

Strategies for Understanding Information Organization in Discourse

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Abstract

The strategies of native and nonnative English speakers reading informational, texts were examined. The texts differed in the degree to which information was explicitly signalled by rhetorical devices such as *first*, *second*, and *third*. Students read a series of passages presented on a microcomputer, one sentence at a time. From traces of students' progress through the text, including time and the sequence in which sentences were read, we categorized each passage in terms of three Global Strategy types and ten local, backtracking strategies. All individuals but one used multiple global and local strategies across the 8 passages they read. Although the signalling affected memory for the signalled information, strategies were not systematically related to this variable. Rather, when both native English and nonnative English speakers were trying to understand these texts, they appeared to use a series of decision rules that encompass local and global, structural and semantic aspects of text. Suggestions are made regarding the nature of these decision rules and their implications for understanding text processing in complex content domains.

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Strategies for Understanding Information Organization in Discourse

The focus of my talk today is the reading strategies people use for understanding the organization of information in text. We know that texts differ in the degree to which their organization is made obvious to the reader. These differences influence how people read and later remember the presented information (e.g., Britton, Glynn, Meyer & Penland, 1982; Lorch & Chen, 1986; Lorch & Lorch, 1986; Mayer, Dyck, & Cook, 1984; Meyer, & Rice, 1981). The organization of a text is often signalled by various rhetorical devices (Meyer, 1975). One of the most important types of rhetorical devices signals the logical connections between pieces of information. Within the general class of logical connectors several different relations are possible. For example, information may be sequentially related, as in a sequence of steps or facts all related to one particular theme or topic. Connectors that signal such relations are next, first, finally, etc.

In acquiring English as a second language (ESL), one skill that students need to acquire is the ability to recognize the value of explicit markers and to use these markers to guide their processing of text. The research I'll talk about today began as an effort to look at the effects of sequential markers on the reading strategies and retention performance of college-level native English speakers and of college students acquiring English as a second language - ESL students. Of particular interest was whether the effects of explicit markers was similar for ESL students and for native, English speakers. Although some investigators have found that reading behavior of ESL students is more reliant on graphic cues in text (as compared to semantic, contextual information) than is that of native English speakers (McLeod & McLaughlin, 1986), other evidence indicates that the comprehension strategies of ESL college students are similar to those of native English speakers (Block, 1986). Our own work

dealing with the question answering strategies of a small number of ESL and monolingual English students indicated that ESL students tended to rely more heavily on the text than did monolingual English students (Goldman & Durán, 1987). However, the verbal protocols that we collected suggested that sequence markers were noticed by both types of students. There are three points I want to make in today's talk:

1. We found the expected effects of the markers on recall and reading time.
2. For the most part, the strategies used by the ESL and by the native English speakers were the same.

3. There was considerable variability within individuals in their reading strategies. This variability suggests that readers use a series of decision rules that encompass local and global structural and semantic aspects of text.

Although it had been my intention to discuss a second study on three other types of connectors, I'll discuss only the sequence marker study today.

For the sequence marker study, we selected relatively short passages (approximately 400 words in length) from a variety of introductory level textbooks in the social and behavioral sciences. We modified the passages to each include four target points. Students were presented with two passages in each of 4 conditions that varied the degree of explicit marking of the points. Each version had a three sentence introduction, a 3 sentence conclusion and 4 points, each elaborated by 2 additional sentences (Table 1). In the "Full" signalling condition (Full), the topic sentence in the passage explicitly provided the number of points to be discussed (shown in Table 1). Then each point was introduced by the appropriate specific numerical marker, e.g., "First", "Second", "Third", "Fourth". Each target point was followed by two sentences that elaborated it. Then the next point was made, e.g., Second..., followed by its two elaborations. In the "Number", the topic sentence explicitly provided the number of points to be discussed. However within the body of the text, the individual points were

not enumerated. The "Vague" condition was identical to "Number" except that a vague quantity term was used instead of the specific number, e.g., several. In the "No" signalling condition, the topic sentence contained no reference to the number of points to be discussed and did not enumerate any of the individual points. For the text in Table 1, the topic sentence read *Plato was concerned with basic issues*.

Students read the texts on a Macintosh computer using a program that presented one sentence at a time. They could go back and forth in the text. Each student read 8 passages and was asked to recall the points from each passage: The topic sentences from the None condition were used to cue recall of the target points, e.g., In the passage about the Ideal State, what were the basic issues that concerned Plato? There were 16 native English speakers and 16 ESL speakers.

With respect to retention, the signalling manipulation had the predicted effect, as the data in the next graph show (Figure 1): For the native English and for the ESL speakers, recall in the full signalling condition was better than in the other three conditions. Similarly, the amount of time spent processing each word reflected the marking manipulation (Figure 2): More time was spent on the passages with the explicit marking. Given that we obtained the predicted effects of marking, we turned to an examination of the reading strategies. Our general expectations were that we ought to find a relationship between what was marked and students' reading time and choice of text segments to reread. These predictions were not really borne out by the data. However, a number of interesting findings did emerge regarding the identification of reading strategies, variability within individuals and between-group comparisons. I'll spend the rest of my time discussing these and the implications of our findings for reading strategy choices.

To examine the specific strategies, we used the traces of the students reading and identified three types of global strategies and a variety of local strategies. The next several overheads show the global strategies. Type 1, shown in Figure 3, is a

straightforward, sequential reading of each sentence in the text from start to finish. Each sentence was read once and when the end of the passage was reached, the subject quit reading and went on to the next passage. In contrast, Types 2 and 3 each involve going back and rereading various sentences in the text. Type 2, shown in Figure 4, involves a straight through read of the passage to the end (as in Type 1), followed by rereading of some or all of the passage. Type 3 (Figure 5) involves backtracking prior to reaching the end of the passage on the first pass through it. Once the end of the passage was reached, the subject might quit or go back and reread additional parts of the passage.

Each of the subject's eight passages were categorized as Type 1, 2, or 3 and proportions for each subject of each strategy type were computed. With respect to the issue of whether different strategies were associated with the different signalling conditions, there was no effect of condition. That is, of the total number of passages that were read with a Type 1 strategy, they were spread evenly across the conditions; similarly for Type 2 and 3. This was true for both ESL and monolingual English readers. The next overhead shows the mean proportion of passages in each strategy type for each language group (Figure 6). Both ESL and Monolingual English students most frequently used Type 3 - backtracking during initial reading of the passage. The ESL students were somewhat more likely to use Type 2; the native English Type 1. However, all but one students used more than one type of approach. We classified each subject in terms of the 8 possible patterns of strategy use combinations (Only Type 1, only Type 2, Types 1 & 2, etc.) and found that the native English speakers and the ESL speakers behaved similarly: about a third of the students used all three strategies. We also determined for each student whether there was a dominant strategy, defined as using the same strategy on at least 5 of the 8 passages. Among the ESL students, 12 of the students had dominant strategies and

67% showed dominance of the Type 3 strategy. For the native English speakers, 9 had a dominant strategy and 55% showed dominance of the Type 3 strategy.

