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Discourse Organization in the Comprehension of Temporal Order in Narrative Texts¹

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We investigated the role of global discourse organization on the comprehension of temporal order in narrative. We proposed three principles of discourse organization: (a) the immediate integration principle—a new event should be integrated immediately with old information, (b) the consistency principle—a new event should be attached to a consistent locus, and (c) the isomorphism principle—discourse structure should match event structure. Five passages varying in discourse structure were presented auditorily, and the comprehension of the underlying event order was tested. Subjects' comprehension was best in the canonical passage. The backward, flashback, and embedded passages were significantly more difficult than the canonical passages. The flashforward passage was the most difficult. The results were interpreted as showing that the immediate integration principle is a strong component of comprehension of temporal order and that the isomorphism principle contributes to text comprehension, but to a lesser degree.

The purpose of the present experiment is to investigate the role of global discourse organization on the comprehension of temporal order in narrative texts using experimental narratives in which discourse order and event order were not confounded. To study global discourse structure, we believe that it is necessary to make a clear distinction between the events in the underlying event world and the linguistic representation of these events in a narrative text. The organization of the events in the underlying event world will be referred to as the *event structure* (E-1, E-2, E-3, etc.), and the temporal arrangements of these events in the text will be referred to as the *discourse structure* (e-1, e-2, e-3, etc.). For example, given an underlying event sequence such as,

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[E-1] *Sara saw a bear*, [E-2] *Sara walked through the trees*, [E-3] *Sara saw a campfire*, one could organize these events into a text such as, “[e-1] Sara saw a bear. [e-2] After this, she walked through the trees. [e-3] Next she saw a campfire.” Or the same events could be organized into a text such as “[e-3] Sara saw a campfire. [e-2] Right before she saw the campfire, Sara had walked through the trees. [e-1] Immediately before this, she had seen a bear.”

EVENT STRUCTURE VERSUS DISCOURSE STRUCTURE

Scholars in the humanities interested in the structure of text have frequently made a distinction between the structure of events and the structure of narrative. The Russian Formalists (e.g., Tomashevsky, 1925/1965) were very clear on this point; they referred to the underlying events as the *fabula* and the events as ordered in the text as the *syuzhet* (see Erlich, 1980; Lemon & Reis, 1965, for additional details). The distinction has continued to play an important role in the analysis of narrative by Structuralist scholars. Thus, the French Structuralist, Genette (1972/1980) uses the terms *histoire* and *récit*, whereas the American Structuralist, Chatman (1978) uses the term *story* and *discourse*. The scholars in this literary tradition make a number of compelling arguments for this distinction. They have pointed out that: (a) there must be a conceptual distinction between a (real or imagined) event and the linguistic description of the event, (b) the same sets of underlying events have been arranged by different authors into very different narratives, and (c) without this distinction one cannot give an appropriate analysis of common narrative conventions such as “flashbacks” and “flashforwards.”

One recent approach to the study of the global aspects of narratives by psychologists was the attempt to write story grammars for narrative text. Initially, researchers in this area focused their attention on how higher order knowledge concerning the structure of stories facilitates narrative text comprehension and memory. For example, story grammars were proposed as attempts to describe the higher order structure that is used to encode, represent, and retrieve information from narratives. The initial papers in this tradition (Mandler & Johnson, 1977; Rumelhart, 1975; Stein & Glenn, 1979) did not make a consistent distinction between the structure of the underlying events and the structure of the narrative text. However, later papers (e.g., Johnson & Mandler, 1980) have postulated a number of “transformational” rules that embody a distinction somewhat similar to that between event structure and discourse structure.

Researchers in the area of text comprehension (Kieras, 1981; Kintsch & van Dijk, 1978; Kintsch & Vipond, 1979; Miller & Kintsch, 1980) have proposed the most detailed psychological processing models of reading comprehension; however, these models have not always made a clear event/discourse distinction. These researchers argue that the reader constructs a text base by connecting the propositions that share arguments to form a coherence graph. Kintsch and van Dijk (1978) and Kintsch and Vipond (1979) developed a microprocess model which suggests three possible sources of reading difficulty during the process of text-base construction: reinstatement searches, reorganization of coherent graphs, and the occurrence of unconnected graphs. In more recent work, van Dijk and Kintsch (1983) do introduce an event/discourse distinction.

However, it is not clear how well this new position is integrated with the earlier detailed model of text-based microprocesses.

Several other theories of global discourse structure have made a clear distinction between underlying events and the discourse presentation of events. Some of these theories (Brewer & Lichtenstein, 1981, 1982; van Dijk, 1976, 1977) were explicitly influenced by the work on text in humanities (see the first paragraph in this section), whereas for other theories (Johnson-Laird, 1980, 1983) the distinction arose out of an independent analysis of the nature of mental representation. Brewer has argued that the event/discourse distinction should play an important role in understanding how global discourse organization affects text comprehension (Bock & Brewer, 1985; Brewer, 1980; Brewer & Lichtenstein, 1982). Brewer assumes that discourse comprehension should be viewed as a process in which a writer/speaker expresses a mental model of the world in discourse form and then a reader/hearer attempts to extract the mental model from the discourse. Within this framework successful comprehension occurs when the reader constructs a mental model from the text that contains the essential aspects of the writer's original mental model (cf. Johnson-Laird, 1983).

