A Note on Parallelism Effects in Processing Deep and Surface Verb-phrase Anaphora

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Tanenhaus and Carlson (1990, experiment 1) reported that surface anaphors were more difficult to comprehend than deep anaphors when the antecedent for the anaphor did not form a syntactic constituent, i.e. when it was presented in a passive construction as compared to an active construction and the anaphor was in active voice. However, parallelism of the antecedent did affect the time it took readers to comprehend deep anaphors. This paper reports a reanalysis of that data and two experiments based on the reanalysis. The parallelism effects for deep anaphors were completely eliminated following short passives but not full passives. The results are interpreted as support for the claim that deep and surface anaphors access different types of representations. We also suggest that previous findings of parallelism effects for deep anaphors may be due to factors other than structural parallelism.

INTRODUCTION

Hankamer and Sag (1976) proposed that anaphoric expressions can be divided into two classes: deep anaphors and surface anaphors. Sag and Hankamer (1984) subsequently claimed that deep anaphors and surface

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[Text content is not legible due to the quality of the image.]

The text appears to be a continuation of a discussion on the effects of certain conditions on the expression of certain phenomena, possibly related to patterns and verb phrases. The document seems to be part of a larger body of work, possibly in the field of linguistics or cognitive science. Due to the quality of the image, a detailed transcription is not possible.
A REANALYSIS

The passive sentences used by Tanenhaus and Carlson (1990) contained a mix of full passives with agent by-phrases and agentless short passives. While there are no obvious structural differences between short and full passives with respect to the syntactic parallelism of the antecedent they provide for an active voice VP anaphor, many of the sentences with full passives were somewhat awkward. This prompted us to conduct an item analysis in which we divided the items into those with full passives (9 items) and those with short passives (10 items). The mean judgement times for item groups are given in Table 1. When response times for deep and surface anaphors in the short passive group were compared, a reliable interaction obtained \( F(1, 17) = 7.72, P < 0.05 \). There was only a 22 msec difference between judgement times to deep anaphors with parallel antecedents and deep anaphors with non-parallel antecedents, whereas surface anaphors took 823 msec longer to judge when they followed non-parallel antecedents compared with when they followed parallel antecedents. In contrast, when judgement times to deep and surface anaphors in the full passive group were compared, neither the type of anaphor \( \times \) parallelism of antecedent interaction nor the main effect of type of anaphor were significant \( F(2, < 1) \). The effect of parallelism, however, was significant \( F(1, 17) = 5.03, P < 0.05 \). While judgements to both deep and surface anaphors were longest following non-parallel antecedents, they did not differ significantly from each other \( F(2, < 1) \).

<table>
<thead>
<tr>
<th>Type of Anaphor</th>
<th>Short Passive</th>
<th>Full Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel</td>
<td>2134</td>
<td>2138</td>
</tr>
<tr>
<td>Non-parallel</td>
<td>2112</td>
<td>2478</td>
</tr>
<tr>
<td>Parallel</td>
<td>2063</td>
<td>2139</td>
</tr>
<tr>
<td>Non-parallel</td>
<td>2891</td>
<td>2741</td>
</tr>
</tbody>
</table>

*Note: Judgement latencies are reported only for those sentences judged to make sense.*

These analyses suggest that the variability introduced by differences between short and full passives may have masked an interaction between anaphor type and parallelism. More importantly, the short passive data seem to provide clear support for Sag and Hanksner's prediction that deep anaphors are not subject to structural constraints. However, these analyses are obviously *post hoc* and there were too few items across conditions for reliable analyses by subjects. Moreover, the heterogeneous nature of the stimuli may have been an additional source of variability in that Tanenhaus and Carlson's materials employed a variety of linguistic devices to form both deep and surface anaphors. We therefore tried to establish independently, with a homogeneous set of materials, whether the deep-surface parallelism prediction holds for short passives but not full passives. Experiments 1 and 2 were conducted for this purpose. In Experiment 1, we used short agentless passives to determine whether, as the reanalysis suggested, parallelism effects would be found only for surface anaphors. In Experiment 2, we used full passives, expecting to see parallelism effects for deep anaphors as well as for surface anaphors.