Thus, the global strategy data indicate that all the students varied the way in which they read the texts. But this variation was **not** related to the structural manipulation that we had done: Type 3 strategy was just as likely for Full signalling passages as for No signalling passages. We pursued the reading strategies further to determine what sorts of structural and semantic/conceptual characteristics of the passage **were** guiding the reading behavior.

We identified ten local or backtracking strategies, as shown in Figure 7. These local strategies are ways of describing the reader's movement through the text on a sentence by sentence level and capture patterns of forward and backward movement through the text. The ten represent two dimensions of reading behavior: whether people read or skimmed and how much of the text they covered in the process of backtracking. In this figure, heavier lines indicate reading, lighter lines indicate skimming. Closed circles represent reading a single sentence.

The first four strategies (A, B, C, & D) reflect movement through the text in one direction over a relatively long string of sentences. Strategies A and B involve sequential movement through the passage over at least 15 consecutive sentences; A involves reading those sentences, B skimming. Strategy A implies a general desire to reread most of the text, either from beginning to end or vice versa. Strategy B was typically used to return to the beginning of the passage prior to going through it again from the beginning. Strategies C and D reflect the use of both reading and skimming over segments at least 12 sentences long. In C, readers skim one or more sentences, read a sentence, continue skimming one or more sentences, then read a sentence. In D, readers skim one or more sentences, read several sentences, resume skimming, then read several sentences, etc.

The other six strategies reflect backtracking in which readers reverse the direction of their progress through the text, using a combination of reading and skimming and covering relatively short runs of sequentially ordered sentences (2 to 11). Strategy E we refer to as a local rereading strategy: the reader is reading along but goes back and rereads the prior sentence before continuing to read. Use of E suggests that readers need clarification of a just-prior sentence before going on in the passage. The remaining five strategies did not occur with any great frequency in these data so I won't go into detail describing them. Briefly, they involve backtracking by reading or skimming 2 to 11 sentences prior to resuming the original direction of reading. Each of these strategies seems to reflect the readers desire to go back and clarify material prior to continuing on in the passage. The strategies differ primarily in terms of the portions of the passage that are read as compared to skimmed.

The frequency distributions of the local strategies were similar for the two language groups but varied with the type of global strategy. Figure 8 shows the distribution for Type 2 global strategy passages. The four single direction strategies - A, B, C, & D- accounted for 80% of the local strategies. Thus, backtracking behaviors that occurred after reading the passage through once tended to involve returning to the beginning or near beginning of the passage (data for B) and going through the passage again either by reading each sentence (data for A), or by selecting certain groups of sentences to read (data for D). Thus, even after getting through the passage once, additional inspection of the text did not tend to involve local rereading strategies that interrupted movement in a single direction (none greater than 10%).

In contrast, the local strategies used in reading the Type 3 passages reflect a relatively high incidence of backing-up-to-go-forward, as shown in Figure 9. Separate distributions are shown for strategies occurring prior to reaching the end of the passage the first time and for those occurring in any subsequent re-inspection of the text. The local backtracking strategy - E - accounted for 55% of the backtracking for

these passages for both ESL and Native English speakers. On these passages, students appeared to be trying to resolve comprehension difficulties and resolve coherence relations prior to taking in additional new information from the passage. The strategy A frequency indicates that about 15% of the time the local backtracking occurred either at the beginning (first 4 or 5 sentences) or end of the text (last 4 or 5 sentences) and then students read straight through the remainder of the text. After the first time through the passage, (bottom figure) the distribution of local strategies was quite variable but generally indicated a greater reliance on skimming the text, with selected rereading of sentences and segments of the text (reflected in the greater frequencies of strategies B, D, and J).

From the processing time data we saw that ESL students took longer to read the passages than the native English speakers. However, they were also engaged in active reading behaviors during this time and these behaviors were highly similar to the strategies used by the native English speakers. It seems reasonable to conclude that the longer time per passage was largely due to the ESL students requiring more time than the native English speakers to execute similar processing strategies.

In addition to the global and local strategies, the time graphs were used to examine a second set of questions about the relationship between text characteristics and reading behaviors. In particular we were interested in which sentences caused people to change the direction of their reading. Essentially, direction changes indicate the beginning and end points of backtracking behavior. Direction changes can be examined independently of the local strategies and are informative with regard to how structural and semantic aspects of text govern reading behaviors. Structural aspects of the text are things like beginning, ending, and explicit rhetorical markers, such as our enumeration terms. We were particularly interested in whether explicit enumeration of the target points was an important cue to backtracking. Semantic

aspects refer to various processes that must occur to achieve coherence, e.g., resolution of anaphor, construction of bridging inferences, etc.

The types of sentences that initiated direction changes were again similar for the ESL and Native English speakers but differed across the global strategies. For Type 2 strategies, about 70% of the direction changes were related to a structural characteristic of the text - reaching the end or beginning of the passage (Figure 10). The topic sentence and the target points accounted for less than 20% of the direction changes. In further support of structural importance are the data showing that the tendency for target points to initiate direction changes was strongest if they were explicitly marked (Full condition). This was true for the ESL students but for the native English speakers, the semantic properties of the target points seemed to be sufficient to cue direction changes.

For the Type 3 passages (Figure 11), direction changes that occurred before getting to the end of the passage were governed more by semantic than structural properties: while direction changes were initiated by the target points far more frequently than in Type 2, the semantic properties of the target points seemed to be sufficient to initiate the direction change in both groups of students: about 60% of the target points initiating direction changes were in the unmarked conditions (Number, Vague and None). This trend was true for both the ESL and the native English speakers.

Finally, for the Type 3 passages after reaching the end of the passage the first time, direction changes appeared to be related to more structural properties of the texts: about 50% were initiated by reaching the beginning or end of the passage (Figure 12). The structural cue of marking was important for the native English speakers: explicitly marked target points accounted for 60% of the direction changes cued by the target points. This tendency was not present in the ESL students' data.

Thus, the direction changes were cued by structural and semantic properties of the texts, depending on the particular global strategy that the students were using. We also found that both structural and semantic aspects of the text were related to the sentences that students strategically selected to reread. These data are shown Figure 13 for one of the global strategies. In Type 3, Before about 65% of the strategically read sentences were in the introduction or were target points. Once again, explicit marking of the points was not necessary for them to be singled out for selective rereading. Furthermore, the points elaborating the targets were strategically reread almost as much as the target points: because these elaborations were not structurally marked and are at the lowest level in a content structure, they imply strategic rereading guided by semantic concerns.

These data indicate that both the semantic and structural properties of the text govern the way people read and recall informational texts. We can begin to offer some decision rules that might underlie students use of one or the other of these strategies. Some examples of such decision rules for are the following:

- If a sentence is semantically difficult, reread. May be due to cohesion, vocabulary, syntactic complexity.
- If a sentence is marked structurally for importance, reread (can be marked by rhetorical device or by being at the beginning or the end)
- If a sentence is semantically central, reread - depends on discourse structure
- If a sentence is higher in the content hierarchy assign greater importance.
- If a sentence is elaborated it is higher in the content hierarchy.

The empirical literature on text processing shows that each of these "rules" does indeed affect what and how people understand text. These rules are related to both structural and semantic aspects of text. But in the context of the **whole** task, the set of decision rules operates. The task before us is to understand how the entire set of decision rules operates to produce the observed types of within and between individual differences in reading strategies.

