Correlational Study on Listening Comprehension
And Auditory Short-Term Memory

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1. Introduction

The English education circle in Japan is expecting a great leap forward, especially in the teaching of oral skills. For one thing, the newly revised Course of Study acknowledged listening and speaking as two independent language skills. Furthermore, Oral Communication will be introduced in upper secondary schools in the near future.

As a result, researchers and language teachers are beginning to pay more attention to listening comprehension. As is often pointed out, however, there has been little direct research on second language listening comprehension either in terms of quantity and quality (Richards 1983, Long 1989). In particular, its cognitive process still remains obscure.

The present study is one attempt to shed some light on the listening comprehension process by investigating the relationship between overall listening proficiency and one mechanical aspect of listening comprehension process, that is, auditory short-term memory. The pedagogical implication of this study is that better understanding of the nature of listening comprehension process would encourage the development of teaching materials and methodologies for listening instruction.

2. Previous Studies

(1) For comprehension to take place, language input, whether written or spoken, must be temporarily stored in short-term memory long enough for the listener to syntactically organize the segmental language components and extract the meaning they convey. Once the information is extracted, the previous language input is purged from short-term memory to make room for the new input. (Kintsch 1970, Caplan 1972, Cook 1977, Kintsch and van Dijk 1978, Chang 1980)

(2) There is a strong correlation between listening comprehension and short-term memory span, and thus a deficiency in or overload of short-term memory results in poor comprehension (Cook 1975, 1977, Baddeley and Wilson...

(3) Hulme, Maughan and Brown (1991) demonstrated that memory span for foreign language input is shorter than that for native language input. One possible interpretation of this is that language learners, even if they can recognize each word of an utterance, may not be able to retain input in short-term memory long enough for syntactic and semantic processing.

(4) Call (1985) showed statistically that auditory short-term memory explains a large proportion of what is involved in listening comprehension, and that short-term memory for syntactically arranged words, namely, sentences is a better predictor of listening proficiency than that for randomly ordered words or digits. She suggests that learners would benefit from a formal teaching of syntactic structure, which could help them process input more quickly and efficiently.

3. The Study

3.1. Purpose and Hypothesis

Purpose:
To replicate Call's methodology and examine if Japanese learners of English show similar tendencies to those revealed in Call's study.

Working Hypothesis:
The subjects' short-term memory for sentences would contribute to the explanation of their scores on listening comprehension proficiency test more than their memory for random words or digits.

3.2. Methodology

Subjects:
40 college students enrolled in English education programs at Hiroshima University, consisting of 17 sophomores and 23 juniors, 22 of whom were majoring in English.

Listening Comprehension Proficiency:
Measured by a 30-item 2nd-grade STEP's simulation test. The reliability was guaranteed by the t-test between two groups of half the subjects. No significant difference was found on the scores between the two randomly assigned groups (t=.55959).
Short-Term Memory:
Measured by four subtests developed for the study. All subtests were oral
repetition tasks in which subjects were required to repeat various types of
auditory input exactly as they heard them.

(1) Sequenced-Sentence Test:
Assessed short-term memory for sentences in a context. The subjects
listened to a brief story consisting of ten sentences, and were asked to
repeat the previously heard sentence immediately after each presentation.

(2) Isolated-Sentence Test:
Eliminated the contextual element from the sequenced-sentence test. The
subjects listened to ten isolated sentences, and were asked to repeat them
immediately after each presentation.

(3) Random-Word Test:
Eliminated the syntactic element from the isolated-sentence test. The
subjects listened to ten strings of randomly arranged content words
ranging from four to eight words in length, and were asked to repeat them.

(4) Random-Digit Test:
Eliminated the lexical element from the random-word test. The subjects
listened to ten strings of randomly ordered digits in English ranging from
four to eight digits in length, and were asked to repeat them.

Data Analysis:
The tape-recorded outcome was evaluated by counting the number of words
which were correctly reproduced. Pronunciation and orders of items were
not taken into account, as those were not the focus of this study. To
examine the relationship between listening comprehension proficiency and
auditory short-term memory, simple correlation and multiple regression
analysis were computed on the data.

3.3. Results

(1) The isolated-sentence test demonstrated the highest correlation with
listening comprehension (r=.70). The second highest was the
sequenced-sentence test (r=.66).

(2) The isolated-sentence test and the sequenced-sentence test were highly
interrelated (r=.78), implying that they assessed more or less similar
capacities for processing auditory input.
(3) The random-word test showed a moderately strong correlation with listening comprehension \((r=.47)\), although weaker than the sentence tests.

(4) The random-digit test produced the lowest correlation with listening comprehension \((r=.28)\).

The order of the correlations of each subtest with the listening comprehension test demonstrated in this study corresponds exactly to that demonstrated in Call's study.

### Table 1
Correlation of the Scores on the Subtests and the Listening Comprehension Test

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Seq-Sent</th>
<th>Iso-Sent</th>
<th>Random Word</th>
<th>Random Digit</th>
<th>Listen Compre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seq-Sentence</td>
<td>1.00</td>
<td>0.78</td>
<td>0.43</td>
<td>0.26</td>
<td>0.66</td>
</tr>
<tr>
<td>Iso-Sentence</td>
<td>1.00</td>
<td>1.00</td>
<td>0.43</td>
<td>0.15</td>
<td>0.70</td>
</tr>
<tr>
<td>Random-Word</td>
<td>1.00</td>
<td>1.00</td>
<td>0.48</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Random-Digit</td>
<td></td>
<td></td>
<td>1.00</td>
<td>0.28</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2
Partial Correlation of the Scores of Each Subtest with the Listening Comprehension Scores