GLOBAL DISCOURSE STRUCTURE

Obviously, the overall process of text comprehension is very complex and includes many levels of analysis. To extract the writer's mental model the reader has to analyze the text at the levels of orthography, word meaning, syntax, propositions, and so forth (Bock & Brewer, 1985; Just & Carpenter, 1977; van Dijk & Kintsch, 1983). However, in this article, we focus on the impact of *global discourse structure* on the comprehension of temporal order in narratives, Brewer (1980) has pointed out that the author of a text has a number of fundamental options in organizing the discourse structure with respect to the underlying event structure. For example, the author can omit information from the discourse structure and thus leave the reader to make bridging inferences to recover the underlying sequence of events. Another important option that is available to authors is the ability to arrange the underlying events in the text in essentially any order that the author wishes. If the reader is to comprehend a narrative text, the reader must be able to derive the underlying event sequence from the given text sequence. It is this process of deriving underlying models from text that is the focus of this study. In particular, we investigated the effects of global discourse organization of narrative texts on comprehension of temporal order.

EXPERIMENTAL STUDIES OF EVENT AND NARRATIVE STRUCTURE

The initial experimental studies on global narrative organization were by Kintsch, Mandel, and Kozminsky (1977), Stein and Nezworski (1978), and Thorndyke (1977). These experiments showed that narrative texts with sentences (or paragraphs) in random order are harder to comprehend or remember than are the original passages. Although these studies demonstrated that there are structures beyond the level of individual

sentences that play a role in text comprehension and memory, these studies were not analytic with respect to what is causing these effects.

The experiments were developed and interpreted without taking into account the distinction between event structure and discourse structure. Simply randomizing the order of sentences or paragraphs in a passage confounds these two aspects of discourse because it produces changes in both the discourse structure and the underlying event structure. Another problem with these studies is that they used narratives that described script- or plan-based events (Lichtenstein & Brewer, 1980; Schank & Abelson, 1977). Some of these underlying event types have much more structure than others, so that the comprehension difficulty in these studies is probably related to the degree of constraint imposed by the different structures. The greater the degree of underlying structure, the easier it should be for the subjects to put the randomized pieces back together. This interpretation is supported by the fact that there were strong effects of passage type (which expressed different types of underlying structure) in both the Thorndyke (1977) and the Kintsch et al. (1977) studies.

The final difficulty with these experiments relates to the issue of discourse cohesion. Natural languages contain a wide variety of linguistic structures which are used to establish coreference across sentence boundaries (Halliday & Hasan, 1976). The procedure of taking the sentences in a linguistically cohesive text and simply changing their order also manipulates this aspect of discourse. For example, in the sample narrative text given earlier in this article the following sequence occurs: “[e-1] Sara saw a bear. [e-2] After this, she walked through the trees.” In this cohesive text the linguistic marker “after this” is used to establish that, at the level of events, [E-2] *Sara walked through the trees* occurred after the event [E-1] *Sara saw a bear*. Clearly, if the sentence, “After this, she walked through the trees,” were moved randomly to some other location in a text, it would lead the reader to establish a wrong coreference or to be unable to identify any coreferent. As a result, the reader would construct a mental model that does not correspond to the event structure intended by the author. Thus, the designs used in these reordering studies also include effects on comprehension due to a disruption of linguistic cohesion as an additional confounding variable.⁴

EXPERIMENTAL STUDIES OF DISCOURSE ORGANIZATION

This review of studies on event and discourse organization shows that in order to understand the impact of discourse organization on text comprehension it is necessary to avoid confounding discourse organization with the other aspects of global text structure. The problem of linguistic cohesion is relatively easy to solve. One can simply make sure that the experimental materials make appropriate use of the linguistic devices that establish coreference. However, separating the influence of event structure from discourse structure is more difficult. One solution to this problem is to use texts that contain purely model-based underlying structures instead of schema-based structures. Brewer (1987) has argued that these two types of global knowledge structures can be

⁴ In fact, Garnham, Oakhill, and Johnson-Laird (1982) have carried out a study explicitly directed at this issue and have shown that establishing referential continuity has a strong independent effect on comprehension of spatial description.

