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Temporal Accent Structure and the Remembering of Filmed Narratives

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Effects of temporal accent structure on the remembering of filmed narratives were examined by varying the placement and number of commercial breaks. Commercials either highlighted a story's underlying organization by occurring between major episode boundaries (i.e., at breakpoint locations) or obscured this structural arrangement by occurring within episodes (i.e., at nonbreakpoints). Relative to the accentuation of nonbreakpoints, results indicated that the attentional highlighting of episode boundaries yielded higher recall and recognition performance and better memory for temporal order information and details from the story's plot. Selective recall and recognition of breakpoint scenes was significantly higher than that of nonbreakpoints, suggesting that people use episode boundaries as referents for attending and remembering. These findings illustrate certain structural invariants across environmental events and ways in which event structure can be used in remembering.

In recent years, a growing amount of research has examined the impact of natural event structure on attending, perceiving, and remembering activities. One of the more interesting findings to emerge from this literature is that many events seem to share certain structural regularities. The type of regularity explored here concerns the joint relationship between temporal and nontemporal structure. That is, many events can be described in terms of a hierarchical arrangement in which lower order periodicities are lawfully nested within higher order units. In addition, this lawful organization of nontemporal information is typically highlighted by the event's temporal structure and patterns of rhythmic accentuation. As outlined below, this type of structural arrangement has been extensively investigated in the auditory environment, where analyses of speech and music reveal patterns of stressed intonation that coincide with "grammatical" phrase boundaries. The goal here is to investigate this phenomenon within another naturalistic setting, namely the viewing of visual stories (i.e., films). By imposing an external rhythm on films in the form of commercial breaks, a joint hierarchy of structure results and allows one to compare its impact on cognitive behavior with that of similarly structured events. This in turn may suggest some ways in which perceiving and remembering processes are linked to a common attentional scheme, and ways in which event structure in general is used to guide remembering. This type of behavior is argued to be adaptive from a cognitive-evolutionary perspective in that a common set of strategies can be applied to a wide variety of events.

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Joint Structural Relations Within the Auditory Environment

The temporal patterning of events is perhaps most obvious in the auditory environment, where the perceptual pickup of speech, music, and other acoustical events is necessarily serial in nature. Many researchers have noted the joint relationship between temporal and nontemporal structure within these events and its impact on cognitive performance. This literature is briefly reviewed for two purposes: first, to illustrate the nature of hierarchical structuring and ways in which this organization is attentionally highlighted by markers of nested relations; and second, to relate how perceiving and remembering activities are influenced by systematic variations of event structure. This discussion focuses primarily on music because its structural relations have been well documented and perhaps best exemplify the potential impact of temporal patterning on cognitive behavior. The end goal is to subsequently demonstrate parallels between auditory events and social situations where people engage in goal-directed activities.

Music

Most music theorists agree that the underlying organization of a tune derives from its tonality scheme. Tonality refers to the underlying scale in which a melody is written, which in turn constrains what particular notes will appear in a melody and how they are ordered in time. For example, a melody may be written in the key of F major, indicating that its tonal intervals are derived from the F major diatonic scale. To a large extent, a listener is able to infer a melody's tonality scheme from the use of tonic triad members at certain nonarbitrary locations within a tune. The *tonic* refers to the underlying key in which a melody is written (e.g., F for a melody in the key of F major), and together with the mediant (A) and dominant (C), these three intervals form the melody's major chord, the *tonic triad.*

One of the more important functions of these intervals is to mark melodic phrase endings within a tune. Melodic phrases represent variations of previous melodic lines or shifts toward new ones, and these are typically arranged in a hierarchical fashion. For example, the folk tune depicted in Figure 1 displays four melodic phrases marked by the dominant, mediant, mediant, and tonic, respectively. Each phrase recurs after every 6 beats of time, and these in turn are nested within higher order melodic spans of 12 beats. Phrase endings thus serve to reveal a melody's overall organization and relations among both adjacent and nonadjacent notes. They also act as summary points of a melody by reaffirming the underlying tonality scheme and marking the array of melodic variations.