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Simple r</th>
<th>(R^2)</th>
<th>Change in (R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iso-Sentence</td>
<td>0.70</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Seq-Sentence</td>
<td>0.66</td>
<td>0.53</td>
<td>0.03</td>
</tr>
<tr>
<td>Random-Word</td>
<td>0.47</td>
<td>0.55</td>
<td>0.02</td>
</tr>
<tr>
<td>Random-Digit</td>
<td>0.28</td>
<td>0.56</td>
<td>0.01</td>
</tr>
</tbody>
</table>

※ The variables were entered in descending order.
Table 3
Partial Correlations of the Scores of Each Subtest with Listening Comprehension Scores

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Simple r</th>
<th>R²</th>
<th>Change in R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random-Digit</td>
<td>0.28</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Random-Word</td>
<td>0.47</td>
<td>0.23</td>
<td>0.19</td>
</tr>
<tr>
<td>Seq-Sentence</td>
<td>0.66</td>
<td>0.49</td>
<td>0.26</td>
</tr>
<tr>
<td>Iso-Sentence</td>
<td>0.70</td>
<td>0.56</td>
<td>0.07</td>
</tr>
</tbody>
</table>

※ The variables were entered in ascending order.

(5) The isolated-sentence alone explains 50% of the variance out of 56% total explained variance. The sequenced-test adds only 3%, bringing to 53%. Similarly, the random word and digit test add very little explanation, 2% and 1% respectively.

(6) The random-digit test alone explains a very small portion, only 8%, of the listening comprehension scores, suggesting that symbolic memory span is not an important component of listening comprehension.

Summary:
The working hypothesis seems to be supported. The scores on sentence memory tests explained the listening comprehension scores more than the scores on random word or digit tests. It was also demonstrated that short-term memory is a considerably strong predictor of listening comprehension proficiency, explaining as much as 56% of it.

4. Discussion

On the whole, the results elicited from this study should be interpreted tentatively, because of several methodological problems.

(1) This study had to assume that the subjects' reproduction of auditory input would be a genuine reflection of short-term memory, although it is very difficult to be confirmed. Long-term memory might be involved in the reproduction of sentences.

(2) It might not be appropriate to make a direct comparison between the reproduction of sentences and that of randomly ordered items, considering the role of word order in sentence reproduction.
(3) This study was unable to integrate the concept of "chunks" (information units in memory). As Miller (1956) points out, the capacity of human memory is seven plus or minus two chunks. In language, however, it is difficult to define the size of a chunk. Accordingly, it might not be appropriate to evaluate the sentence reproduction in terms of the number of words reproduced instead of larger linguistic units.

5. Conclusions and Suggestions for Future Research

(1) Auditory short-term memory plays a considerably crucial role in listening comprehension process.

(2) Auditory short-term memory for syntactically arranged words is a better predictor of listening comprehension than that for randomly arranged words or digits.

The first conclusion provides us with an obscure but informative picture of listening comprehension process. The scores on short-term memory tests explained as much as 56% of listening comprehension. One question concerning this is what variables could explain the remaining 44%.

With regard to the second conclusion, it can only be claimed that those who with high listening proficiency scores tended to score highly in sentence reproduction. One possible interpretation of this is that syntactic knowledge might influence their listening comprehension. Call (1985) claims that learners' syntactic knowledge facilitates language processing, thus rendering input comprehensible. The relationship between syntactic knowledge and listening comprehension should be examined in the future research by experiments treating syntactic knowledge as one independent variable.

Questions for Future Research:
(1) Does syntactic knowledge really facilitate listening comprehension process, and how?
(2) If it does, then, is the teaching of syntactic knowledge beneficial to the development of listening proficiency?
(3) If syntactic knowledge should be taught, should it be taught implicitly or explicitly?

«References»


Appendix: Four Subtests

1. Sequenced-Sentence Test
(1) Jack woke up early this morning.
(2) His wife, Betty, was still sleeping comfortably.
(3) He slowly got out of the bed.
(4) Then he walked quietly to the bathroom.
(5) He washed his face and hands.
(6) Then he entered the kitchen to make breakfast.
(7) He cooked bacon and eggs and poured some milk.
(8) Betty woke up to find the breakfast was ready.
(9) She was very happy about his kindness.
(10) They had breakfast together in the bedroom.

2. Isolated-Sentence Test
(1) She was waiting for her friend.
(2) He played soccer after school yesterday.
(3) Mary had a pizza for lunch.
(4) They danced at a disco all night long.
(5) Eric tried to write a short letter in French.
(6) I was surprised to hear she got married.
(7) She had to take a taxi to get home.
(8) He bought a diamond ring for his girlfriend.
(9) I watched a baseball game on TV last night.
(10) She suddenly turned around and smiled at me.

3. Random-Word Test
(1) dance-help-sad-bed
(2) keep-play-cry-ice
(3) bag-hair-rain-art-kiss
(4) rock-camp-ink-time-game
(5) light-see-car-meet-stop-feel
(6) milk-wait-dog-green-talk-ask
(7) park-star-bird-look-call-egg-jump
(8) food-fly-kill-quiz-air-night-use
(9) girl-name-wind-desk-now-pig-earth-hope
(10) top-room-end-lake-watch-face-make-trip

4. Random-Digit Test
(1) 9-3-8-6
(2) 9-1-5-8
(3) 5-1-8-6-2
(4) 7-5-2-1-9
(5) 6-1-4-3-9-8
(6) 6-1-2-7-8-4
(7) 9-6-2-5-8-7-3
(8) 2-6-9-5-8-3-4
(9) 4-8-5-6-2-1-9-3
(10) 7-8-5-2-1-3-9-4