

# EPISODES AS MEMORY UNITS IN DISCOURSE REPRESENTATION: ANAPHOR USE IN ENGLISH AND MANDARIN

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## ABSTRACT

*The present study investigates the relationship between cognitive constraints and discourse processing. In particular, it examines how the hierarchical structure of discourse is organized and presented, and what consequences that structure has for the linguistic coding employed during the dynamic time course of discourse processing. Special attention is directed to the distribution of full NPs and pronouns in discourse as a function of the location of episode boundaries. Results obtained from an experiment support the hypothesis that episode structure governs the alternative use of anaphora.*

## 1. INTRODUCTION<sup>1</sup>

The notion of episode or paragraph as a semantic unit dominated by a macroproposition has been extensively investigated and discussed both in linguistics (Longacre 1979, Schank and Abelson 1977, Hinds 1979, van Dijk 1982, van Dijk and Kintsch 1983, Tomlin 1987) and in psychology (Black and Bower 1979, Haberlandt, Berian and Sandson 1980). From both these perspectives, an episode (a semantic unit) is generally regarded as a set of actions described to obtain a subgoal, along with the outcome of those actions. Black and Bower (1979) demonstrated, in a psychological study of story processing, the existence of episodes as chunks in narrative memory. Their study yielded three basic results. First, episodes in stories are stored as separate chunks in the memory representation of the story; second, adding related but relatively unimportant actions to a story episode increases the recall probability of the important statements in the episode; and third, the recall probability of a general superordinate action in a story increases with the number of subordinate actions that further specify it. Similarly, R. Guindon and W. Kintsch (1982), in their experiment studying the macrostructure of texts, found that macrostructure formation ap-

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appears to be a virtually automatic process. That is, people appear to form macrostructure during reading and derive relevant macropropositions of a passage as soon as possible. Their findings provided evidence for the 'episode' and the 'macrostructure' theories of van Dijk and Kintsch (1978) and Schank and Abelson (1977).

Other studies of story processing (Mandler and Johnson 1977, Kintsch 1979, Haberlandt, Berian and Sandson 1980) suggest that readers slow their processing at or around the episode boundary more so than would be predicted on the basis of sentence level and text-level factors. The boundary hypothesis, which derives from these findings, assumes that there are cognitive processes at work around the episode boundary which are not present inside the episode. At the beginning of an episode, several overlapping cognitive processes may occur. Haberlandt, Berian and Sandson (1980), who tested the boundary hypothesis with reading and recall experiments, found that the encoding load was greater at the boundary nodes than elsewhere, suggesting that readers are sensitive to episode boundaries and use them in encoding story information.

In studies on anaphora patterning, many linguists (Tomlin 1987, Marslet, Wilson, Levy and Tyler 1982, Givón 1983 a & b, Fox 1987a, van Dijk 1982, van Dijk and Kintsch 1983, Chafe 1987, Tomlin and Pu 1991) have examined the importance of episodes to the syntax of reference and have found a crucial relationship between the episode and the limited capacity of short-term memory. They argue that referential choices may be regarded as stemming from such factors such as textual representation in episodic memory, the role of episodic situations and other world knowledge, and the capacity of short-term memory. Many text-oriented studies show that full NPs may be used at the beginning of an episode to introduce or reinstate reference, while pronominal NPs tend to be used internally to maintain reference and cohesion.

The present study draws on the discussion of the prior research and attempts to examine further the relationship between the episode and its cognitive correlate, the memory chunk, and to determine how this relationship is realized in linguistic coding. We argue that in discourse production, the speaker, constrained by short-term memory, organizes discourse into a sequence of episodes. The encoding load for discourse representation is assumed to be greater at an episode boundary than that within an episode since an episode is a memory unit which represents sustained attentional effort and endures until an episode boundary is reached. Attention shifts at the episode boundary, where new agents, places, times, objects or possible worlds are expected to be introduced, since each episode is subsumed by a different macroproposition (cf. van Dijk and Kintsch 1983).

Such a cognitive-based discourse organization may be reflected in anaphoric patterning in discourse production along the following lines: full NPs (*more marking materials*)<sup>2</sup> are expected to be used at episode boundaries to mark thematic discontinuity between episodes, while pronominals (*less marking materials*) are expected within the episode to maintain referential continuity. These predictions are quite congruent with Givón's general psychological principle: 'Expend as much energy on a task as is required for its performance.' (1983a:18).