distinguished in terms of when the knowledge structure is constructed: Schemas refer to prestored generic information, whereas models are constructed at the time of input. As an extreme example of the problem with using schema-based structures, imagine an experiment on narrative structure in which the underlying event sequence in the text is a restaurant script (e.g., “Fred gave his order to the waiter. Fred ate his salad.”). Suppose comprehension or memory experiments are carried out using this text and show that the reader knows that the underlying event [E-2] *Fred ate his salad* occurred after [E-1] *Fred gave his order to the waiter*; it is not obvious whether one is actually testing narrative text comprehension, because the order information is also available from generic knowledge about restaurants in long-term memory. However, if a model-based text (e.g., “[e-1] Fred mailed the letter. [e-2] Later, Fred got a haircut”) is used and testing shows that the reader knows that in the underlying event sequence [E-1] *Fred mailed the letter* occurred before [E-2] *Fred got a haircut*, then the information must have been obtained by comprehending the given narrative text because the order information is not available from prestored generic knowledge in long-term memory. Most of the early studies that manipulated text order (Kintsch et al., 1977; Stein & Nezworski, 1978; Thorndyke, 1977) and many of the more recent studies (Mandler & Goodman, 1982; Stein & Glenn, 1982) have used narrative texts that contained largely schema-based underlying structures.

One of the few studies that has investigated discourse organization of texts with purely model-based structures is the work of Ehrlich and Johnson-Laird (1982). Ehrlich and Johnson-Laird propose a general principle of discourse organization (a principle of “referential continuity”). They hypothesize that text which is organized so that new information can be related to an already constructed model is easier to comprehend and recall than text organized so that new information cannot initially be related to an already constructed model. They carried out a series of experiments using descriptions of a spatial array and found that texts which violated the principle of referential continuity (e.g., “The knife is in front of the pot. The glass is behind the dish. The pot is on the left of the glass.”) were harder to understand and remember than texts which obeyed the principle (e.g., “The knife is in front of the pot. The pot is on the left of the glass. The glass is behind the dish.”).

In the next section, we extend the theoretical framework of Ehrlich and Johnson-Laird (1982) and propose a number of general principles of discourse organization. However, in doing this, we propose principles that are in direct opposition to some of the theoretical statements in Ehrlich and Johnson-Laird’s paper. In particular, Ehrlich and Johnson-Laird proposed that once one takes into account the principle of referential continuity, “the order in which sentences or referents occurred in the text has no bearing on the construction of the representation” (p. 298). This statement may not be generalizable to narrative comprehension. By examining whether subjects successfully make order inferences in the opposite direction to the mental model built from text, Ohtsuka (1990) reported that the mental model built from descriptive text is a two-dimensional global spatial model, whereas the model from narrative text is a one-dimensional path. Morrow (1985, 1986) has shown that readers use different strategies to determine the referents of ambiguous pronouns in descriptive and in narrative texts. Taken together, these results suggest that the processes of mental model building, as well as the constructed models, differ depending on genres. The Ehrlich and Johnson-Laird

study used spatial descriptive text, and this choice of genre may be the reason why sentence order did not matter in their study.

In the next section we propose three principles of discourse organization and suggest how each principle is related to discourse comprehension. We describe the three principles, which are nested in each other, in the descending order of influence they contribute to the comprehension of event order.

PRINCIPLES OF DISCOURSE ORGANIZATION

The Immediate Integration Principle

Discourse comprehension is facilitated by introducing new information into the discourse so that it can be integrated immediately into an already constructed model of underlying event structure. For example, when a text has introduced underlying events E-2, E-3, and E-4, comprehension will be facilitated if the next event introduced is either E-5 or E-1, because these two events could be integrated immediately to the already established model of event structure. On the other hand, introducing E-6 at this point would violate the immediate integration principle because it cannot be integrated immediately. We assume that violations of this principle cause strong reductions in comprehension by forcing the hearer/reader to hold information in working memory until it can be integrated into the developing structure. This psychological processing assumption has been included in a number of models of text comprehension (Ehrlich & Johnson-Laird, 1982; Kieras, 1978, 1981; Kintsch & van Dijk, 1978). Our immediate integration principle is essentially equivalent to Ehrlich and Johnson-Laird's principle of referential continuity. This principle can also be thought of as a form of the given-new principle (Clark & Haviland, 1977).

The Consistency Principle

Discourse comprehension is facilitated by organizing discourse so that new information is attached to an already constructed mental model of event structure at a consistent locus. The consistency principle is nested under the immediate integration principle and assumes its operation. For example, with a text that has already introduced underlying events E-2, E-3, and E-4, the introduction of E-5, then E-6, and then E-7 would follow the consistency principle because the event model is built in one direction. On the other hand, introducing E-5, then E-1, then E-6 after the establishment of event model, E-2, E-3, and E-4, would violate the principle. Although the latter example conforms to the immediate integration principle, new elements are added at different loci on the event model when new information is being attached. In the terms of Kintsch and van Dijk (1978) this principle suggests that text will be more difficult to comprehend if the information in the "leading edge" moves with respect to the already constructed event structure. We assume that the violation of this principle forces the hearer/reader to move the locus of structure construction, with a possible drain of memory resources, leading to difficulty in the construction of the underlying structure.

