The effect of suppressing subvocal speech on text processing during auditory and visual presentation

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A text was presented auditorily or visually with or without suppression of subvocal speech to 48 6th graders. Subjects in the suppressed condition were masticating chewing-gum during presentation of the text so that subvocalization would be suppressed. Subjects in the normal condition were free from suppression. After the text, 20 test items were presented audiovisually and subjects answered them in writing. There was no modality difference in the normal condition, while auditory superiority was observed in the suppressed condition as for the test performance. This interaction is due to the effect of suppressing subvocal speech on visual performance. From this result it became clear that only the text processing in the visual condition depends on subvocal speech. And it lends support to the explanation of the modality effect on text processing in terms of the visual disadvantage of translation.

Key words: subvocal speech, suppression of subvocalization, the modality effect, translation, text processing.

In the previous research (Sannomiya, 1984), the relation between presentation modality and comprehension ability of subjects in text processing was examined. As a result, the modality effect was found for the poor comprehenders (3rd graders of a primary school) but not for the good comprehenders (6th graders of a primary school). That is, test performance after presentation of the text indicated auditory superiority over visual presentation in the case of the poor comprehenders.

This interaction of modality by comprehension ability is compatible with the finding of modality by text difficulty (Sannomiya, 1982a, 1982b). In the previous experiment, the given text was a difficult one for the poor comprehenders, and was an easy one for the good comprehenders. As for the modality by difficulty interaction including the interaction of modality by comprehension ability, a consistent explanation has been hypothesized: Visually presented texts undergo the translation into an acoustic form. Therefore the text processing in the visual condition tends to be insufficient because of the additional process of translation when the given text is difficult for the subject and needs much time for processing.

The translation in the visual condition is considered to take the form of subvocalization, because overt vocalization was forbidden in the previous experiment. It seems, therefore, that for the good comprehenders subvocal speech functioned well in the visual condition so that the text processing in that condition could be as good as in the auditory condition. On the other hand, for the poor comprehenders, the subvocal speech would not function sufficiently. We can confirm this assumption by suppressing the subvocal speech of good comprehenders (6th graders) for whom there will be no modality difference. If the subvocalization during visual presentation effectively
facilitates text processing and make visual performance level as high as auditory one, the suppression of subvocalization will deteriorate visual performance and will make modality difference. The present study attempts to examine this prediction.

Method

Subjects

Forty-eight 6th graders of a Japanese primary school served as subjects. All of them were able to understand the instructions of the present experiment and were able to follow them. Those who did not follow the instructions were excluded from the group of the subjects. The subjects were allotted to four conditions at random with the ratio between males and females being made equal in all conditions.

Design

A 2 × 2 factorial design with 12 subjects per cell was used. The two between-subjects factors were presentation modality (auditory and visual) and suppression (normal and suppressed).

Material

A part of an article by Loftus and Palmer (1974) was translated into Japanese, and then modified and edited for children by the author. A preliminary experiment ascertained that all expressions in the revised text were understandable for 6th graders. The material used here was the same as the former one (Sannomiya, 1984), and it dealt with the memory for a car accident.

Procedure

Subjects were instructed to try to comprehend and remember the text without overt vocalization, and were informed of a test about the text. The subjects in the suppressed condition were delivered chewing gum and were told to chew it during presentation of the text. After the explanation, the auditory group listened to the text recorded by the tape-recorder with a female voice. At the time of recording, care was taken to read the text monotonously without strong intonations and pauses which could serve as remembering cues. The visual group read the text projected on the white screen by the overhead projector sentence by sentence. The presentation rate was 5.3 kana letters/s for both modalities. After presentation of the text, test items were presented on the screen and were read by the experimenter. The number of test items was 20. Ten of them were to examine the memory for single items in the text (Single Test). The rest of them were to examine the integration of items in the text (Integrated Test). Each test item was the same as that used in Sannomiya (1984). Table 1 shows the examples of test items and correct answers. Subjects were asked to write down their answers on an answering sheet. Each test item was presented till all subjects finished their answers.

Results

As Single Test requires one-word or one-phrase answers, there is little possibility of rewording. As opposed to it, Integration Test draws variously expressed
Suppression of subvocal speech

Table 2
Mean test score

<table>
<thead>
<tr>
<th>Suppression</th>
<th>Test type</th>
<th>Presentation modality</th>
<th>Auditory</th>
<th>Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Integrated</td>
<td>M</td>
<td>16.58</td>
<td>17.25</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>SD</td>
<td>2.60</td>
<td>2.17</td>
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<tr>
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<td>M</td>
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<td>9.08</td>
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<td></td>
<td></td>
<td>SD</td>
<td>3.29</td>
<td>3.64</td>
</tr>
<tr>
<td>Suppressed</td>
<td>Integrated</td>
<td>M</td>
<td>17.83</td>
<td>13.38</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>SD</td>
<td>2.54</td>
<td>4.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>13.75</td>
<td>4.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD</td>
<td>3.06</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Note: Maximum score = 20.

Therefore an answer was considered as correct if the gist was contained. For instance, as for the question in Table 1 ("What kinds of things are remembered for a complex event?"), the following answer was also permitted: 1) The things which we ourselves saw. 2) The thing which we heard from someone. Full marks were 2 points for each test item and 1 point was scored if the answer was partially correct. Table 2 shows the mean test score. Since none of the interactions involving test type were significant, the two test types were combined for further analysis. A 2×2 (modality × suppression) analysis of variance yielded significant main effect of modality (F(1,48)=18.71, p<.01) and interaction (F(1,48)=11.70, p<.01). As results of subtests, the performance of the normal condition was significantly better than that of the suppressed condition for visual presentation (t(11)=2.92, p<.05), but not for auditory presentation (t(11)=1.83). And auditory superiority over visual presentation was significant in the suppressed condition (t(11)=5.06, p<.01) but not in the normal condition (t(11)=.70).

Discussion

There was no modality effect in the normal condition, which replicated the previous result about good comprehenders (Sannomiya, 1984). As opposed to it, the effect was observed in the suppressed condition. This interaction is due to the effect of subvocalization suppression on visual performance. From these results, it became clear that only the text processing in the visual condition depends on subvocal speech. That is, in the visual condition, the translation of visual input into an acoustic form takes an important role on text processing. On the contrary, the auditory condition does not seem to depend on the translation, from the absence of suppression effect. The present result on the interaction between modality and subvocalization suppression supports the explanation of the modality effect on text processing in terms of visual disadvantage of translation.

There are some findings that subvocalization suppression disturbs reading texts (e.g. Levy, 1977; Slowiaczek & Clifton, 1980). In these studies, subjects were requested to repeat counting from one to ten or to pronounce irrelevant sounds continuously during visual presentation. Subvocalization was suppressed by those tasks, and subjects' comprehension level lowered in the suppressed condition.

Considering the above findings and the series of experimental results of the modality effect on text processing, it seems that subvocal speech is not fully available when a text is presented "relatively" too fast, even without the suppression tasks. And whether the presentation is too fast or slow enough is supposed to depend on the difficulty of the given text for
References


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