Based on this crucial relationship between cognitive activities of attention and memory and discourse organization, we propose the following hypothesis:

*Hypothesis:* The speaker's cognitive processes of attention and memory control discourse organization, which is manifested in the alternative use of anaphors.

That is, during discourse production, the speaker is hypothesized to organize his discourse into episodes and to present the episodes by differential use of NPs and pronominals.

In order to test this hypothesis, an experiment was conducted in which subjects were asked to watch a video program consisting of three episodes from a storybook and then construct short narratives describing what they had seen. The experimental study is detailed in the following section.

## 2. THE EXPERIMENTAL STUDY

### 2.1. Stimulus Materials

The stimulus materials for the study consist of adaptations of three excerpts from a children's picture storybook (without a written text), *Here comes Alex Pumpernickel*, by Fernando Krahn (1981). The storybook is about a little boy named Alex Pumpernickel, presented by vivid and witty illustrations. The book consists of eight short stories, each of which describes the activities of a certain period of time during a day in Alex's life. Each natural episode is given a title based on the activity, with a picture-clock denoting the time of the day.

The three natural episodes adapted for the present experimental study are subtitled: 1) Alex Pumpernickel in a sticky situation, 2) Alex Pumpernickel swats, and 3) Alex Pumpernickel lends a hand. Each of the three natural episodes consists of 8 pictures which are presented in pairs on each page. The three episodes – twelve pairs of pictures, with the subtitles removed, were made into a black and white video program which could be viewed directly as a cartoon sequence of 24 pictures from a Macintosh screen. The resulting video program was de-

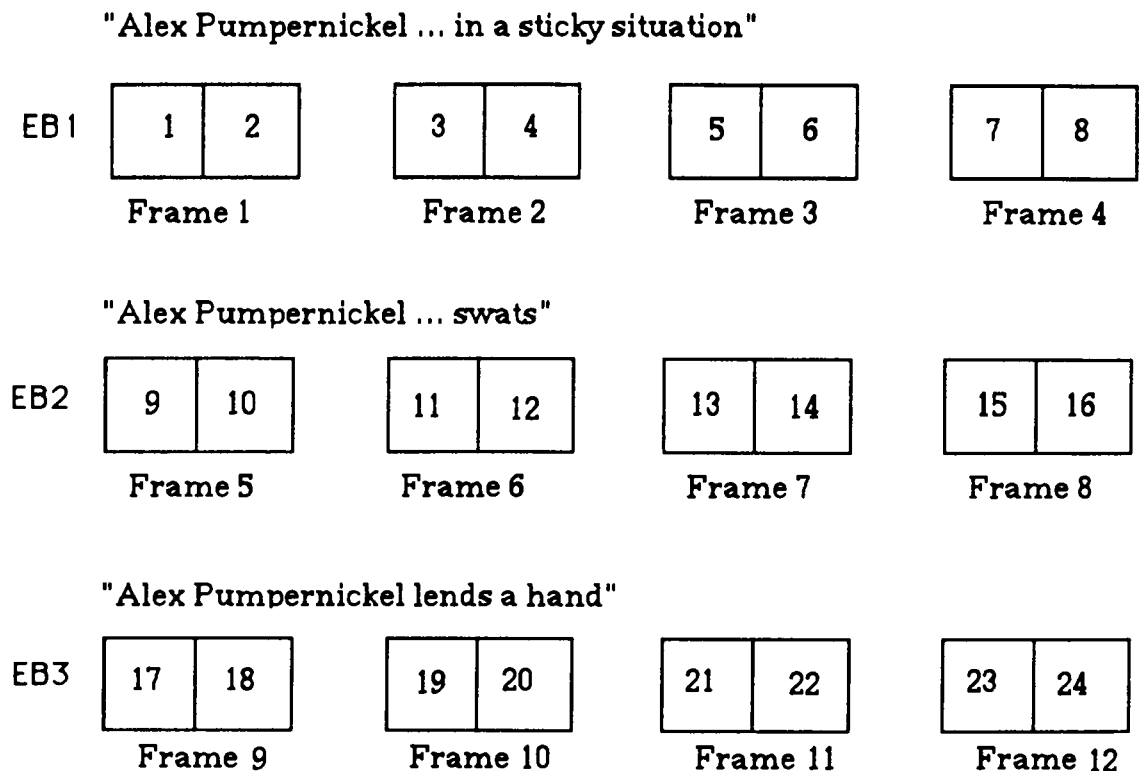
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<sup>2</sup>The terminology *more/less marking materials* is Givón's (1983a).

signed to give as little presupposition as possible to subjects so that rich and uncontaminated data could be collected for the study.