The Isomorphism Principle

Discourse comprehension is facilitated by having a discourse structure map isomorphically onto (i.e., match) the underlying event structure. For example, introducing three underlying events in the order E-1, then E-2, and then E-3 would be consistent with the isomorphism principle, but introducing the events in reverse order E-3, then E-2, and then E-1 would violate the principle. This principle is essentially identical with the principle of “experiential iconicism” proposed by Enkvist (1981) in which “elements of language are ordered to make a text isomorphic with the universe it describes” (p. 98). To apply this principle, one must, of course, have some knowledge about the structure of the information that underlies a particular form of discourse. This may be difficult for some types of discourse, such as expository texts, but is relatively straightforward for narrative texts. In fact, Brewer (1985) has proposed that a universal property of narratives designed primarily for comprehension is that “the order of events in the discourse will map the order of the underlying events” (p. 187). We hypothesize that violations of this principle make construction of the underlying structure by the hearer/reader more difficult.

We assume that the comprehension of narrative texts requires the construction of an appropriate underlying event sequence from the surface discourse structure. Therefore, we hypothesize that violations of any of these three principles of discourse organization will reduce the ability of the hearer/reader to construct the intended mental model of underlying event structure and lead to reduced comprehension.

OVERALL EXPERIMENTAL PLAN

The goal of the present experiment was to examine the impact of violations of each of the hypothesized principles of discourse organization on comprehension for the genre of narrative text. The basic approach was to establish a particular underlying event sequence, construct narrative texts with different discourse organizations from this event sequence, and then test the difficulty of comprehension of each type of narrative organization. We used ecologically valid temporal structures found in narratives as much as possible. In keeping with the methodological arguments outlined previously, we used passages with underlying event sequences that have no temporally predictable relations among events and have used the appropriate forms of discourse coreference to form cohesive texts. There were five types of passages, each with a different discourse organization. Each type of passage describes the same starting and ending event in the underlying event structure. The orders of presentation of events between these two anchor points differ in the five types of passages. Currently, it is not clear what contribution each principle actually provides to the overall comprehension process. For simplicity, we will assume that each of the three principles plays an equal and additive role in the process of comprehending temporal order in narrative texts.

Canonical Passages

In the canonical passages, the order of events in the narrative (e-1, e-2, e-3) was mapped directly onto the underlying event order (E-1, E-2, E-3). The discourse structure of canonical passages allows the immediate integration of new information, is consistent in the locus of mental model construction, and maps isomorphically onto the underlying

event structure. This form of narrative organization follows all three principles and thus should be the easiest form of narrative passage to understand.

Backward Passages

In the backward passages, the order of the events in the narrative was given in reverse order (e-3, e-2, e-1) from the underlying event order (E-1, E-2, E-3). This text manipulation violates the isomorphism principle because the narrative order does not map the direction of the underlying event order. The backward passages violate neither the immediate integration principle nor the consistency principle in mental model construction. The reader should be able to attach new information to the beginning of an already constructed mental model in an orderly manner, even though the narratives present the information from the last event to the initial event in terms of the underlying event sequence. This form of narrative organization should be the second easiest form of narrative passage to understand.

Flashback Passages

In the flashback passages, the order of events in the narrative was in canonical order, but an event was omitted from the discourse and given later in the narrative (e-1, e-3, e-4, e-2). These passages were designed so that readers would initially be able to construct an underlying structure, E-1, E-3, and only later learn that it was necessary to insert E-2 into this already constructed model. This form of narrative organization requires comprehenders to reorganize models as they build mental representations. It violates the consistency principle because the locus of model construction shifts each time there is a flashback in the passage. This form of narrative organization also violates the isomorphism principle. Therefore, this type of narrative organization should be more difficult to understand than the backward passages.

Embedded Passages

In the embedded passages, the text introduced an event from the middle of the underlying event sequence after the starting statement. The narrative continued with the next following underlying event; however, the narrative then gave the underlying event that preceded the initial event and continued in embedded form (e-3, e-4, e-2, e-5, e-1). This type of narrative organization provides a strong violation of the consistency principle because the locus of structure construction shifts repeatedly from one end of the already constructed structure to the other. This organization also violates the isomorphism principle because half of the narrative events are given in reverse order from the underlying event order (E-1, E-2, E-3, E-4, E-5). Therefore, we expected the comprehension of the embedded passages to be similar to that of the flashback passages.

Flashforward Passages

In the flashforward passages, the text started with the narrative events (e-1, e-2) given in canonical order. The narrative then introduced an event that occurred later in the underlying event sequence (e-5). Then, by describing the immediately following event (e-3), flashforward passages continued in canonical order (e-1, e-2, e-5, e-3, e-4). This form of discourse organization violates the immediate integration principle because the information in the flashforward portion (e-5) is new information that cannot yet be

attached to an already constructed underlying event structure. These passages also violate the consistency and isomorphism principles. Because this type of narrative organization violates all three principles, we predicted it to be the most difficult to comprehend.