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Table 1. Example Text for Sequence Marker Study

The Ideal State

Plato was concerned with achieving systematic unity of a society. He did not believe that the primary role of the state was to ensure a feeling of well-being in each one of its participants. According to his theory, the state is a permanent organization that, as a whole, has definite needs and a definite inner structure, and goals that are higher than that of making individuals happy. In his reflections on society, Plato was concerned with four basic issues. **First**, he was convinced that increasing individualization threatened the social order. His model of the ideal state provided for numerous measures that would ensure the citizens' conformity, both in their public behavior and in their thoughts and feelings. He provided for supervision and control of all aspects of individual life. **Second**, Plato's conception of the state addressed the problem of the division of labor and specialization. He argued that no human being was self-sufficient and so the coexistence of human beings must be based on mutual exchanges of services. The individual and the state would each attain wholeness and prosper only if labor was divided so that each man did the task for which nature had designed him. **Third**, Plato attached great importance to the optimal size of a city. He thought that the city could be either too small or too large, and he actually fixed the optimum population of the Greek city at 5,040. He strongly believed that excessive territorial expansion and increased population of the state posed a particular threat to its unity. **Fourth**, he attached great significance to the problem of differentiation of wealth within the society. He saw increasing social inequalities as a major source of decomposition of the state because it led to the interests of small groups being put before the interests of the society. He argued for the abolition of private property and the family, regarding both as prime sources of the problem. Plato viewed society as an interdependent system made up of many parts possessing their own interests. He was interested in social facts insofar as they had definite consequences for the integration or disintegration of society. Above all, he was concerned with discovering conditions that were conducive to social integration and equilibrium.

^aThe bold-faced number terms appeared only in the Full signalling condition. In the Number condition, the underlined term (four) was included. In the Vague version, a vague quantifier (e.g., several) replaced the underlined term. In the None condition, the quantifier term was deleted from the topic sentence.

Figure 1.

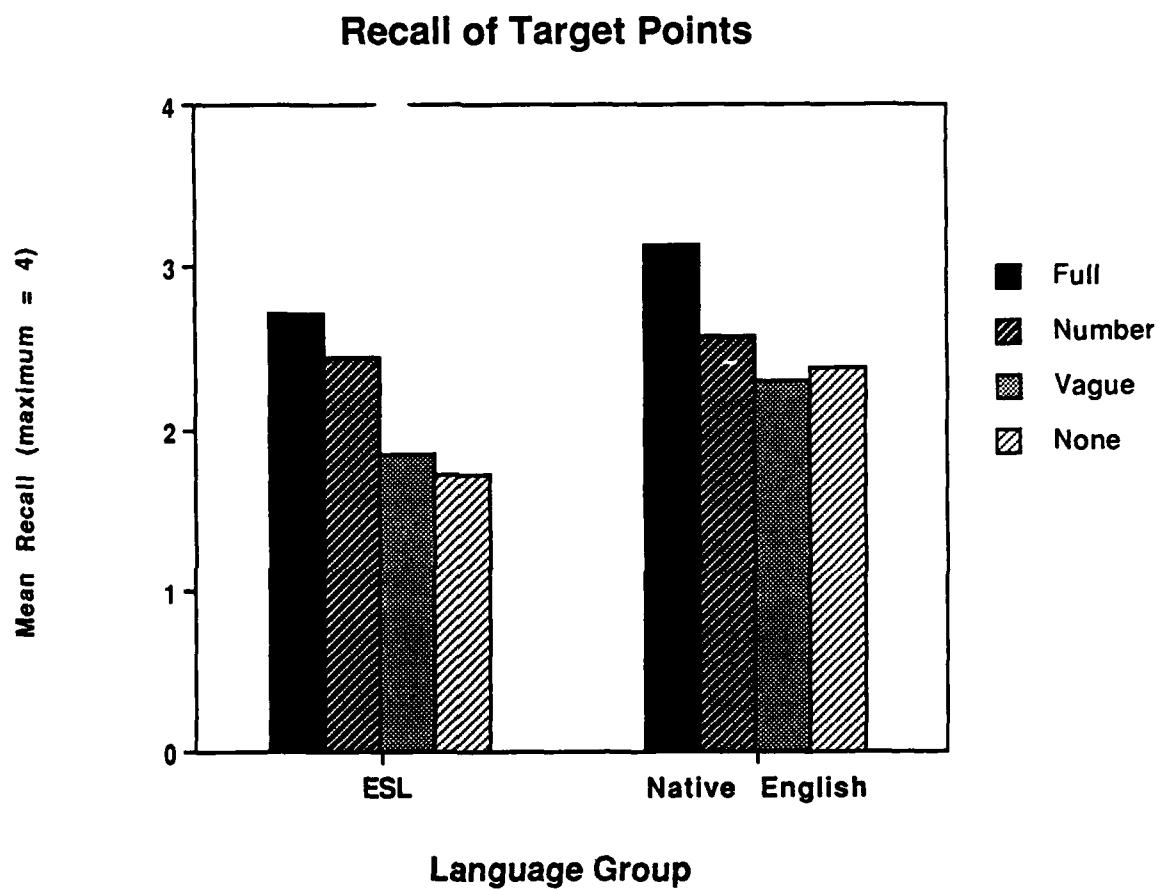


Figure 2.