In most Western music, the layout of melodic phrase structure is attentionally highlighted through rhythmic accentuation (Berry, 1976; Cone, 1968; Piston, 1978). Rhythm refers to the relative patterning of temporal accents that arise from prolonged tonal durations and/or lengthened pauses. For example, the melody in Figure 1 displays accents (*t*) after every third note that arise from the relatively longer dotted quarter notes (♩.). Temporal accents are considered to be psychologically important because they capture attending and direct it toward the corresponding melodic information. In particular, the accentuation of phrase endings results in a joint accent structure that focuses attending on the underlying tonal organization of a tune and the hierarchical nesting of melodic relationships (Boltz, 1991a; Boltz & Jones, 1986; Lerdahl & Jackendoff, 1983; Monahan & Carterette, 1985; Yeston, 1976). In addition, others have argued that joint accent structures provide a structural basis for anticipatory attending and the generation of expectancies. Because joint accents recur with temporal regularity, a listener is able to anticipate not only the "what" of upcoming accents but also "when" they should occur (Jones, 1976, 1981, 1982; Jones & Boltz, 1989).

Of most relevance to the present research is the effects of joint accent structures on memory performance. In a recent study by Boltz (1991a), subjects were asked to recall a set of folk tunes that varied in rhythmic accent structure and referents of tonality. Results showed that overall recall was facilitated by tonic triad members marking phrase endings, but only when their presence was highlighted by a corresponding pattern of temporal accentuation. Subsequent error analyses also revealed that recall was highest at phrase ending points, suggesting that these acted as anchors for remembering and facilitated the retrieval of lower order relations among notes. Conversely, recall significantly declined when tonality information was either absent or obscured by rhythmic structure. Intervals marking phrase ending points were less apt to be retrieved, and a high incidence of missing notes and fragmented relations were revealed. Similar effects have also been reported by both Deutsch (1980) and Boltz and Jones (1986).

These results are interpreted within a framework that links the acts of perceiving and remembering to a common attentional scheme. The basic idea is that the same structural relations used to guide attending and perceptual pickup are used to recapitulate the event's sequence of items. Joint accent structures offer particularly efficient schemes for perceiving and remembering because the overall hierarchical arrangement of nested relations is attentionally outlined. By using patterns of temporal accentuation to guide attending, the inherent meaning or gist of the event will be revealed, as well as adjacent and nonadjacent relations within the underlying organizational scheme. Similarly, by recapturing the event's original rhythm, temporal accents will illuminate regularly recurrent landmarks for remembering in the form of phrase endings. These nonarbitrary markers of nested relations offer cognitive anchors from which to recapitulate both higher order phrase relations and lower order relations among adja-

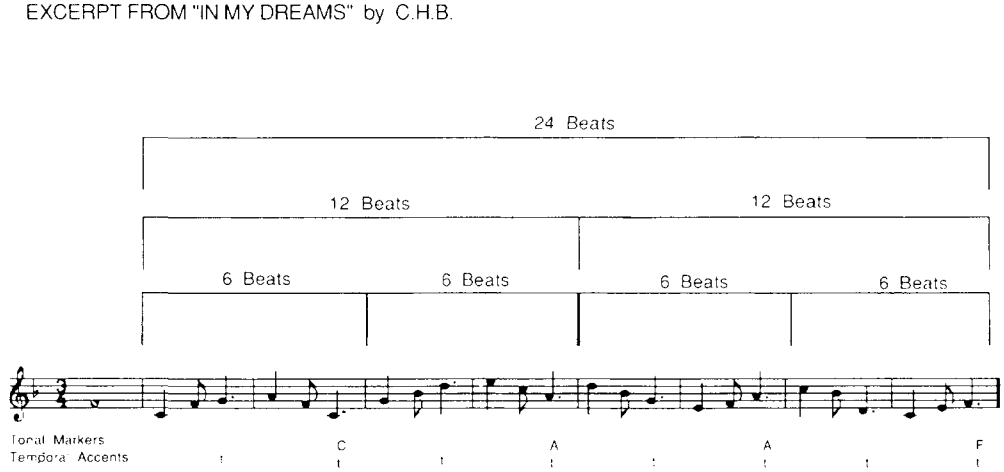

Figure 1. Example of a musical composition displaying a hierarchical arrangement of melodic–temporal structure. (This melody opens and closes on the tonic note, F, and thereby displays tonal resolution [Boltz, 1989a, 1989b; Kramer, 1982; Meyer, 1956]. Within this total time span, sequences of notes are nested within four melodic phrases marked by tonic triad members [the dominant, mediant, mediant, and tonic, respectively]. Phrase endings are attentionally highlighted by temporal accents [♩.], and both regularly recur in time to outline higher order phrase relations.)

cent items. Unsuccessful retrieval schemes, on the other hand, arise from less lawful relations between temporal and nontemporal structure. Attending and subsequent remembering become misguided in these situations because the dissociation of temporal and nontemporal accents creates various levels of change that occur unpredictably in time. In effect, there is no apparent organization within the event or any salient referents to guide cognitive behavior.