METHOD

Subjects

The subjects were 100 undergraduate university students who participated in the experiment to fulfill a course requirement. They were all native speakers of English.

Materials

Underlying Events. Two underlying event sequences were developed: *A walk in the forest*, and *A day in the life of the president*. Each event sequence contained 14 events that were not structured in terms of script information or plan information. Thus, for example, in the *A day in the life of the president* event sequence, the first three events were; [E-1] *President declared National Pickle Week*, [E-2] *President met with Miss America*, and [E-3] *President walked in Rose Garden*. A set of five narrative passages was developed from each event sequence. Each set contained one narrative with each of five different forms of global discourse structure: (a) canonical, (b) backward, (c) flashback, (d) embedded, and (e) flashforward. The passages derived from the *A walk in the forest* sequence of events are given in the Appendix.

Canonical Passages. Two passages with canonical narrative organization were developed, one from each underlying event sequence. The sentences describing the events used temporal markers such as “next,” “after this,” and “then” to establish discourse cohesion.

Backward Passages. Two passages with backward narrative organization were developed, one from each underlying event sequence. Each sentence was related to the next with the initial phrase “before that.”

Flashback Passages. Two passages with flashback narrative organization were developed, one from each underlying event sequence. Three of the 14 underlying events were given in the text in flashback form. The event to be given in flashback form was omitted from the discourse where it would have occurred in canonical organization. Thus, for the event sequence: [E-1] *Bear*, [E-2] *Redwoods*, [E-3] *Rain*, the discourse was given as: “She heard a loud noise and turned to see a large black bear breaking into a cabin. A little later during the walk, the sky darkened and a light rain began to fall.” Later in the narrative, at the point where the flashback occurred in the discourse, cohesiveness was established by using appropriate tenses and by referring to the event in the already established event structure that immediately preceded the omitted event, for example, “Earlier in the walk, right after she had seen the bear, Sara had walked through a grove of giant redwoods.”

Embedded Passages. Two passages with embedded narrative organization were developed, one from each underlying event sequence. The second sentence in the text introduced an event from the middle of the underlying event sequence. The third sentence in the text described the event that followed the middle event in the underlying event sequence. The next sentence used standard flashback discourse conventions (described in the previous section) to introduce the event that immediately preceded the middle event in the underlying event sequence. For example, “About half way through her walk, she heard a loud noise and turned to see a large black bear breaking into a cabin [middle event in underlying event sequence]. After this, she walked through a grove of giant redwoods. Before she saw the bear, she had seen some people skinny-dipping in a small pond.” The narrative continued by introducing new events into the text in alternating sequence. Discourse cohesiveness was maintained by tense markers and by appropriate reference to the initial (or last) event of the already established event structure

Flashforward Passages. Two passages with flashforward narrative organization were developed, one from each underlying event sequence. Three of the 14 events were given in flashforward form. Each flashforward event and the event immediately preceding it in the underlying structure were introduced into the discourse (before their appropriate canonical positions) with an adverbial clause indicating an unspecified period of future time. For example, “Next, she saw a flock of geese heading south [event from established canonical event sequence]. Later in the day, after she had spotted a campfire [event immediately preceding the flashforward event in the underlying event sequence], she almost stepped on a rattlesnake while walking through a meadow [flashforward event].” Immediately after the flashforward event, the discourse reverted to the original time line by introducing the next new event into the discourse with respect to the last event in the established event sequence. Thus, for the given example, the narrative continued with, “However, immediately after she had seen the geese [established event], she met a hiker who told her that the west trail was impassable [next new canonical event].” When the discourse progressed to the point in the underlying event sequence where the flashforward event should be inserted, the event immediately preceding the flashforward event in the underlying event sequence was given, but not the flashforward event itself. Thus, for this example, when the appropriate point was reached, the text stated, “Next, Sara spotted the campfire up on the ridge. Later during the walk, Sara saw the moose crash through a grove of poplar trees.”

Comprehension Test

Comprehension of the texts was measured by two sets of 20 true-false questions about the order of events in the underlying event sequences. Because the events in the underlying event sequences did not contain temporally predictable relations, it was necessary for the subjects to use the information given in the discourse to establish the underlying event sequences. The pairs of events to be tested were selected so that no item tested the pairs of events that occurred next to one another in the underlying event sequence. The distances between the pairs of events in test materials were such that there were one to seven intervening events between the pairs of events in the underlying event sequence. Note that the comprehension test never tested information given in literal form in the text.