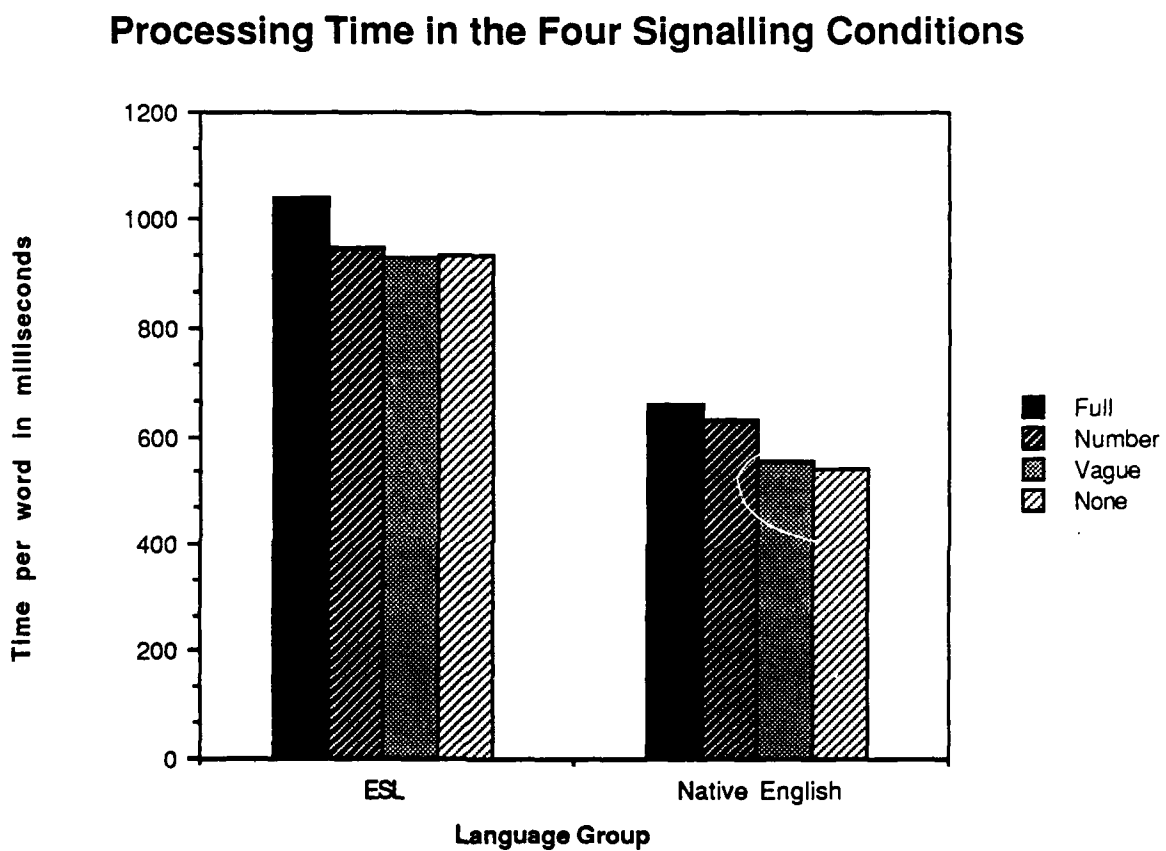


Figure 3. Type 1 Global Strategy

SEG MARKER TIME/READING ORDER

1	I1	8.183
2	I2	5.467
3	I3	7.183
4	TS	5.083
5	P1	5.533
6	P1.1	5.033
7	P1.2	8.450
8	P2	12.517
9	P2.1	4.933
10	P2.2	3.200
11	P3	4.167
12	P3.1	5.083
13	P3.2	5.900
14	P4	12.300
15	P4.1	8.717
16	P4.2	5.467
17	F1	19.533
18	F2	9.717
19	F3	8.400

PASSAGE #13: Pattern Recognition of Speech Signals

Figure 4. Type 2 Global Strategy

1	I1	9.267	4.033	
2	I2	6.783	1.983	
3	I3	6.717	1.817	
4	TS	4.450	2.233	
5	P1	4.767	1.350	
6	P1.1	0.500	1.133	
7	P1.2	7.950	1.333	
8	P2	5.033	3.517	
9	P2.1	4.317	2.767	
10	P2.2	10.617	8.117	
11	P3	4.067	3.333	6.450
12	P3.1	8.600	5.333	
13	P3.2	19.533	1.967	2.100
14	P4	4.783	6.800	5.367
15	P4.1	7.383		13.367
16	P4.2	7.550		8.367
17	F1	7.583		2.817
18	F2	7.750	7.683	4.667
19	F3	5.333		3.300

PASSAGE #8: Location

Figure 5. Type 3 GLocal Strategy

1	I1	17.400	6.467		
2	I2	2.317	7.833		
3	I3		12.817		
4	TS		4.767		
5	P1		9.500	4.867	4.167
6	P1.1		22.600	2.850	2.967
7	P1.2		3.833	1.983	1.200
8	P2			16.367	3.967
9	P2.1			7.883	1.617
10	P2.2			7.250	2.650
11	P3			14.583	2.267
12	P3.1			11.483	0.967
13	P3.2			9.617	1.483
14	P4			7.600	0.883
15	P4.1			4.717	2.050
16	P4.2			5.250	1.167
17	F1			8.733	1.133
18	F2			15.367	2.283
19	F3			20.700	2.533