Although this framework was originally proposed to explain the remembering of music, it has applications for a wider range of events within the natural environment. One of the more obvious is speech. The grammatical structure of a speech utterance is typically described in terms of a hierarchical arrangement where successive words are nested within higher order clauses such as noun and verb phrases (Chomsky, 1957, 1965). The temporal structure of speech reinforces this hierarchy in that pauses and hesitations are not only longer and more frequent at clause boundaries (Goldman-Eisler, 1972; Grosjean, Grosjean, & Lane, 1979), but patterns of stress and intonation regularly recur in time and coincide with high-content words (Martin, 1972; Shields, McHugh, & Martin, 1974).

The goal of the present research is to investigate whether similar effects of temporal–nontemporal relations also generalize to the social environment and the viewing of visual stories. Such findings would illustrate that certain structural regularities apply to many natural events, which in turn has implications for the kinds of strategies used for perceptual pickup and subsequent remembering.

Structure of Stories and Action Events

To understand a story, two types of knowledge structure must be invoked (Brewer & Lichenstein, 1981, 1982; Lichenstein & Brewer, 1980; Mandler & Johnson, 1977). The first is knowledge about what people do in various situations and the sequence of actions required to achieve a given goal. Some theorists have referred to this as *plan understanding* (Brewer & Lichenstein, 1982). The second is knowledge about the structure of a story itself. This is typically referred to as a *story scheme* and reflects a tacit understanding about how stories should be organized for purposes of entertainment, persuasion, or relating information. As the following discussion illustrates, plans and story schemes both display an intrinsic organization that can be described in terms of a hierarchical arrangement.

One of the earliest studies demonstrating the psychological reality of structured action units was performed by Bower, Black, and Turner (1979). In these experiments, subjects were given short scenarios of various goal-directed events (e.g., visiting a dentist or doctor, going to a restaurant, etc.); for each, they were asked to relate the sequence of actions required to perform such activities. Results indicated extremely high intersubject agreement on both the ordering of actions as well as the boundaries of action units. Furthermore, this data was also highly correlated with a second study, where subjects were presented with the entire event scripts and asked to demarcate these into "natural chunks." Given this overall pattern of results, Bower et al. (1979) concluded that action units are hierarchically nested where different hierarchical levels reflect the varying importance of goals and subgoals.

A similar conclusion was made by Newtson and his colleagues (Newtson, 1973, 1976; Newtson & Engquist, 1976). The strategy within this research is to present 5–12–min videos of simple activities (e.g., a person answering a phone or searching for a lost item) and asking subjects to use button presses to identify *breakpoints* or boundaries between component actions. Results not only reveal a high degree of consistency between subjects but evidence for varying levels of analysis. That is, depending on the type of instructions (Newtson, 1973; Newtson & Rindner, 1979), the degree of predictability within events (Newtson, 1973; Wilder, 1978), or the overall rate of the event (Newtson & Rindner, 1979), subjects will either attend to "fine units" encompassing details of the event or "gross units" spanning over larger action units. Again, such results suggest a hierarchical nesting of action events in that the same breakpoints identified by gross-unit trackers are among those of fine-unit trackers.

Some of the most interesting findings to emerge from Newtson's research are those concerning the impact of breakpoints on cognitive behavior. In a series of studies by Newtson and Engquist (1976), the perceptual processing of breakpoints and nonbreakpoints was compared by presenting subjects with filmed scenarios in which certain actions were omitted either at unit boundaries or locations within a unit. Subjects were much more accurate at detecting deletions at breakpoints, suggesting that action boundaries provide the basis for perceptual units. Subsequent studies further support this notion in that breakpoints, relative to nonbreakpoints, not only yield better recognition memory but also memory for the temporal ordering of scenes.

In summary, the previous literature indicates that people's actions can be described in terms of meaningful units that form super- and subordinate relations. Perceivers are sensitive to this structure and appear to rely on markers of nested relations to guide cognitive processing.