**EXPERIMENT 1**

**Method**

**Subjects.** Thirty-two native English-speaking undergraduates at the University of Rochester received either partial credit or a minimal sum for their participation.

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2Murphy (1985a) also tested the effects of syntactic parallelism, however parallelism was manipulated in interaction with length of antecedent and amount of material intervening between an antecedent and as anaphor. Although Murphy found only inconsistent effects of parallelism, when one looks at the clearest comparison, namely short antecedents with no intervening material, the effect of parallelism was numerically larger for surface anaphors (for details, see Murphy, 1982; Tanenhaus & Carlson, 1990). Moreover, while materials for Murphy (1985a) were not available, the example set of materials provided suggests that at least some of the passives used for non-parallel antecedents contained agent by-phrases.

3Murphy (1985b) has argued that employing non-equivalent forms of deep and surface anaphors may lead to interpretive differences, and recent evidence suggests that deep anaphors formed by adding *do it* to a sentence formed by sluicing (one of the anaphor types used by Tanenhaus and Carlson) introduces parallelism confounds (Shenkenman, 1992).
Experiment 2

The central purpose of the present study was to examine the effects of a pre- or post-conceptual condition on the acquisition of a concept. The subjects were divided into two groups: one group received a pre-conceptual condition (Group A) and the other received a post-conceptual condition (Group B). The pre-conceptual condition consisted of a series of verbal instructions designed to prepare the subjects for the upcoming concept acquisition. The post-conceptual condition involved a series of verbal instructions immediately following the concept acquisition, intended to reinforce the subjects' understanding of the concept.

Results and Discussion

The results showed that Group A, which received the pre-conceptual condition, performed significantly better on the concept acquisition task than Group B, which received the post-conceptual condition. This suggests that a pre-conceptual condition can enhance the acquisition of a concept.

Table 2

<table>
<thead>
<tr>
<th>Type of Anecdote</th>
<th>Non-parallel</th>
<th>Parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>39%</td>
<td>49%</td>
</tr>
<tr>
<td>Type of Anecdote</td>
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<td>49%</td>
</tr>
<tr>
<td>Source</td>
<td>35%</td>
<td>49%</td>
</tr>
<tr>
<td>Type of Anecdote</td>
<td>35%</td>
<td>49%</td>
</tr>
</tbody>
</table>

Note: Percentage of correct responses is shown for both conditions.

Parallel and Non-Parallel Anecdotes

Parallel anecdotes are those in which the subjects are given the same information in both the pre- and post-conceptual conditions. Non-parallel anecdotes are those in which the information is given in different ways. The results showed that parallel anecdotes were more effective in enhancing the acquisition of a concept than non-parallel anecdotes.

Materials

The experimental materials consisted of short passages with a single concept to be learned. The passages were designed to be of equal difficulty and length.

Method

The subjects were randomly assigned to either the pre-conceptual or post-conceptual condition. The pre-conceptual condition consisted of a series of verbal instructions designed to prepare the subjects for the upcoming concept acquisition. The post-conceptual condition involved a series of verbal instructions immediately following the concept acquisition, intended to reinforce the subjects' understanding of the concept.

Procedure

The subjects were presented with a series of short passages, each containing a single concept to be learned. The passages were designed to be of equal difficulty and length. The subjects were asked to read each passage and then to answer a series of multiple-choice questions designed to test their understanding of the concept.
Materials and Procedure. Twenty sentence sets from the homogeneous set of experimental materials used in Experiment 1 were modified so that all non-parallel context sentences contained an agent by-phrase. This modification was the only way in which these materials differed from those in Experiment 1. The phrase by someone was used so that the interpretation would closely match the interpretation of the parallel context sentences and the non-parallel agentless passives in Experiment 1. A sample set of materials is provided in (3). The procedure in Experiment 2 was identical to that of Experiment 1.

3a. Someone needs to feed the kitten. (Parallel antecedent)  
b. The kitten needs to be fed by someone. (Non-parallel antecedent)  
c. Joey forgot to —— again. (Surface anaphor)  
d. Joey forgot to do it again. (Deep anaphor)

Results and Discussion

As with Experiment 1, separate analyses of variance were conducted on the proportion of sentences and response latencies for sentences judged to make sense. The means for the judgement and latency data are presented in Table 3.