PASSAGE #16: The Nineteenth Century

Figure 6

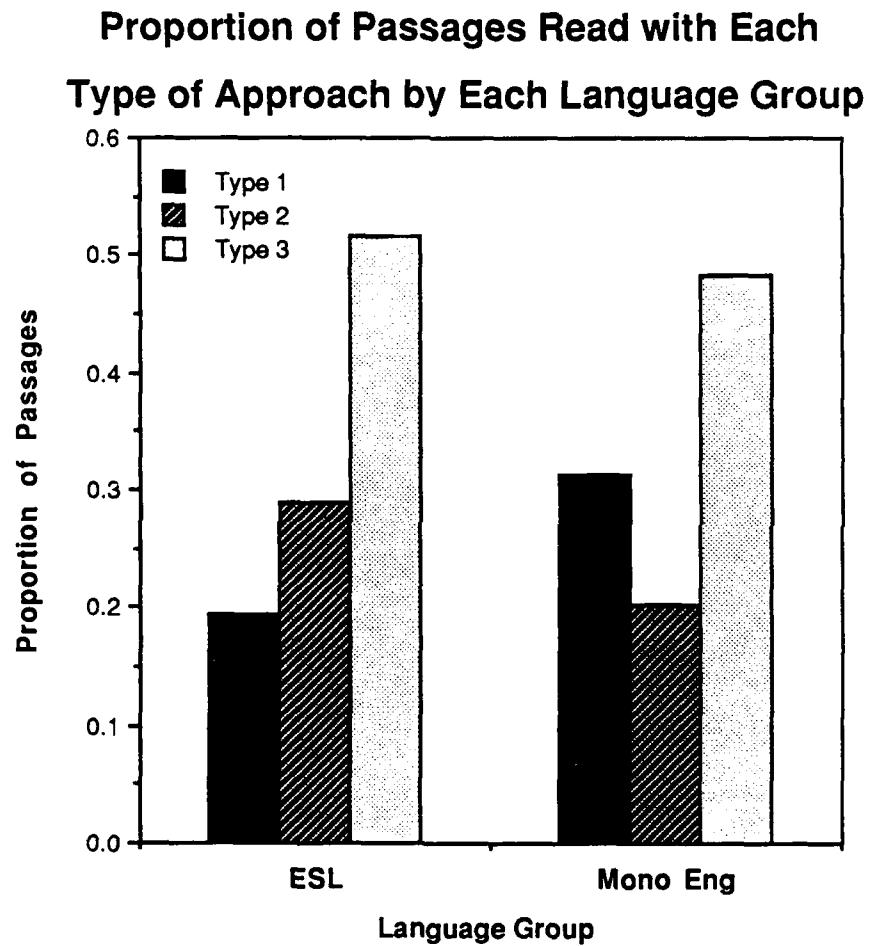


Figure 7. Ten Local Backtracking Strategies

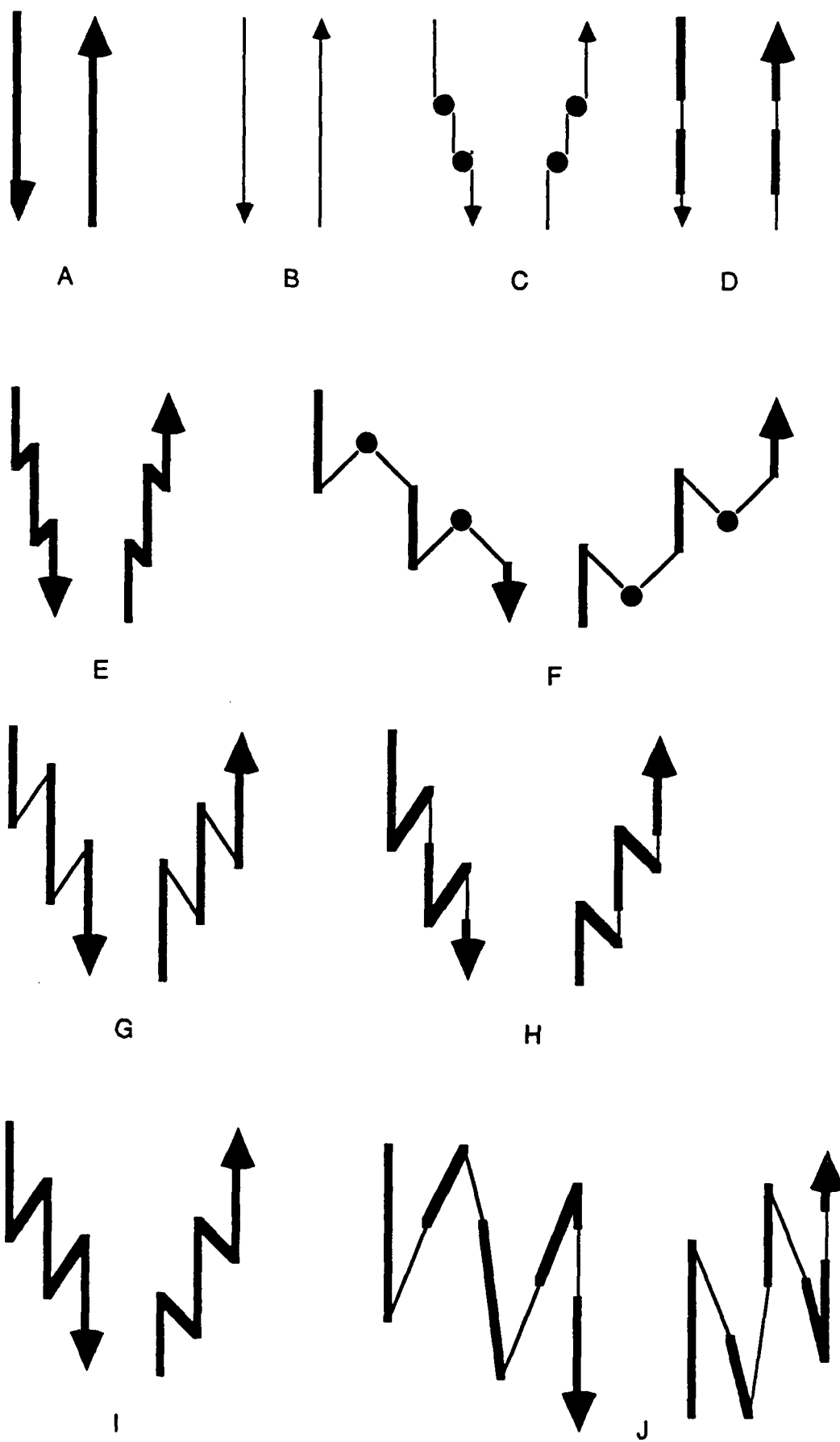
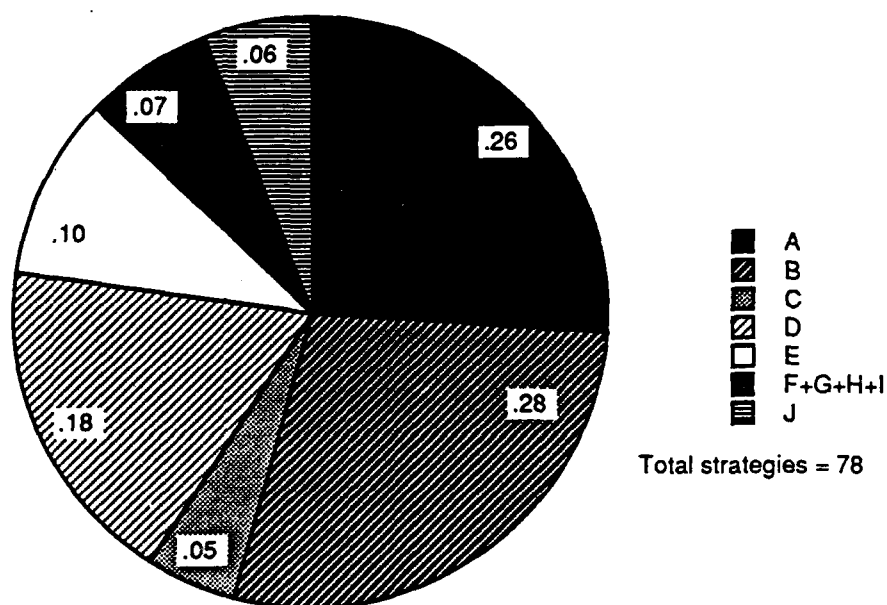


Figure 8. Frequency Distributions of Local Strategies for Type 2 Global Strategy

Local Strategies for Type 2 - ESL



Local Strategies for Type 2 - Native English

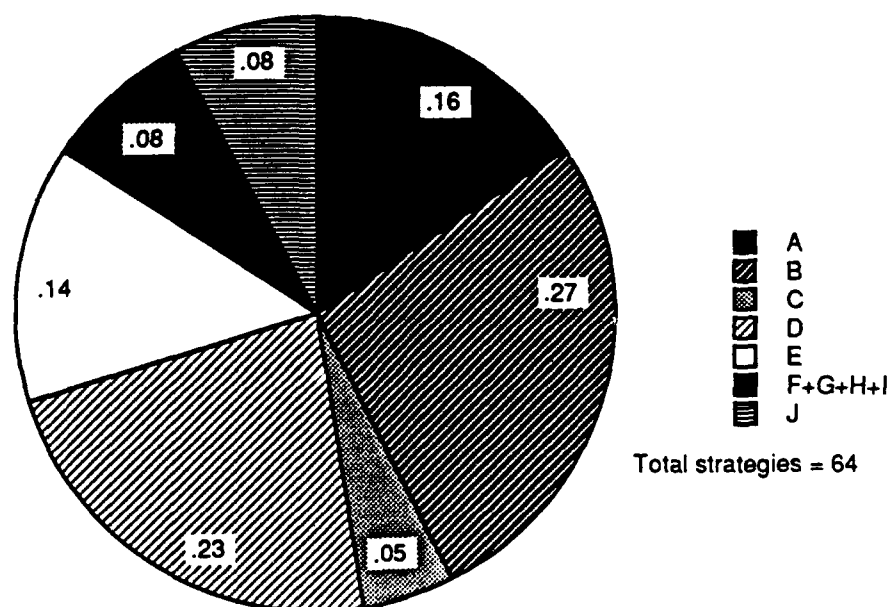
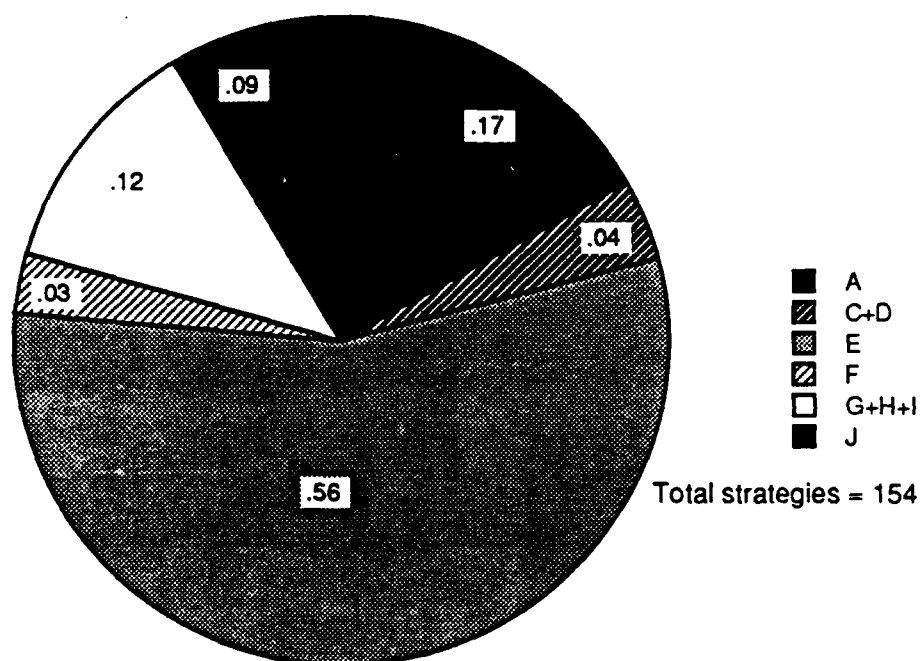