When depicting action sequences within a narrative, most authors conform to an underlying structural scheme known as a *story grammar.* According to Thorndyke (1977) and others (e.g., Mandler & Johnson, 1977; Rumelhart, 1975; Stein & Glenn, 1979), this grammar can be described in terms of a hierarchical arrangement in which there are four major superordinate relations: setting, theme, plot, and resolution. The theme specifies the overarching goal of the story (e.g., whodunit in a mystery novel) that unfolds against a setting of a particular time, location, and cast of characters. The plot provides the overt surface structure of a story by relating a series of episodes in which activities are oriented toward various subgoals critical to the story's resolution. Several researchers have demonstrated the psychological reality of this scheme by noting declines in memory performance as a function of incorrect orderings, deletions, or a lack of relations among story elements (e.g., Kintsch, Mandel, & Kozminsky, 1977; Stein & Nezworski, 1978; Thorndyke, 1977). Others have reported a levels effect in which the memory of a particular episode can be predicted from its relative position in the hierarchical framework (e.g., Johnson, 1970; Kintsch, Kozminsky, Streby, McKoon, & Keenan, 1975; Meyer &

McConkie, 1973; Thorndyke, 1977). Here, it is suggested that the accentuation of different hierarchical relations within a story's structure may also exert an influence on memory performance.

Accent Structures in Stories

Although the concept of rhythm is typically not associated with narrative structures, a pattern of temporal accents can arise whenever one pauses or takes a break during the unfolding course of a story. This sequence of breaks over time serves as a type of external rhythm in which the corresponding story elements are attentionally highlighted. One of the more compelling illustrations of this phenomenon can be found in the viewing of visual stories. Given a society in which television is a major medium of advertising, viewers must often endure commercial breaks while watching a film. The question addressed here is, does it matter where commercial breaks occur in a film?

The music literature discussed earlier provides a basis from which to generate a set of specific predictions. First, commercials coinciding with higher level episode boundaries should yield superior comprehension and memory performance. This type of structural relationship forms a joint accent structure where patterns of temporal accents (i.e., commercial breaks) highlight the underlying organization of the story and the hierarchical nesting of story elements. In addition, this type of external rhythm should facilitate the ability to make coherence and memory-unit inferences that are critical for story understanding (Black, Galambos, & Read, 1984). That is, because commercials occur between episodes, this will enable one to infer relations between goals and patterns of activity as well as causal relations that occur within the episode itself. This then allows one to integrate events and activities at lower levels within the story grammar. Memory-unit inferences should also be facilitated because the accentuation of higher order episodes will highlight relations between various episodes of a plot as well as relations to the overarching theme.

This type of rhythmic accent structure is also predicted to yield better performance than conditions in which no commercials occur at all. In this latter case, there is no external rhythm to attentionally highlight the story's organization, and so performance should be somewhat lower relative to compatible accent conditions. This parallels situations in music where it has been found that isochronous rhythms (i.e., devoid of temporal accents) yield lower levels of melody recall than rhythms that accentuate important tonal relations (Deutsch, 1980).

Finally, the lowest performance levels should occur in conditions where commercial breaks obscure the story's underlying organization and relations among story elements. This type of rhythm arises when commercials appear within episodes. Here, accents fail to coincide with the hierarchical nesting of structure, and this in turn will disrupt the ability to make inferences about both lower and higher order relationships. Attending and comprehension become misguided, and the underlying story grammar no longer provides an effective retrieval scheme.

There is a second issue of interest, and it concerns effects due to the number of commercial breaks within a televised story. This variable is predicted to interact with the manipulation of commercial placement in a nonordinal fashion. That is, an increasing number of commercials coinciding with nested story elements should improve performance because a larger portion of the story's organization is attentionally highlighted. In contrast, the opposite effect should occur when commercials conflict with the story's hierarchical arrangement. Here, an increasing number of commercials serves to further obscure relations among story elements and disrupt processes of comprehension and remembering.