## 2.2. Experimental Conditions

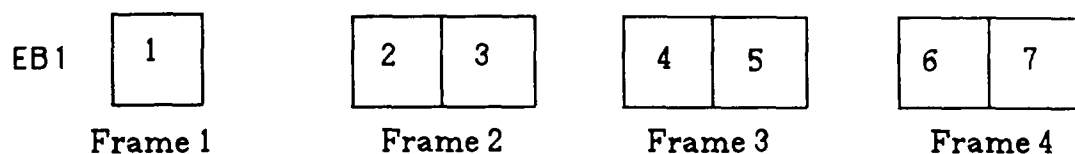
Two experimental conditions, Even and Odd, were established to test the present hypothesis. In the Even condition, the picture sequence was presented in the original pairs; that is, there are twelve picture frames, and the three original story episode boundaries do not cut into any of the frames. The presentation of the pictures in the Even condition is illustrated in Figure 1.



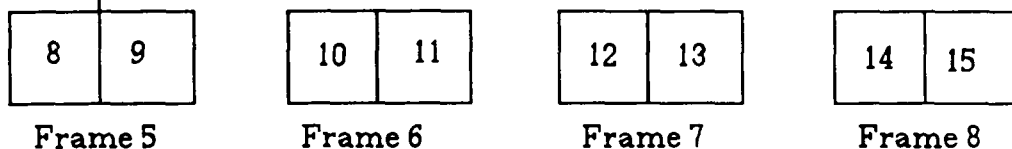
**Figure 1: Even Condition**

In the Odd condition, the first single picture of the first episode ('Alex Pumpernickel in a sticky situation') was presented alone and the rest of pictures still in pairs, with the last single picture of the last episode ('Alex Pumpernickel lends a hand') also presented alone. There are therefore thirteen picture frames in the Odd condition, and two of the three original story episode boundaries (EBs) are embedded in two of the picture frames (i.e. EB 2 cuts into Frame 5, and EB 3 cuts into Frame 9). The presentation of pictures in the Odd condition is illustrated in Figure 2.

"Alex Pumpernickel ... in a sticky situation"



EB2 | "Alex Pumpernickel ... swats"



EB3 | "Alex Pumpernickel lends a hand"

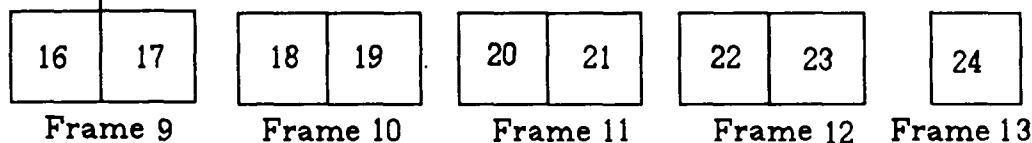


Figure 2: Odd Condition

Since discourse organization is assumed to be controlled by cognitive processes, it was expected that subjects would respond to the episode boundary in exactly the same way regardless of how the picture sequence was presented. In other words, subjects were expected to recognize and mark the episode boundary with full NPs regardless of whether or not it is embedded within a picture frame.

### 2.3. Subjects and procedures

Forty volunteers participated in the experiment. Twenty were native Chinese speakers who were all students at the University of Alberta and who speak English as a second language (though they vary a great deal in English fluency). Fifteen of the Chinese participants speak Mandarin as their first language, the other five (from the South of China) speak fluent Mandarin and communicate with other Chinese mostly in Mandarin. All Chinese subjects did the experiment in Mandarin Chinese.

All twenty English participants were native English speakers. Thirteen were students at the University of Alberta, and the other seven were university graduates. All forty subjects were adults (over the age of twenty); ten of the Chinese speakers and seven of the English speakers were male. All English subjects did the experiments in English. English subjects were assigned randomly to the two

English conditions, English Even and English Odd, while Mandarin speakers were randomly assigned to the two Mandarin conditions, Mandarin Even and Mandarin Odd.

There were two narrative production tasks for each subject: an on-line description task and a recall task. In the on-line description task, which was performed first, subjects were asked to watch the video program and at the same time produce a story based on the pictures presented on the screen. Each subject was told to take as much time as needed for each single picture or pair of pictures on a screen. Once finished with a screen, the subject could not see it again.

Upon completion of the on-line description, subjects were asked to recall the entire story they had just described. They were instructed to retell as much as possible of the story without looking at the picture sequence again on the Macintosh screen. The recall task is the focus of the present paper. Since episodes are expected to act as separate memory units/chunks, subjects should be able to structure and mark such units linguistically.