Figure 9. Frequency Distributions of Local Strategies for Type 3 Global Strategy

Local strategies for Type 3 - ESL

Before reaching the end



Local strategies for Type 3 - ESL

After first time through

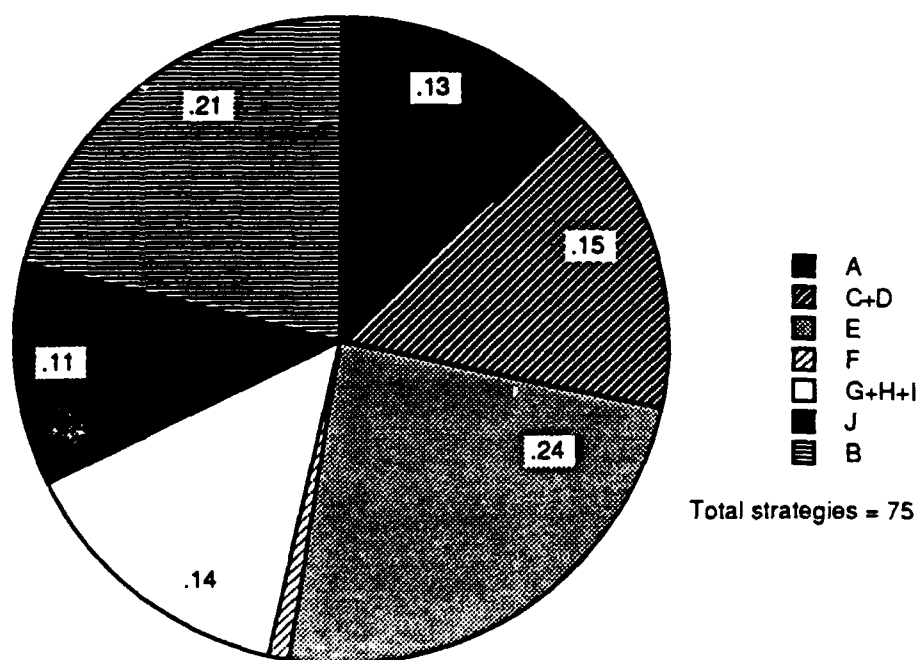
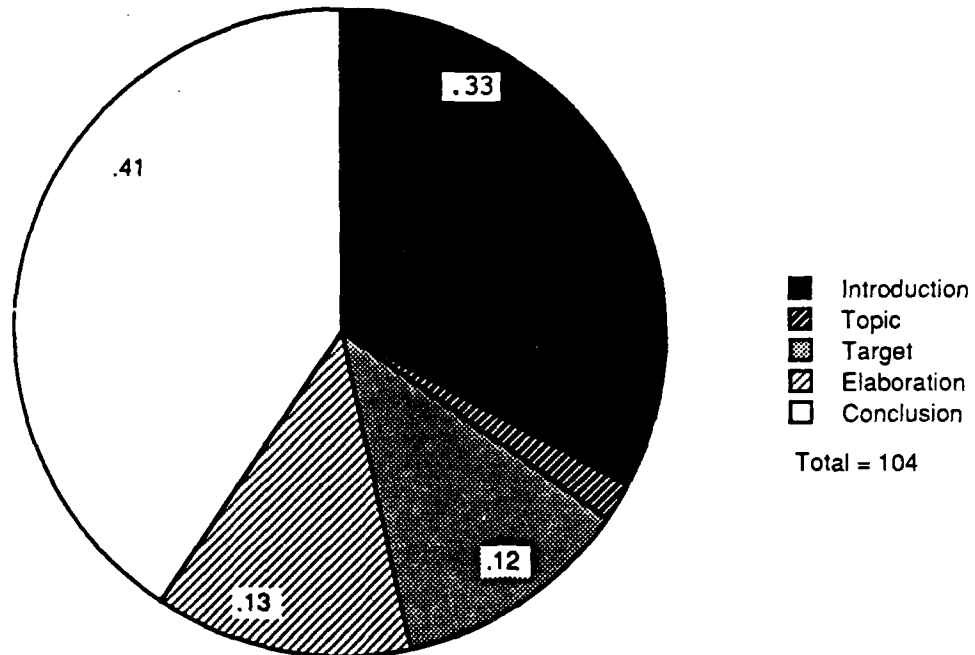


Figure 10. Sentence Types that Initiated Direction Changes for Type 2 Global Strategy