These ideas are assessed in the present experiment by manipulating both the placement and number of commercials within a televised film. Although films have traditionally not been used to investigate issues of discourse comprehension, the visual depiction of stories offers a richness of information that cannot be surpassed by written narratives. The particular films selected for this study were two 40–45-min episodes from a miniseries entitled *The Perfect Spy*. A set of zero, three, or six commercial breaks was then inserted at locations that a preliminary group of subjects had identified as breakpoint or nonbreakpoint locations. The former represent boundaries between higher level episodes that are particularly important to the story's overarching theme. From the perspective of filmmakers, episodes depict a series of individual camera shots in which activities are directed toward a common subgoal within a particular setting. Episode boundaries are therefore defined as *cuts* or transitions toward new scene settings and classes of activities (Bordwell & Thompson, 1979; Gianetti, 1982; Kraft, 1986). Nonbreakpoints, on the other hand, occur at a much lower level within the hierarchical arrangement of story structure. Within the present experiment, these are defined as boundaries between activities within an episode and correspond to cuts between individual shots.

After viewing one of these different film versions, subjects are then asked to perform a series of memory tasks that are carefully ordered to minimize any carryover effects. The first is a serial recall task where subjects are asked to provide a written recall of the plot's episodes. The goal is to assess not only overall recall performance but also the kinds of errors that appear as a function of the experimental manipulations. Selective recall at breakpoint–nonbreakpoint locations is also of interest to determine the extent to which these act as anchors for remembering. The second task is one of recognition memory in which subjects are asked to discriminate old breakpoint–nonbreakpoint scenes from new, distractor scenes. Results are predicted to converge with the recall data, as well as Newtson and Engquist's (1976) research reporting that breakpoints are better recognized than nonbreakpoints. A third task involves recognition of temporal order information. Subjects are presented with pairs of scenes that originally occurred at different break or nonbreakpoint locations and asked to determine which scene appeared first within the film. This task is also designed as a converging operation for the recall data and assesses whether breakpoints act as more effective referents for remembering the ordering of story elements. The final task consists of asking subjects to remember

where in the film each commercial break previously occurred. Findings here are predicted to converge with research by both Sloboda and Gregory (1980) and Garret, Bever, and Fodor (1966), who found that the location of clicks superimposed on a melody or speech utterance are consistently misperceived as occurring at phrase boundaries. If these results generalize to the present study, then commercials originally occurring at nonbreakpoints will be erroneously remembered as appearing at breakpoint locations.

Method

Design and Subjects

The design was a 2 × 2 × 2 between-subjects factorial. Subjects viewed one of two films that varied in both the number (three or six) and location of commercial breaks (breakpoint or nonbreakpoint locations). Two control groups were also included in which a version of each film containing no commercials at all was presented.

One hundred subjects from an introductory psychology course at Haverford College participated in the experiment in return for course credit. Ten subjects were randomly assigned to 1 of the 10 between-subjects conditions.

Stimulus Materials

The films selected as experimental stimuli were two 40–45-min installments from *The Perfect Spy* miniseries, based on the book by John Le Carre.[1] As seen in Appendixes A and B, both were relatively equal in complexity in that each contained two to three subplots within the overall story. In addition, each film displayed 20 different episodes marked by distinct shifts in scene setting and a new sequence of goal-directed activity. Although each film was part of a longer miniseries, each qualified as a story in that the two installments began at different points in the protagonist's life and showed resolution of the plot's conflicts. The two films in their original versions did not contain any commercials.

To determine the location of breakpoints and nonbreakpoints within each film, a preliminary rating study was conducted with an independent group of 12 subjects. As they watched one of the two films and later reviewed it, they were asked to select at least six episode boundaries that represented "major shifts in the story's plot, that is, shifts in major idea units," and to rate the certainty of each selection on a 7-point scale ranging from *very uncertain* (1) to *very certain* (7). Those six locations most consistently and confidently selected as episode shifts were identified as breakpoints. Nonbreakpoints represented shifts between individual action shots and thereby coincided with the boundaries of lower level action units within an episode. These were selected from those locations never identified in the preliminary rating study and were subsequently validated by a group of three independent judges. Break and nonbreakpoint locations for each film are shown in Appendixes A and B.

Twenty-four different commercials were recorded from network television and arranged into six sets of four commercials each with a total duration of 2–2½ min. These commercial sets were then inserted into each film such that they coincided with the three or six break or nonbreakpoint locations. In all conditions, the amount of time between successive commercial breaks was relatively constant.

Stimuli for the recognition memory task consisted of 24 randomly ordered film clips, each approximately 3 s in duration with a 5-s blank screen between each clip. For each of the two films, 12 of the clips were "old"; of these, 6 corresponded to a scene immediately before or after the six breakpoints, and 6 were scenes immediately before or after the six nonbreakpoints. The remaining 12 scenes were "new" and represented scenes before or after breakpoint–nonbreakpoint locations from the second film.

