help refine interpretation of test results in the audiology clinics.

Published by the Acoustical Society of America through the American Institute of Physics
INTRODUCTION

Many individuals are consulting in audiology because of difficulties understanding speech while in presence of background noise. Audiologists then need to assess their speech perception abilities in order to provide proper intervention. Unfortunately, very few standardized tests are available for measuring speech perception in noise. For audiologists working with Canadian French populations, this situation is even worse. There are essentially four speech-in-noise tests available to use with children and adults speakers of Canadian French: 1) Test de seuil vocal en images (TSVI) dans le bruit,1 2) the Canadian French adaptation woodland of the Synthetic Sentence Identification with Ipsilateral Competing Message test (SSI-ICM),2,3 3) the Canadian French adaptation (children version) of the Hearing In Noise Test (HINT),4 and 4) different in-house adapted versions of a word recognition test in noise. Although, the TSVI may be an interesting tool to use with children populations, there are no published normative data and the test has not been adapted for use with adults. The Canadian French adaptation of the SSI-ICM test consists of presenting sentences along with an ipsilateral continuous discourse. A response template containing a list of the ten numbered sentences of the SSI-ICM test is provided to the listener. The listener has to report the number of the sentence heard instead of repeating it. This type of response format reduces the potential influence of memory and language on the test results.9 However, good reading skills are required to identify the sentence on the response template,10 which can be a limitation with some listeners. The Canadian French adaptation of the HINT has been developed to assess the effects of any type of hearing impairment on speech perception in noise.8 The sentence lists are used to determine a reception threshold for sentences in quiet and in a background of spectrally matched speech noise. The HINT is being employed in some audiology clinics and has been utilized in several studies with Canadian French populations.11-13 However, the HINT is not used by the majority of the audiologists. As context greatly contributes to the intelligibility of this type of stimuli when presented in noise, it is believed that performances measured with sentences do not allow the evaluation of the basic auditory function.14 Also, the required cognitive functions necessary to repeat sentences in noise may be more complex than for simple words. These complex cognitive processes may differentially affect older listeners compared to younger listeners.15 Even if word in noise tests have shown to be sensitive to the different recognition abilities of listeners with normal hearing and listeners with hearing loss,16,17 this type of test stimuli has been criticized for lacking the natural dynamics of real speech.18 Word recognition remains the most popular stimulus type being used by audiologists to assess speech perception in noise abilities,14 but there are actually no available recorded tests for speakers of Canadian French.

The Test de Mots dans le Bruit (TMB)19 is a recent attempt to ameliorate this situation. The test allows the evaluation of monosyllabic word recognition abilities when presented along with a multitalker speech babble. The TMB includes four lists of 35 words presented to each ear with a signal-to-noise ratio (SNR) of +5 dB HL. The listener is asked to repeat each word after its presentation. Normative data are presently being developed with children from six to 12 years of age, as well as with adults 18 to 45 years old, living in the Acadian French region of Moncton (New Brunswick, Canada).

Previous studies examining performance on auditory tasks showed differences between populations speaking the same language but with different cultural linguistic particularities.20-22 For example, Dawes and Bishop23 and Marriage et al.21 have examined the performance of United Kingdom children on the SCAN-C tests,24 and showed that they performed significantly worse than the United States norms where the test was developed. The lower scores of the United Kingdom children were attributed to misinterpreting the United States’ accent in which the test was recorded.

Important cultural linguistic variations have been documented across the Canadian francophone communities,25 but to the authors’ knowledge, no research has examined the effects of these dialect variations on the performance on auditory tasks. The goal of this study is to evaluate the effect of dialectal variations among Canadian French listeners on the TMB. The performances measured with listeners from Ottawa (Ontario), Montréal (Québec) and Moncton (New Brunswick) will be compared. Knowledge of the effect of regional linguistic variations on the TMB performance will help refine interpretation of test results in audiology clinics, as well as to guide the development of the normative data for the TMB.
METHODS

Participants

Fifty adult Canadian French speakers were recruited for this project and divided into three groups: Moncton group included 24 participants (mean age: 33 years) living in the Moncton area (New Brunswick), the Ottawa group was composed of 19 participants (mean age: 23 years) living in Ottawa (Ontario) and the Montreal group included eight participants (mean age: 27 years) living in the Montreal region (Quebec). Participants in the Moncton and Montreal groups were drawn from the staff’s families and friends, and participants included in the Ottawa group were mainly university students. Canadian French was the first language of all the participants, as well as their language of education.

