Omission Rates of Young and Elderly Listeners in Word Recognition Testing

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Abstract

Elderly listeners, as a group, do not perform as well as younger listeners on tests of word recognition, particularly in the presence of competing noise. It has been suggested that elderly listeners may be less willing to guess at items when they are unsure of the correct response, and as a result omit more responses. Omitting responses on word recognition tests may deflate word recognition scores. To test whether elderly listeners actually do omit more responses on word recognition tests, a group of elderly normal-hearing adults was compared to a group of young normal-hearing adults. To promote guessing, ipsilateral multitalker babble was presented at individually determined levels that approximated 50 percent performance. The subjects responded to two lists of NU6 words, and numbers of omissions were recorded. The elderly group did not omit significantly more responses to word recognition test items than the younger group. Variability was high within both groups.

Key Words: Elderly, omission error, word recognition

When an individual fails to respond to an item on a test or other behavioral task, he or she has committed an omission error. The omission error results if the individual is unwilling to guess at an answer when the correct response is not clear. The elderly are more likely than their younger counterparts to commit omission errors on a variety of perceptual and cognitive tasks, including intelligence tests (Birkhill and Schaie, 1975) and visual-perceptual word recognition tasks (Silverman, 1963).

The omission error has been hypothesized as a possible contributor to the reduced word recognition scores observed among elderly listeners (Working Group on Speech Understanding and Aging, 1988). Most of the discrepancies between the scores of young and elderly listeners on tests of word recognition have been accounted for by loss of hearing sensitivity (Kasden, 1970; Humes and Roberts, 1990). However, when hearing levels have been taken into consideration, differences between older and younger listeners have still been documented in quiet (Bess and Townsend, 1977) and in noise (Dubno et al, 1984). If the elderly listener is unwilling to guess at test items and fails to respond when uncertain, the resulting word recognition score may be artificially deflated.

Failure to respond has not been studied directly with elderly listeners on tests of word recognition. However, caution in response behavior of the elderly has been examined by investigating the response criteria employed by older listeners on word recognition tasks. By modifying the tasks utilized in the theory of signal detection (TSD), Yanz (1984) adapted TSD to speech perception testing. This modification employed a two-step procedure. First, the listener was required to respond to the word recognition test items. Then he or she provided a self-rating of confidence in the correctness of the response just made. Based on the individual listener's word recognition ability and ability to judge the correctness of the response, a response criterion was derived. This response criterion reflected the individual's bias toward judging his or her responses as correct or incor-
rect. Response criteria derived in this way by Yanz and Anderson (1984) suggested that the elderly were not more cautious on word recognition tests than their younger counterparts. Using similar procedures, Gordon-Salant (1986) found that older listeners actually applied more liberal response criteria than younger listeners. In other words, she found that older listeners reported more confidence that they had responded correctly in instances when they had responded incorrectly.

Recognizing that the elderly population was heterogeneous across many dimensions, Jerger, Johnson, and Jerger (1988) divided an elderly sample into three criterial groups based upon the response criterion each subject employed on a sentence identification task. They found that criterial group membership was related to the degree of high frequency hearing loss. Greater hearing loss was associated with the use of a more conservative response criterion on word recognition tests. Differences found between criterial groups on speech recognition scores were accounted for primarily on the basis of hearing loss.

The present study was undertaken for at least three reasons. First, none of the studies that have derived response criteria for elderly listeners have examined directly the behavior that is ultimately in question, namely whether elderly listeners actually omit more responses than younger listeners on word recognition tests when task difficulty is held constant. Second, cautious behavior and the likelihood of the omission error are highly task-dependent. Small changes in task structure can affect the cautiousness elderly individuals employ when responding. The modifications to the signal detection tasks used in previous studies have removed the tasks from their common clinical presentation. Consequently, generalization of the findings from these studies to clinical practice is difficult. Furthermore, Gordon-Salant (1986) required written responses rather than the more common verbal response, further distancing the experimental procedure from its clinical practice counterpart. Finally, the derivation of response criteria on word recognition tasks has required the use of a self-assessment of confidence in a response that has already been made. Botwinick (1984) has suggested that older individuals may feel more confident in a response after it has been made than they felt while responding. As a result, he suggests that self-ratings of confidence may not accurately reflect the actual degree of caution with which the response was made.

The present study was designed to compare directly the number of response omissions of young and older listeners using word recognition tests to determine whether elderly listeners actually omit more responses than their younger counterparts. To separate the effects of aging from the effects of hearing loss, only normal hearing listeners served as subjects in either group.