In the recall task, each of the Chinese groups – Mandarin Even and Mandarin Odd – was divided into two subgroups: five of each group performed the recall task in oral form and the other five in written form. The task was so divided for the following reason. Mandarin makes no gender distinction among third-person pronouns in oral form; all third-person singular pronouns ('he/she/it') have the same pronunciation *ta*. Chinese subjects thus might have to use NPs to distinguish male characters from female characters in orally retelling the story, where the pronouns would do in English. However in written Mandarin, gender distinction is present for personal pronouns, and there are three different forms for 'he', 'she', and 'it'. By performing a written recall task, subjects would be able to use disambiguating pronouns instead of NPs. Thus we might distinguish disambiguating anaphors from those sensitive to episode boundary conditions by comparison of oral and written productions for the Mandarin groups.

### 3. RESULTS

#### 3.1. Psychological reality of episodes

The episode boundary results obtained from the recall task in all four groups give evidence that episodes exist as chunks in narrative memory. Subjects in each of the four groups performed the recall task immediately after the on-line description task. Although there was no written clue in either of the conditions that there were three episodes in the story, 34 out of 40 subjects (85%) recognized the three natural episodes and mentioned the fact overtly. Overall, the

Mandarin groups<sup>3</sup> had the same rate of episode recognition as the English groups: 85% (17 out of 20) across the languages. However, both Even conditions had higher rates of episode recognition than both Odd conditions: 90% (9 out of 10) for the English Even and 100% for the Mandarin Even; 80% (8 out of 10) for the English Odd and 70% (7 out of 10) for the Mandarin Odd. Each one of these 34 'recognizing' subjects overtly mentioned that the story consisted of three episodes. They used the phrases such as 'three short stories', 'three sections', 'three parts', 'three episodes', 'three groups/sets of pictures', etc. Such mention generally occurred at the beginning of the recall, and many subjects again started each of the three episodes with 'the first story/section ...', 'the second story/section...', and 'the third story/section ...'.

More interestingly, some subjects' recall showed the specific monitoring role macropropositions play in discourse processing. Five of the 34 subjects who overtly mentioned the three natural episodes then failed to remember the content of all three during their recall. Of the five subjects, two were in the English groups (1 in Even and 1 in Odd), and 3 in the Mandarin groups (1 in Even and 2 in Odd). The one episode they tended to forget was always the middle one ('Alex Pumpnickel swats'). The five subjects remembered and recalled the first and the third episodes first, and then commented that they remembered there was one more episode, but could not tell what it was. The way they finally recalled the second episode is also of great significance: each first recalled the paragraph level theme, or macroproposition, and then the whole episode came flowing out. Some exact wordings were: 'Well, I remembered it's the boy chasing the fly ...', 'Okay, it's about the kid swatting a fly ...', or 'Yes, it's about the boy and the fly'.

In addition to the overt mention of the three episodes, subjects consistently marked the beginning of each episode, using full NPs reinstating reference throughout their recall task. This demonstrates, as the boundary hypothesis (Mandler and Johnson 1977, Kintsch 1977, Haberlandt, Berian and Sandson 1980) claims, that cognitive processes at episode boundaries are different from those inside the episode. The subject had to devote a special effort to encoding

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<sup>3</sup>Two sets of data (written and oral recall) were collected for the Mandarin recall task since the Mandarin third person pronouns have gender distinction in their written form. It was expected that Mandarin subjects would use more lexical pronouns in their written recall to differentiate between referents than in their oral recall. However comparing lexical pronouns used between the written and oral recall, there is no difference found for the human central character: for the Even condition, 27.45% in the written and 27.01% in the oral; for the Odd condition, 22.70% in the written and 22.61% in the oral. As for the human non-central characters, lexical pronouns used in the written recall are even fewer than those used in the oral recall. Since no difference is found in subjects' anaphoric choice between the Mandarin written and oral recalls, the two sets of data are discussed as one in the present study.

the beginning of an episode because (1) the subject tried to grasp the initiating and topical event of the episode during the quick flow of discourse processing, (2) the subject identified the protagonist of the episode and established a new memory location for the protagonist, (3) at the beginning, the subject shifted the perspective, breaking the sustained attentional effort for the previous episode even when the protagonist of the episode remained the same, and (4) the subject lacked the expectations that facilitate inference processes. Without such expectations, the beginning is essentially an isolated node.