The test items were always tests of subjects' inferences concerning underlying event order. Example test items for the *A walk in the forest* event sequence were: (T F)

1. "Sara saw the bear break into the cabin after she almost stepped on the rattlesnake.";
- (T F) 2. "Sara talked with the hiker before she walked through the redwood grove."⁵

Procedure

The subjects were seen in small groups of 5 to 10. The subjects were instructed to listen to the tape recording of a passage and were told that they would be asked to answer questions concerning the passage after the second presentation. The passage was presented twice by a tape recorder, with a 10-s interval between the two presentations. Subjects were not allowed to take notes during the two auditory presentations. Immediately after the second presentation, the experimenter handed out the booklets and subjects answered 20 true-false questions.

Design

There were five types of discourse organization (canonical, backward, flashback, embedded, and flashforward) and two underlying event sequences (*A walk in the forest* and *A day in the life of the president*) in a factorial design. Both factors were between subjects. There were 10 subjects in each experimental condition.

RESULTS

The analyses were carried out on the number of correct responses on the 20-item comprehension tests, with maximum possible scores of 20 and a chance score of 10 correct. The means and standard deviations for each type of narrative organization are given in Table 1.

A two-way analysis of variance (Event Sequence X Discourse Organization) was carried out on the comprehension scores. There was a statistically significant effect of discourse organization, $F(4,90) = 12.03$, $MSe = 11.85$, $p < .001$. The main effect of event sequences (*A walk in the forest* versus *A day in the life of the President*) and its interaction with discourse organization were not statistically significant. Thus, narrative organization had a powerful effect on the comprehension of temporal order in narratives.

To determine heterogeneous sets among passage types of discourse organization, we used a posteriori Newman-Keuls multiple-range tests. Type of discourse organization fell into three groups. The comprehension scores for the canonical passages (17.7) were significantly higher ($p < .05$) than the comprehension scores for all other types of discourse organization. There were no significant differences between the comprehension scores for the backward passages (14.9), the flashback passages (14.7), and the embedded

⁵ To test if subjects can reconstruct event order from the experimental passages, we asked a separate group of subjects to read the passages and answer the comprehension questions with the passages still available. The mean comprehension scores for each passage type were, in order, 19.1, 18.8, 17.3, 18.2, and 15.2 for the canonical, backward, flashback, embedded, and flashforward passages.

passages (13.6). The comprehension scores for the flashforward passages (10.3) were significantly lower than those for all the other types of discourse organization.

TABLE 1
Mean Comprehension Scores for Each Type of Passage Organization

Passage Type	Comprehension Score	
	<i>M</i>	<i>SD</i>
Canonical	17.7	2.0
Backward	14.9	5.0
Flashback	14.7	3.2
Embedded	13.6	4.1
Flashforward	10.3	2.0

Note. Maximum score = 20. Chance score = 10.

DISCUSSION

These results show strong effects of global narrative organization on discourse comprehension.

The immediate integration principle states that discourse comprehension is facilitated by introducing new information so that it can be integrated immediately to an already constructed underlying event structure. Violations of the immediate integration principle produced the largest effects among the discourse manipulations in this experiment, with three flashforward events reducing comprehension scores to almost chance levels. The strong effect of violating the immediate integration principle is consistent with previous studies of discourse comprehension (Ehrlich & Johnson-Laird, 1982; Kieras, 1978) and suggests that discourse organizations that cannot be integrated into a unified structure in working memory have particularly disruptive effects on comprehension.

The consistency principle states that discourse comprehension is facilitated by organizing discourse so that new information is attached to an old underlying structure with a consistent locus. The findings of reduced comprehension scores for the embedded texts and for the flashback texts support this principle, because both of these texts violate the consistency principle by shifting the focus of structure construction. However, this interpretation is not completely unambiguous because the embedded texts also violate the isomorphism principle.

The finding of reduced comprehension scores for the flashback passages is also consistent with this principle because the flashback texts omit relevant information and then insert the missing information into the already constructed event sequence. Although the flashback passages also violate the isomorphism principle, the results do show that subjects' comprehension of the embedded passages was similar to that of the flashback

passages, as we hypothesized. Apparently, violation of the consistency and isomorphism principles in both passages has roughly the same effect on comprehension.

It is interesting to note the contrast between flashforward texts that violate the immediate integration principle and flashback texts that do not. The reader of flashback texts can construct a reasonably coherent model as a unified representation, although it might be a temporary one, during the reading at any given point. However, the reader of flashforward texts cannot build a unified coherent model until the gap in the time line is completely filled. The immediate integration principle is thus particularly important for comprehension, and so flashforward texts are more difficult to comprehend than flashback texts.

The isomorphism principle states that discourse comprehension is facilitated by having the discourse structure map the underlying structure. The finding of reduced comprehension scores for the backward texts supports this principle because these texts obey the immediate integration principle and the consistency principle, but violate the isomorphism principle. It appears that subjects find it more difficult to construct an underlying directional event sequence when the events are presented in the discourse in the reverse order. The data from the backward passages did not completely agree with our prediction. Our theory predicted that this type of narrative organization should have been significantly easier than the flashback and the embedded passages.