Sentences that initiate direction change

Type 2 - ESL



Sentences that initiate direction change

Type 2 - Native English

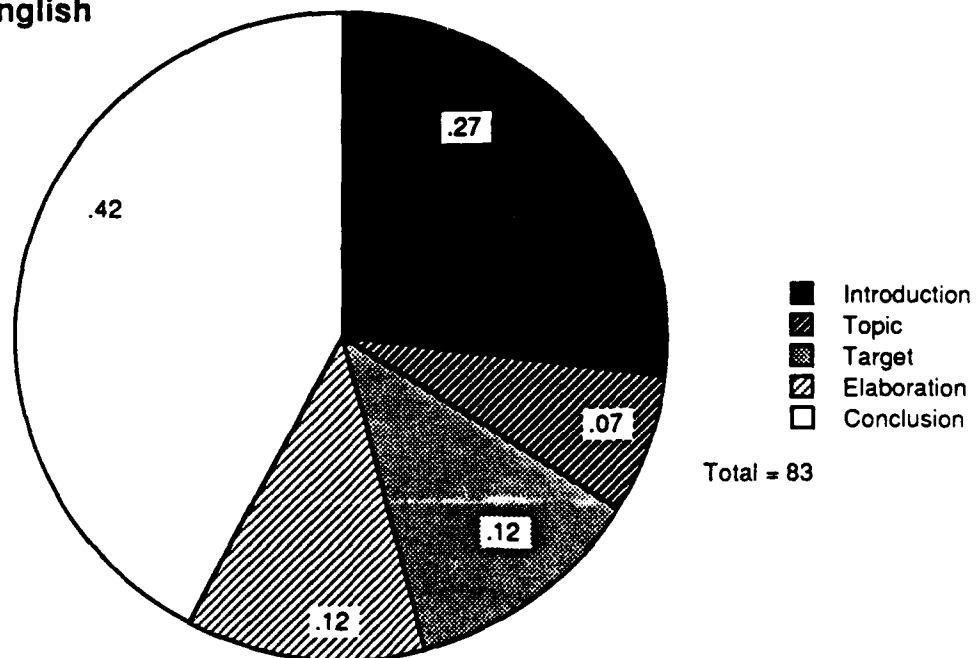
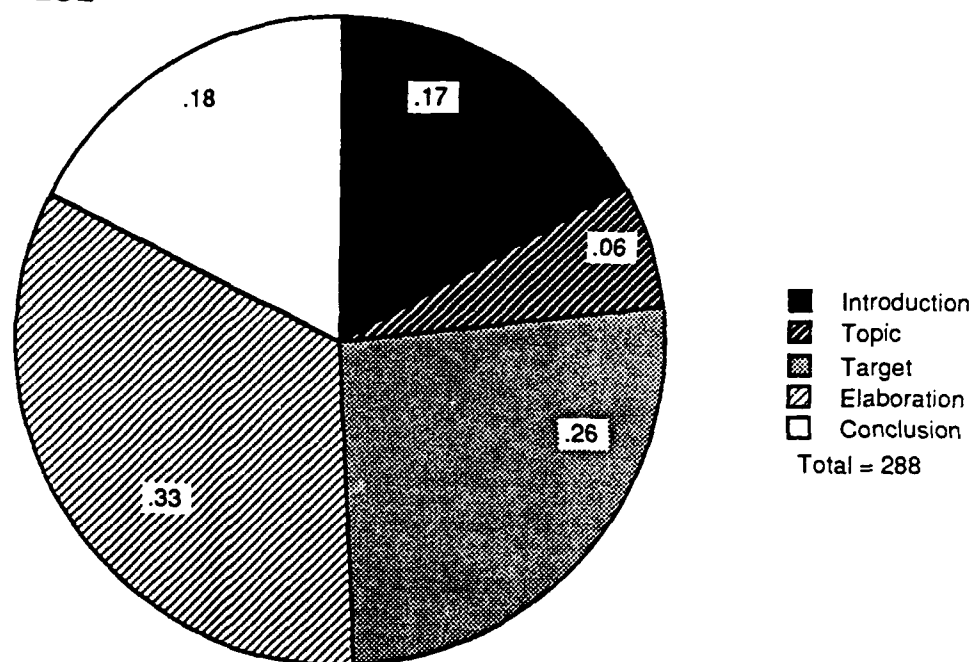


Figure 11. Sentences that Initiated Direction Change Type 3 (Before getting to the end once)

Sentences that initiate direction change

Type 3, Before - ESL



Sentences that initiate direction change
Type 3, Before - Native English

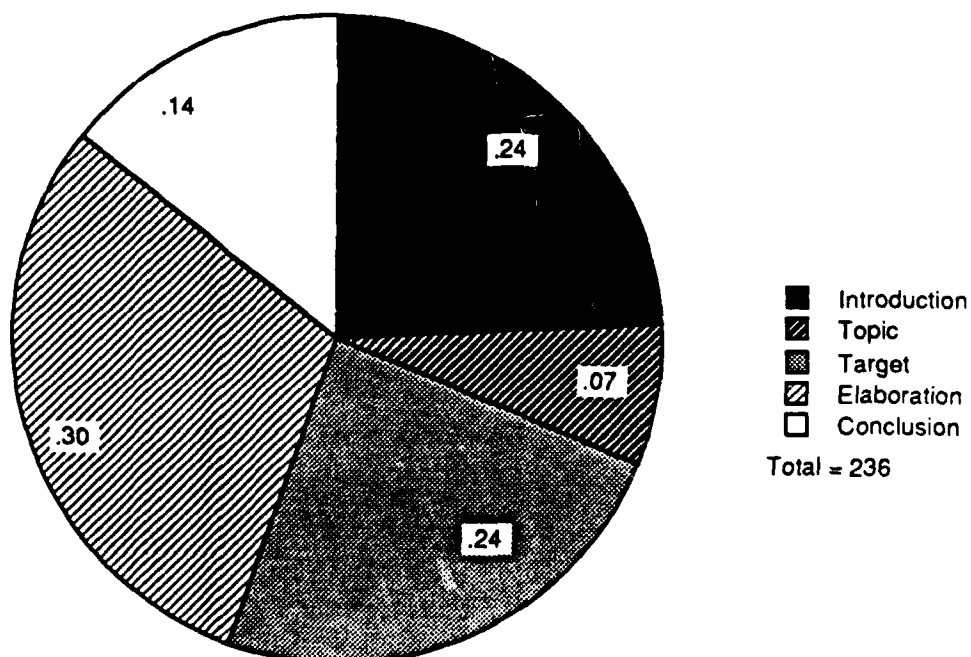
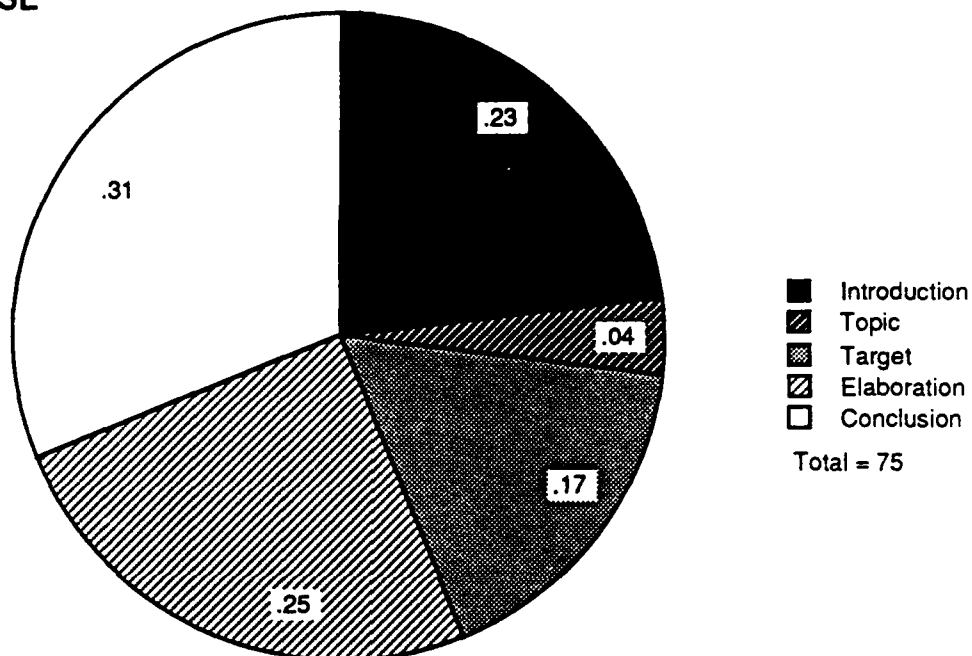