### 3.2. Alternative Use of Anaphors

We now examine in detail how subjects' episodic organization was reflected in their reference management. As was shown in the present experimental results, NPs were used at the boundary to mark the boundary shift or thematic discontinuity, and pronouns (including zero anaphora) within the episode to maintain referential continuity. Table 1 shows the frequencies (the second and third columns) of full NPs and pronominals (including zero anaphora) used at the three original episode boundaries and within them, and the proportions of *Hits* (the final column), namely, the proportions of NPs used at episode boundaries plus pronominals used within episodes.

Table 1: Episode Boundary Results

ANAPHOR	NP		PRONOUN		PROPORTION OF HITS (%)
	EB	NEB	EB	NEB	
English Even	73	125	2	340	76.48
English Odd	71	131	3	360	76.46
Mandarin Even	75	139	0	353	75.49
Mandarin Odd	76	143	3	294	72.71
<b>TOTAL</b>	295	538	8	1347	75.05

EB = at an episode boundary

NEB = within an episode

Table 1 shows that the hit rates of the four groups are strikingly similar, with an average hit rate of about 75%. There is no statistically significant difference (at the 0.05 level) for the hit rates between the two conditions of the same language groups, nor is there any between the two languages. The results demonstrate that in discourse production the episodic organization which reflects attention/memory spans is indeed coded in the syntax of reference. It is obvious that the encoding load at the episode boundary is always greater than at the re-



maintaining part of the episode so that subjects expended more 'energy' on the task by using more marking materials.

#### 4. DISCUSSION

Although the results of the experimental study are consistent with the present hypothesis, there still remains 25% of the overall tokens which appear to run counter to the hypothesis, i.e., intra-episode NPs (those used within the episode – about 24%), and inter-episode pronominals (those used at the boundary – about 1%). All 8 cases of inter-episode pronominals were used by the six subjects who didn't recall the story as consisting of three episodes. None of these mentioned that there were three episodes in the story in their recall, nor did they mark the boundary as most of the others did. Since almost all counter-examples are intra-episode NPs, the following section focuses on these.

##### 4.1. Analysis of counter-examples

A close study of the data reveals some secondary functions of NPs used within the episode. After the episode boundary is recognized and marked, other important features within the episode also requires extra attention on the part of the speaker or/and the listener, such as differentiating the protagonist and minor characters and signaling changes of events, perspectives, participants, etc. Consequently, more marking materials (full NPs) may be used in these specific places to mark the different status of characters in the story and some minor thematic discontinuity within the episode. The general patterns of NPs used within the episode reveal several distinguishing factors.

First, the human central character was almost always maintained by pronominals within episode, and human non-central characters were very frequently referred to by NPs within episodes (see Tables 2 and 3) even if the central and non-central characters were of different gender.

Table 2: Distribution of Anaphors in Mandarin Recall Task

CONDITION REFERENT	EVEN		ODD	
	HUM-C	HUM-NC	HUM-C	HUM-NC
NP	105	109	127	122
PRON	310	43	257	40
TOTAL	415	152	84	162
% NP	25.30	71.71	33.07	75.31
% PRON	74.70	28.29	76.93	24.69

Table 3: Distribution of Anaphors in English Recall Task

CONDITION	EVEN		ODD	
	HUM-C	HUM-NC	HUM-C	HUM-NC
REFERENT				
NP	96	102	97	105
PRON	273	69	290	73
TOTAL	369	171	387	178
% NP	26.02	59.65	25.06	58.99
% PRON	73.88	40.35	74.94	41.01

HUM-C = Human central character    HUM-NC = Human noncentral character

The experimental results reveal that the more central a referent, the more is attended to, the longer it stays in focus, and consequently the more frequently the inexplicit (or attenuated) anaphors, i.e., lexical and/or zero pronouns, are used to code and identify it. For example, Subject 5 in the English Odd recall task produced (1).

- (1) The child went outside. Just as he went around the corner, he saw **his** mother coming home with some groceries. So he stopped and asked **his** mother what was inside the bag. The **mother** then gave him one of the bags to carry and they proceeded on. He was following **her**. Then the curiosity of the boy got the better of him because he stopped. He had to see what was in the bag. He opened up the bag and out jumped this big lobster and scared him. So he put the lobster back in. Because he was scared, he was crying a little bit and picked up the bag, and followed **his** mother back into the house.

Here, lexical and zero pronouns are consistently preferred for the central character, with full NPs used for the non-central character even if gender could come into play. The differential use of anaphors between the central and non-central characters thus resulted in more NPs (35% of all intra-episode NPs) than expected occurring within the episode.