Once the consent form was signed, each participant completed a questionnaire to rule out any exclusion criteria such as history of otological problems, language delay, attention disorders or general learning delay. If none of the exclusion criteria were identified, participants were asked to undergo a bilateral hearing evaluation, including air conduction threshold for pure tones from 0.25 to 8 kHz, in an audiometric test suite, as well as tympanometry and otoacoustic emissions. If no sign of hearing loss was identified, the individual was invited to participate in the experiment.

Experimental Protocol

Each participant was tested individually in an audiometric test suite. The lists of monosyllabic words and the babble noise of the TMB were transmitted via a compact disk player (Moncton and Ottawa) or computer (Montreal) connected to the audiometer.

The four lists of 35 monosyllabic words were presented at a SNR of +5 dB HL (the words at 60 dB HL and the speech babble at 55 dB HL) with monaural presentation. The selection of the SNR was based on pilot data to prevent floor and ceiling effects. Two lists were presented in the right ear, and the two others in the left ear. The order of presentation of the four lists was counterbalanced across the participants to prevent the learning effects on the results. Participants were instructed to repeat the word they heard after each presentation, and to guess if necessary.

The speech babble of European French talkers (4 females and 4 males) by Perrin and Grimault was used. Among the available pre-recorded babble, this was the most representative of the babble conditions of the target population (i.e. speakers of Canadian French). The speech babble was recorded in a continuous loop on a separate channel of the compact disk or audio file.

RESULTS

The mean percent correct word recognition scores and standard deviations are detailed on Table 1 for each participant group in each list of the TMB. Across the four lists of monosyllabic words, the average recognition score ranged from 76.2% to 82.6% (range of 6.4%) for the Moncton group, from 68.4% to 72.3% (range of 3.9%) for the Ottawa group, and from 77.5% to 81.8% (range of 4.3%) for the Montreal group of participants.

<table>
<thead>
<tr>
<th>Group</th>
<th>List 1</th>
<th>List 2</th>
<th>List 3</th>
<th>List 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moncton</td>
<td>82.6%</td>
<td>79.3%</td>
<td>79.4%</td>
<td>76.2%</td>
</tr>
<tr>
<td></td>
<td>(6.1)</td>
<td>(6.5)</td>
<td>(7.3)</td>
<td>(6.6)</td>
</tr>
<tr>
<td>Ottawa</td>
<td>71.0%</td>
<td>72.3%</td>
<td>68.4%</td>
<td>71.9%</td>
</tr>
<tr>
<td></td>
<td>(7.7)</td>
<td>(10.0)</td>
<td>(7.7)</td>
<td>(7.8)</td>
</tr>
<tr>
<td>Montreal</td>
<td>77.9%</td>
<td>81.8%</td>
<td>80.7%</td>
<td>77.5%</td>
</tr>
<tr>
<td></td>
<td>(8.7)</td>
<td>(4.3)</td>
<td>(5.7)</td>
<td>(10.9)</td>
</tr>
</tbody>
</table>

A mixed between-within subject’s analysis of variance was conducted to explore the impact of regional linguistic characteristics on the average correct word recognition on each lists of the TMB. The analysis included the within-subjects factor of LISTS (four lists) and the between-subjects factor of GROUP (three groups). This analysis
indicated a significant main effect of GROUP \( [F(2, 48) = 15.20, p = .000, \eta^2 = .39] \). The main effect of LISTS was not significant \( [F(3, 144) = 1.45, p = .231, \eta^2 = .03] \), which indicates that the degree of difficulty was equivalent across the lists. The two-way interaction LISTS X GROUP was statistically significant \( [F(6, 144) = 2.34, p = .035, \eta^2 = .09] \).