**METHOD**

Two groups of 12 subjects each (Table 1) were compared in this study: an older group, with an average age of 68.8 years and a range of ages of 67 to 73 years; and a younger group, with an average age of 22.1 years and a range of ages of 19 to 26 years. Both groups were composed of individuals with hearing thresholds ≤ 25 dB HL from 250 through 4000 Hz. Normal tympanograms were obtained on all subjects in both groups. The mean three-frequency pure tone average (500, 1000, and 2000 Hz) for the elderly group was 10.33 dB HL. For the younger group, the mean pure tone average was 3.89 dB HL.

The stimuli consisted of Auditec of St. Louis recordings of the Northwestern University Auditory Test #6 lists (Form A) played back on a Sony TC 765 tape recorder through a GSI 16 clinical audiometer, and presented to the right ear at 80 dB SPL via a TDH 50P earphone. To provide a sufficiently difficult listening environment that promoted guessing, an ipsilateral competing noise was presented. The noise consisted of the 12-talker babble from the Speech Perception in Noise (SPIN) test played back on a Sanyo RD S29 stereo cassette deck through the same audiometer and earphone.

A preliminary phase was undertaken to ensure and equalize task difficulty across subjects. Using the adaptive procedure described by Dirks et al (1982), babble level was adjusted in 2-dB increments while NU6 lists 1A and 2A were presented. A 50 percent response criterion level was based on the final four of eight excursions.

**Table 1 Subject Group Composition**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Age</th>
<th>Age Range</th>
<th>Mean PTA (dB HL)</th>
<th>PTA Range (dB HL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elderly</td>
<td>68.8</td>
<td>67 to 73</td>
<td>10.33</td>
<td>3.3 to 18.3</td>
</tr>
<tr>
<td>Young</td>
<td>22.2</td>
<td>19 to 26</td>
<td>3.89</td>
<td>-5.0 to 11.7</td>
</tr>
</tbody>
</table>
The 50 percent criterion babble levels obtained in the preliminary phase of this study were held constant during the test phase. Standard instructions were provided to all subjects (Appendix). No feedback or encouragement to guess was provided. Subjects responded verbally to both NU6 Lists 3A and 4A. The verbal response mode was selected because of its common usage in clinical practice. Test scores and numbers of omissions were recorded.

RESULTS

Means, standard deviations, and ranges for omission errors are presented in Table 2. Large variability was evident for both groups, as evidenced by the standard deviations and ranges for the omissions. The elderly group omitted more responses than the younger group, as shown by the difference in means of 15.2 omissions for the older listeners and 11.3 for the younger listeners.

Because of the small sample sizes and the variability observed in the two groups, the data were analyzed by the Mann-Whitney U test. A U-value of 45 was obtained. This was larger than the critical value of 42 ($p < .05$), indicating that the difference between the groups was statistically significant.

DISCUSSION

These results do not support the hypothesis that elderly listeners are significantly less willing as a group to guess at test items on word recognition lists. As such, the failure to respond to test items by elderly subjects cannot be held as the cause of group differences in scores on word recognition tasks between older and younger listeners. According to Botwinick (1984), the occurrence of the omission error on behavioral and perceptual tasks is minimized by clear instructions and task structure. Clear instructions and a highly structured task result in fewer omissions and consequently smaller differences between younger and older subjects. The task of repeating stimulus words is unambiguous even when the listening situation is difficult, as in the case of competing babble. Therefore, the straightforward nature of the speech recognition test may have contributed to the negative findings of this study.

The second issue of interest is the wide variability on this task for both groups of listeners. Typically variability is wide for older groups on most dimensions. Changes in function with increasing age affect different individuals at different rates and to different extents, so a wide range of omission rates for older listeners is not surprising. The range of omissions for younger listeners on the word recognition task in this study, however, was as wide as for their older counterparts. For some individuals in each group, omissions were high. For these individuals, omission rates could affect overall scores regardless of the age of the listener. The clinician must be aware that both older and younger clients may omit enough responses to affect word recognition scores. This highlights the need to maximize the client’s likelihood of guessing.

In summary, the results of this study did not provide evidence of group differences on omission rates between younger and elderly normal hearing subjects on a word recognition task presented in noise. Future research should focus on whether these findings regarding omission rates extend to hearing-impaired elderly listeners. Furthermore, research efforts should examine which strategies will best minimize omission rates on word recognition tests and whether these strategies are equally effective for younger and older listeners. Finally, the question of whether the consequent reduction in omission errors actually would affect overall word recognition scores should be addressed.

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REFERENCES


<table>
<thead>
<tr>
<th>Table 2 Omission Errors</th>
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<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td>Elderly</td>
</tr>
<tr>
<td>Young</td>
</tr>
</tbody>
</table>


**APPENDIX**

You will hear some background noise composed of several people talking. Please try to ignore that. Concentrate on the voice which will ask you to repeat words. Repeat the word at the end of each sentence. For example, if he says “Say the word fish,” you say, “fish.” Do you understand?