Linear Ordering and Discourse Organization

This experiment was developed within the general theoretical framework of humanistic studies of text (Chatman, 1978; Erlich, 1980) and more specifically within the framework of the experimental study of discourse (Graesser, 1981; Johnson-Laird, 1983; van Dijk & Kintsch, 1983). However, the processes postulated to underlie the effects of global discourse organization on comprehension are presumably general cognitive processes that are brought into operation during the process of text comprehension. Thus, it is interesting to compare the results of these experiments with an independent line of research on linear ordering.

There is a fairly large body of literature on the psychological processes involved in making comparative judgments (Potts et al., 1978). Within this literature one popular research paradigm has been the study of four-term linear order problems. An example of a four-term linear order problem is: "The doctor is taller than the farmer. The farmer is taller than the soldier. The soldier is taller than the teacher." The subject can then be asked questions about the relative heights of a pair of individuals or be asked to recall the entire set of sentences. Within this literature, there is one set of studies that seems to tap many of the same psychological processes as the experiment in this article. These experiments used an arbitrary underlying linear ordering (as in the previous example) and studied all possible orderings of the three pairs (Foos, Smith, Sabol, & Mynatt, 1976; Smith & Foos, 1975). Thus, if this example is represented as AB, BC, CD, then this ordering of the three pairs is equivalent to our canonical discourse organization. The order, CD, BC, AB would be equivalent to our backward discourse organization. The order BC, CD, AB would be equivalent to our flashback organization. Note that in this case the pair AB is moved from its canonical location. The first two pairs BC, CD build up an underlying structure, and finally the omitted pair is attached to the beginning of the already constructed structure, as in a flashback narrative. Finally, the order AB, CD, BC

is equivalent to our flashforward organization. In this case, the second pair does not attach new information to the already constructed structure and so must be held in working memory. It is only with the final pair that the underlying structure can be constructed. Thus, this ordering is equivalent to a narrative text with a single flashforward.

Examination of the recall data in Smith and Foos (1975) and Foos et al. (1976) shows that the linear order equivalent of our canonical organization gives higher recall than any of the other orders. Linear orders that correspond to our backward and flashback organizations show roughly equivalent recall. The recall for both of these orderings is lower than that for the canonical ordering. Finally, the linear ordering that corresponds to our flashforward organization shows the lowest recall of any of the orders. This patterning of the linear order data is the same as our results for the comprehension scores for the appropriate discourse organizations. This unusual degree of consistency across rather different experimental paradigms suggests that both tasks are, in fact, tapping the same underlying cognitive processes.

The Function of Discourse Organization

The finding that a number of violations of canonical discourse organization will reduce comprehension leads to an obvious puzzle. Why don't authors always write texts in canonical form? This paradox only arises if one assumes that all texts are designed to optimize comprehension. Admittedly, our article focused on only one aspect of event order comprehension--how readers construct a mental model of event order from narrative text. As we discussed earlier, text comprehension is very complex and often requires many levels of analysis. In order to study the roles and functions of temporal order in narrative, one must take into account other functions of temporal manipulation, such as discourse force. Brewer (1980) has argued that although some discourse genres are designed primarily for comprehension (e.g., newspaper articles), other genres are designed primarily for other functions, such as entertainment or persuasion. Thus, an author's use of a noncanonical discourse organization is not so puzzling if it contributes to some discourse function other than comprehension, and these noncanonical organizations may also contribute to literary understanding in some broad sense of text comprehension. In fact, several authors in the humanistic tradition have analyzed the functions of discourse organization in these terms. For example, both Sternberg (1978) and Genette (1972/1980) have argued that flashforwards are used to build up suspense in the reader about events that are yet to come. Brewer and Lichtenstein (1981, 1982) have carried out a series of psychological experiments showing that discourse organization can have large effects on the reader's affect and liking judgments for narratives. Thus, it appears that authors may choose a particular form of discourse organization that is not the most efficient form for comprehension if that form has some other important discourse function.

CONCLUSIONS

Overall, this experiment suggests the importance of a careful distinction between underlying events and the representation of these events in discourse. It provides

evidence that there are powerful effects of global discourse organization on comprehension and, more specifically, it shows that the immediate integration principle has a strong contribution. It appears that the consistency principle may also provide an independent contribution to comprehension, but the data did not provide completely unambiguous evidence for the operation of this principle. Finally, the data show that the isomorphism principle has a moderate contribution to comprehension of temporal order in narrative texts.