To investigate the group effect, a t-test comparing each group average correct scores over the four lists was conducted, using the Bonferroni corrected alpha, i.e., \( \alpha = 0.017 \). Scores were significantly different between the Moncton group and the Ottawa group by 8.5\% \( (t_{41}) = 5.02, p = .000 \), as well as between the Montreal group and the Ottawa group and by 8.6\% \( (t_{25}) = 3.29, p = .003 \). The scores were not significantly different between Moncton group and the Montreal group \( (t_{30}) = 0.05, p = .961 \).

**DISCUSSION**

The present study revealed that normative data obtained with the francophone population of Moncton (New Brunswick) were significantly different from the one collected in Ottawa (Ontario), as well as between the data collected in Montreal (Québec) and Ottawa. The performance Moncton and Montreal participants were not significantly different. The Ottawa group of participants obtained the lowest average of correct score on the TMB. Their performance cannot be attributed to their general abilities, as the sample was mainly composed of university students. University students are commonly considered to be individuals with high average general ability and are, most of the time, highly practiced test-takers, compared to the general population. The equipment used to measure the participants’ performance was different at each of the three locations. This may explain some of the variance, but a calibration tone was used to adjust the babble noise and the speech signal to reduce this possible equipment effect.

The TMB is intended to measure the ability to recognize words presented along with speech babble, which is a pre-cognitive and perceptual stage of auditory processing. No understanding at a cognitive level of phonetic differences between speech sounds is required. As such, the effect of dialectal variations should be minimal. As with other studies exploring the effect of dialectal variations on the performance measured with auditory tasks, the results of the present study is not in agreement with this hypothesis. According to Dawes, abilities measured with any speech-based test not only depend on the auditory skills of the listener, but also on its phonological processing competency. Mappings of inputs to phonological representations of sounds depend on the listeners’ linguistic experience. As such, there is always a risk that the performances measured with speech-based tests are influenced by the accent in the stimuli recording. On the other hand, if one were to re-record stimuli with the same accent as the population the test will be used with, a potential bias still exist against those who speak French as a second language, and those with weak phonological or linguistic ability. Some have suggested the use of non-speech tests in order to avoid confound with phonological or linguistic impairment, but speech-based tests are necessary to allow the evaluation of speech perception ability in noise in order to provide proper intervention.

**Limitations of the Study**

Specific data on the language spoken at home since birth, as well as at school and at work were not collected. It has been documented that the use of French at home and at work is variable across speakers of Canadian French in New Brunswick, as well as those living in Ontario. Recent findings about the effect of linguistic experience on the perception sounds suggest these factors should be taken into account in future studies. Participants were all considered to be speakers of the regional dialect by the examiner, but the number of years that participants lived in the region where the measures were conducted, was not documented. This may also have added to the variance.

It is possible that differences in sample size resulted in minor variation between groups. The size of the samples was also small, especially for the Montreal group (n=8).

**CONCLUSIONS**

Because of the small sample size, the present study can be considered a preliminary one. Despite limitations, it stresses the need for caution when using norms derived from populations that do not share the same cultural linguistic characteristics when interpreting the results obtained with the TMB. Future studies using a larger population size and a wider population source with a more even gender distribution are clearly warranted. Knowledge of the effect of regional linguistic variations on the TMB performance will help refine interpretation of test results in audiology clinics.
ACKNOWLEDGMENTS

The authors wish to thank the audiologists who contributed to the data collection at the Centre hospitalier universitaire Dr. Georges-L.-Dumont (Moncton, New Brunswick) and the Polyclinique de l’Oreille (Montréal, Québec), as well as Véronique Boisvert, masters student, who was responsible of the data collection conducted in Ottawa (Ontario). Special thanks are also addressed to the participants.

REFERENCES

http://www.thebsa.org.uk/apd/Home.htm#working%20def;2005. (Last viewed December 20th 2012)