The second major factor to emerge in the exceptions to the hypothesis is that more NPs were used within the first episode (in which Alex appears with another child) than within the other two, probably because:

- At the beginning of the total recall task, subjects usually established and identified the participants with more NPs than expected.
- In the first episode, both of the participants appear in each of the eight pictures and both take part in the activities together; subjects thus tended to weigh both characters equally for centrality.
- For the English subjects (10 out of 20) who regarded the two children as being of the same gender, NPs had to be used often to distinguish between

the two characters. For example, Subject 4 in the English Even recall condition produced (2).

- (2) This appears to be three separate stories. The first story, (...) and in each of these stories, the story role is taken by a fat child with a pig-tail. In the first story, the child is playing tennis outside with another friend (um...), another little kid. And they were playing just outside a large house. The thinner child hit the ball towards the fat child, the fat child hit it and it went back toward the thin child. The thin child tried to get it, but missed. And the ball went into a window ...

Unable to differentiate between the two children in gender for the moment, the subject used full NPs to refer to both of the children throughout the retelling of the first episode. The first episode witnesses 30% of all intra-episode NPs.

The third factor to emerge was that some minor thematic discontinuity occurred within episodes: there are changes of scene, changes of participant, changes of perspective or point of view within each natural episode. Subjects tended to use NPs to signal these changes, i.e., to treat them as indicating sub-episodes in the story structure. For example, Subject 9 in the English Odd recall condition produced (3).

- (3) ...Then the final, the third event, the girl is out on the street and sees this woman coming toward her. And the woman might even be her mother carrying some groceries. And she stops and enquires, (...) she stops the woman and asks her about what bags she's carrying. (...) Well I guess she offers to carry one of the bags. And so the woman gives her a bag. / And then the little girl stops and lets the woman get farther ahead and around a corner. Then when the woman goes around the corner, she stops and she is curious about what's in the bag. She opens it up and a lobster jumps out ...

Here in the third episode, when Alex stops at the corner of the street with the woman walking out of sight, there is a shift of focus from the interaction of both characters to the action of Alex alone. This signals a sub-boundary or thematic discontinuity (as is indicated by a '/' in the above recall data), which the subject marked with an NP.

The above discussion of the counter-examples has shown that the differential use of anaphors by subjects during their narrative production not only reflects cognitive factors of attention and memory, but also directs the listener to identify uniquely the correct referent, the episode boundary, the change of participant and perspective, etc. Therefore, the counter-examples also appear to be 'rule-governed' since their occurrences depend on subjects' episodic organization of the story processing, the pragmatic status of the participants, the supposed needs of the listener, and the contextual and discourse information at hand.

## 5 CONCLUSION

The findings of the present experimental study demonstrate first that episodic organization of narrative production has psychological content: the story was memorized as a series of episodes. Second, episodes exist as memory chunks: an episode is remembered as a whole, and tends to be forgotten as a whole. Third, episodes are shown to be dominated by macropropositions: the paragraph level theme such as 'the boy swats the fly' governs the lower level propositions which are elaborations of the macroproposition. Fourth, the fact that the initial and the final episodes tend to be better remembered than the middle ones is also the manifestation of the effect of cognitive constraints on discourse production: initial information must form the foundation of the mental structure of the information being processed and it has a privileged place in a language user's mental representation (Gernsbacher 1989), while final information also has a privileged place in mental representation because of short-term memory constraints. Because of these privileged positions, initial and final information (or episodes in our study) are more resistant to being suppressed and they are more strongly enhanced and remembered. Finally, not only has the present hypothesis been supported, but in addition, it has been shown that the differential use of anaphors also has some important secondary functions in discourse production.

The present study further demonstrates that while stories and texts may be presented or produced in a linear fashion, they are nevertheless formulated and processed hierarchically as constrained by the cognitive processes of memory and attention. In this process, the episode serves as a basic unit in production as well as in comprehension. The different episodes of a discourse are subsumed under different macropropositions, which are properly connected by various connective devices (e.g. connectives, conjunctions, adverbs, etc.), and which are coherent to the overall macrostructure of the discourse. Nevertheless, the discontinuity between episodes is also marked in discourse processing. These results also strongly suggest that the status of the episode as a basic unit in discourse processing has some universal characteristics, since the results are so consistent across two vastly different languages. In general, the correlation between discourse organization and anaphoric patterning is crucial if we are to extend our understanding of the relationship between language and cognition.

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