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APPENDIX: EXPERIMENTAL PASSAGES (A WALK IN THE FOREST)

Canonical Passage

It was a beautiful afternoon, so Sara decided to walk through the forest. While walking, she noticed the remains of the old ranger station. Next, she saw a flock of geese heading south. She then met a hiker who told her that the west trail was impassable. After this, Sara went to her favorite spot, a cliff which overlooked a small village, and sat for a while. Next, she saw some people skinny-dipping in a small pond. Hearing a loud noise, she turned to see a large black bear breaking into a cabin. After this, she walked through a grove of giant redwoods. Then the sky darkened and a light rain began to fall. Next, Sara spotted a campfire up on the ridge. Then, while walking through a meadow, she almost stepped on a rattlesnake. After this, Sara saw a moose crash through a grove of poplar trees. Sara then circled around Bald Mountain in order to go down into the valley. Finally, Sara followed the Cairn River back home.

Backward Passage

The last thing Sara did the day she walked in the forest was to follow the Cairn River back home. Before that, Sara had circled around Bald Mountain in order to go down into the valley. Before that, Sara had seen a moose crash through a grove of poplar trees.

Before this, while walking through a meadow, she had almost stepped on a rattlesnake. Before that, Sara had spotted a campfire up on the ridge. Before this, the sky had darkened and a light rain began to fall. Before that, she had walked through a grove of giant redwoods. Before this, she had heard a loud noise and turned to see a large black bear breaking into a cabin. Before that, she had seen some people skinny-dipping in a small pond. Before this, Sara had gone to her favorite spot, a cliff which overlooked a small village, and sat for a while. Before that, she had met a hiker who told her that the west trail was impassable. Before this, she had seen a flock of geese heading south. Before that, while walking, Sara had noticed the remains of an old ranger station. Right before this, Sara had decided to walk through the forest since it was a beautiful afternoon.

Flashback Passage

It was a beautiful afternoon, so Sara decided to walk through the forest. Shortly afterward, Sara saw a flock of geese heading south. Next, she met a hiker who told her that the west trail was impassable. A little later in the day, Sara saw some people skinny-dipping in a small pond. After this, she heard a loud noise and turned to see a large black bear breaking into a cabin. A little later during the walk, the sky darkened and a light rain began to fall. Then, Sara spotted a campfire up on the ridge. Earlier in the walk, right after she had seen the bear, Sara had walked through a grove of giant redwoods. Immediately after she had spotted the campfire on the ridge, Sara almost stepped on a rattlesnake while walking through the meadow. Next, Sara saw a moose crash through the grove of poplar trees. Considerably earlier in the walk, right after she had met the hiker, Sara had gone to her favorite spot, a cliff which overlooked a small village, and sat for a while. Immediately after she had seen the moose, Sara circled around Bald Mountain in order to go down into the valley. Much earlier in the walk, right after she had decided to walk through the forest, Sara had seen the remains of an old ranger station. Finally, immediately after circling Bald Mountain, Sara followed the Cairn River back home.

Embedded Passage

It was a beautiful afternoon, so Sara decided to walk through the forest. About half way through her walk, she heard a loud noise and turned to see a large black bear breaking into a cabin. After this, she walked through a grove of giant redwoods. Before she saw the bear, she had seen some people skinny-dipping in a small pond. Immediately after she had walked through the redwood grove, the sky darkened and a light rain began to fall. Earlier, just before she saw the people skinny-dipping, she had gone to her favorite spot, a cliff which overlooked a small village, and had sat for a while. Right after the light rain had begun, Sara spotted a campfire up on the ridge. Just before she had gone to her favorite spot, she had met a hiker who told her that the west trail was impassable. Later, right after she had noticed the campfire, she almost stepped on a rattlesnake while walking through a meadow. Earlier, just before she met the hiker, she had seen a flock of geese heading south. Right after almost stepping on the rattlesnake, Sara saw a moose crash through a grove of poplar trees. Earlier, just before she saw the flock of geese, she had noticed the remains of the old ranger station. Right after she had seen the moose, Sara circled around Bald Mountain in order to go down into the valley. Finally, Sara followed the Cairn River back home.

Flashforward Passage

It was a beautiful afternoon, so Sara decided to walk through the forest. Later during the walk, after she had seen a moose, Sara circled around Bald Mountain in order to go down into the valley. However, right after she began the walk, she noticed the remains of the old ranger station. Next, she saw a flock of geese heading south. Later in the day, after she had spotted a campfire, she almost stepped on a rattlesnake while walking through a meadow. However, immediately after she had seen the geese, she met a hiker who told her that the west trail was impassable. After this, Sara went to her favorite spot, a cliff which overlooked a small village, and sat for a while. Later in the day, after she had seen a bear, she walked through a grove of giant redwoods. However, immediately after she went to her favorite spot on the cliff, she saw some people skinny-dipping in a small pond. Then, she heard a loud noise and turned to see the large black bear breaking into a cabin. Later during the walk, the sky darkened and a light rain began to fall. Next, Sara spotted the campfire up on the ridge. Later during the walk, Sara saw the moose crash through a grove of poplar trees. Finally, Sara followed the Cairn River back home.