Figure 12. Sentences that Initiated Direction Change Type 3 (After getting to the end once)

Sentence that initiate direction change

Type 3, After - ESL



Sentence that initiate direction change

Type 3, After - Native English

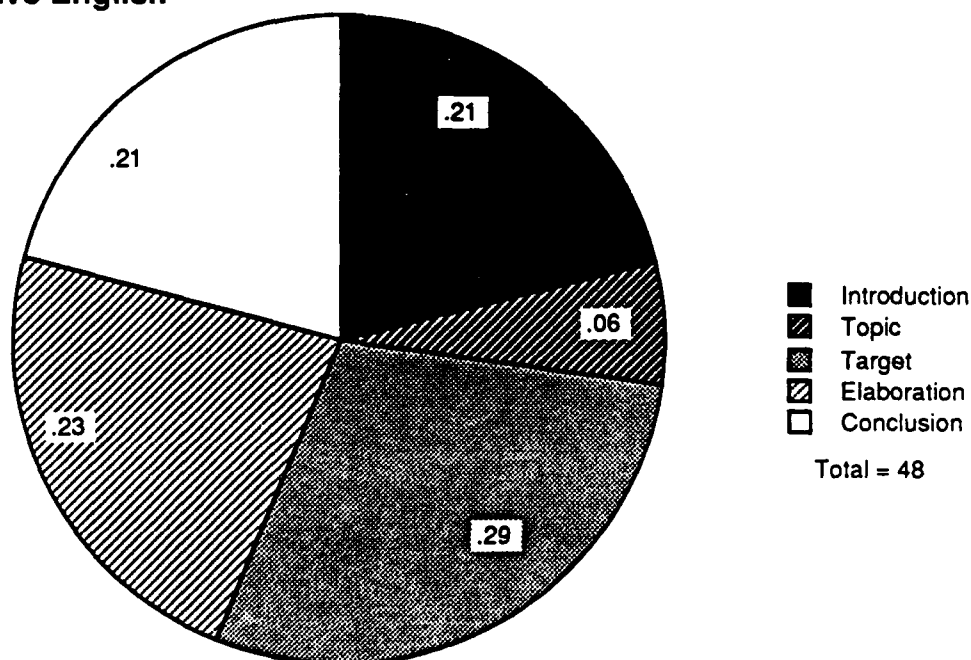
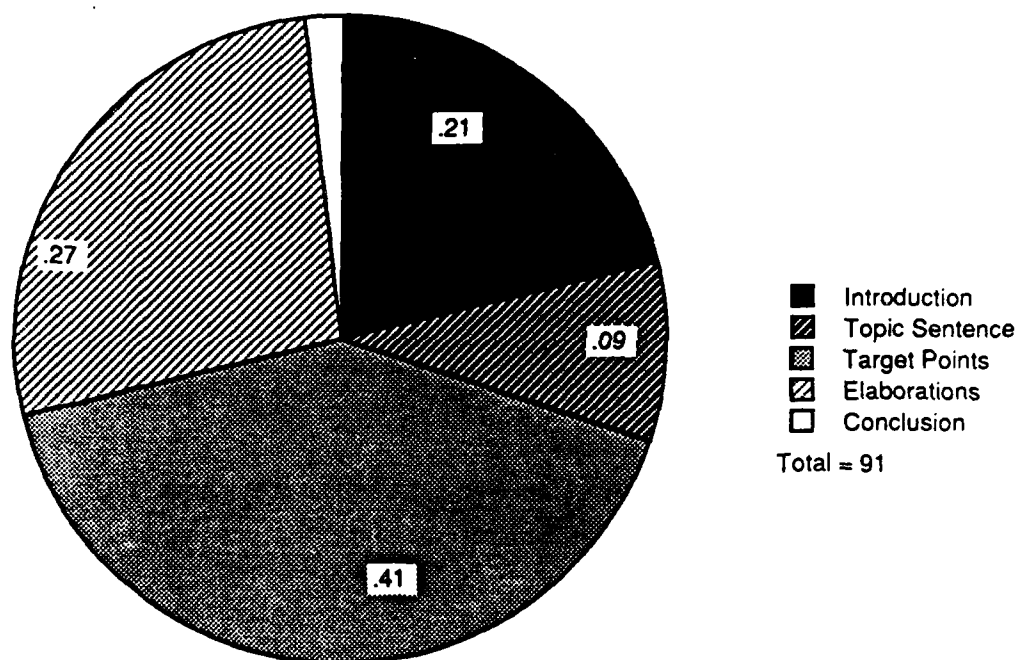
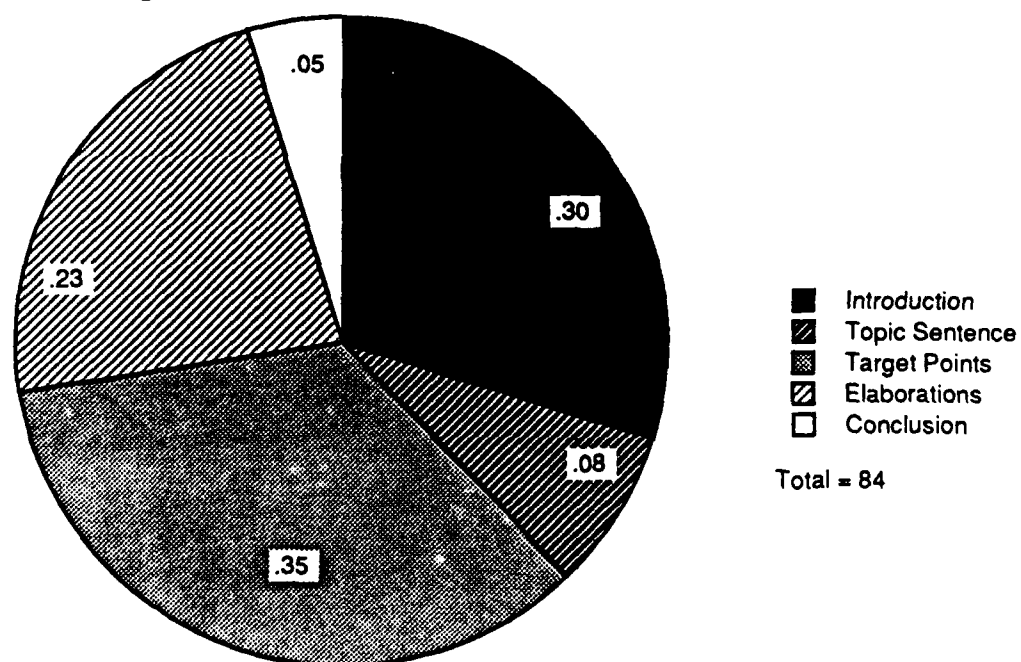


Figure 13. Sentences Strategically Read for Type 3 Global Strategy (Before end)

Sentences read to strategically
Type 3, Before - ESL



Sentences read to strategically
Type 3, Before - Native English



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