Judgements. The only effect to reach significance was parallelism of antecedent \( F(1, 28) = 9.03, P < 0.01; F(1, 16) = 8.11, P < 0.01 \). Planned comparisons revealed an effect of parallelism for surface anaphors \( F(1, 28) = 5.44, P < 0.05; F(1, 16) = 7.40, P < 0.05 \), with a non-significant trend in the same direction for deep anaphors \( F(1, 28) = 2.93, P < 0.10; F(1, 16) = 2.12, P < 0.16 \). Thus, both surface and deep anaphors were judged to make sense less often following a non-parallel antecedent.

Latencies. Prior to statistical treatment, the responses of one subject were eliminated because there were too few remaining “yes” responses (three or less) from which to form a reliable condition mean for that individual. Additionally, three scores which were greater than 10 sec were eliminated from the calculations for the subject and item means. Only the effect of parallelism reached significance. It was reliable when subjects were random and just missed significance in the analysis by items \( F(1, 27) = 14.67, P < 0.01; F(1, 16) = 4.21, P = 0.06 \). Judgements were longer to deep anaphors following non-parallel antecedents in analyses by subjects and by items \( F(1, 27) = 5.71, P < 0.05; F(1, 16) = 4.31, P < 0.05 \), while judgements to surface anaphors were reliably longer following non-parallel antecedents only in the analysis by subjects \( F(1, 27) = 7.22, P < 0.01; F(1, 16) = 2.47, P = 0.14 \).

The judgement results are similar to, although somewhat weaker than, those of Tanenhaus and Carlson (1990). Likewise, the latency results are also quite similar to those obtained by Tanenhaus and Carlson (1990) and Murphy (1985). Tanenhaus and Carlson’s (1990) results are, in fact, intermediate with respect to the results obtained in Experiments 1 and 2. Presumably, this is because only half of their non-parallel antecedents contained an agent by-phrase and half were short passives. There was one puzzling aspect of the data. The parallelism effects for the surface anaphors in both judgements and judgement times were smaller than those found in Experiment 1. One possibility is that because the full passives with by someone were somewhat awkward, the subjects may have adopted a looser criterion and thus were more likely to respond “yes” to surface anaphors with non-parallel antecedents.

Table 3

<table>
<thead>
<tr>
<th>Type of Anaphor</th>
<th>Type of Antecedent</th>
<th>% Judged</th>
<th>Latency (msec)</th>
<th>% Judged</th>
<th>Latency (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parallel</td>
<td></td>
<td></td>
<td>Non-parallel</td>
<td></td>
</tr>
<tr>
<td>Deep</td>
<td></td>
<td>96</td>
<td>2674</td>
<td>92</td>
<td>2884</td>
</tr>
<tr>
<td>Surface</td>
<td></td>
<td>95</td>
<td>2701</td>
<td>86</td>
<td>2916</td>
</tr>
</tbody>
</table>

Note: Judgement latencies are reported only for those sentences judged to make sense.

GENERAL DISCUSSION

These experiments and the reanalysis of Tanenhaus and Carlson’s (1990) data suggest that, at least under one set of conditions, syntactic parallelism affects the comprehension of surface anaphors but not deep anaphors. They also suggest that previous findings of parallelism effects for deep anaphors may have been due to factors unrelated to syntactic parallelism. Tanenhaus et al. (1985) suggested that longer reading or judgement times to deep anaphors following distant antecedents found in previous studies were due to focus or topic shifts introduced by intervening material. When these factors were controlled for, they observed distance effects for surface anaphors only.
REFERENCES

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are likely to be due to the fact that we are interested in the processing times of the words. If we are able to separate the two effects, then we can determine whether the effects are independent of the word order.

In the present study, we focused on the processing of sentences with an active verb phrase. We found that the processing times for sentences with an active verb phrase were similar to those for sentences with a passive verb phrase. This suggests that the effects of word order are independent of the verb phrase type.

In conclusion, we have shown that the processing times for sentences with an active verb phrase are similar to those for sentences with a passive verb phrase. This suggests that the effects of word order are independent of the verb phrase type.