Finally, stimuli for the temporal order recognition task consisted of 20 pairs of film clips arranged in a random order. Each clip was approximately 3 s in duration with a 3-s blank screen between the two clips of a pair. A 7-s blank screen was also used to separate one pairing from another. For five of the pairs, both clips represented scenes immediately before or after one of the six breakpoints (B–B), whereas in another set of five, both scenes were from locations immediately surrounding one of the six nonbreakpoints (N–N). In the remaining pairs, a breakpoint scene was paired with a nonbreakpoint scene and occurred either in the initial (B–NB) or secondary position (NB–B) of a pair. In all cases, the two film clips within a pair were extracted from adjacent (non)breakpoint locations (e.g., BP4–BP3) and across the entire set of stimuli, there were an equal number of trials in which the first (or second) scene of a pair had originally occurred before (or after) the second scene.

Apparatus

A Panasonic AG-1950 Editing System was used for the construction of stimulus materials. During the actual experiment, films were presented on a JVC HR-D320 videocassette recorder (VCR) interfaced with a 19-in. (48.3-cm) Toshiba C990 television. When testing more than 1 subject at a time, the Panasonic Editing System and a Sharp XA205 VCR interfaced with a 19-in. (48.3-cm) GE 8–1902 television were also used to test subjects individually during the last task.

Procedure

Subjects were instructed that they would be watching an episode from a filmed miniseries entitled *The Perfect Spy* and asked afterward to perform several different tasks. The nature of these tasks was not disclosed, and those subjects familiar with the miniseries (or book) were dismissed from the experiment.

Recall task. Immediately following the presentation of a given film version, subjects were initially asked to estimate how much time, to the nearest minute, seemed to have passed between the film's beginning and end. They were then asked to give a written recall of the story on a blank sheet of paper. Subjects were told to provide a detailed description of all episodes in the order that they had occurred. Episodes were defined as "story units representing a common set of goal-directed activities occurring at a particular time and location, and so a new episode occurs whenever there is a shift toward a new set of activities and scene setting." Subjects were informed that if the exact location of an episode could not be remembered, then they should indicate its approximate position relative to other episodes. All subjects were given 20 min to complete this task.

Recognition task. Following the recall task, subjects were presented with a series of 24 film clips and asked to decide whether each was "old" or "new" by circling the appropriate judgment on a response sheet. Subjects were instructed that old scenes had appeared in the film they had just viewed and that new scenes were from other

[1] *The Perfect Spy* miniseries was produced by BBC-TV Productions. The use of all filmed material in this experiment conformed to the specifications of the House Report on piracy and counterfeiting amendments (H.R. 97–495, pp. 8, 9).

episodes of the miniseries. They were asked to be very careful in making these judgments because the new scenes often depicted the same characters and physical locations they were familiar with. In addition to making an old–new judgment on each trial, subjects were also asked to indicate the certainty of this response on a 7-point scale ranging from *very certain* (1) to *very uncertain* (7). This task took approximately 5 min to complete.

Recognition of Temporal Order Information

In the third task of the experiment, subjects were presented with 20 sets of paired film clips and asked to decide which of the two scenes within a pair, A or B, had appeared first in the original presentation of the film. These judgments were indicated on a response sheet along with a confidence rating on a 7-point scale. This task took approximately 8 min to complete.

Recall of Commercial Locations

The final task required subjects to remember where in the film each commercial break had occurred. Here, each subject was sent to one of four individual viewing rooms, in which a film version with no commercials was presented. Subjects were then asked to fast-forward through the film until they reached those locations where they remembered commercials as having occurred. At each location, they were asked to write down the number on the VCR counter display and to write a very brief description of those scenes immediately preceding and following the selected commercial break. Subjects were allowed to fast-forward through the film as often as they wished and were not told how many commercials had actually occurred in the version they had viewed earlier. A 15-min time period was provided to complete this task.

For all tasks, subjects were tested in groups of 1 to 4 except in the last task, in which subjects were tested individually.

Results and Discussion

The time estimation data were collected for another series of studies and are presented elsewhere (Boltz, 1991b). Data from the various memory tasks were analyzed separately through a series of analyses of variance (ANOVAs). In all cases, mean performance was collapsed over the two different film instances because this variable contributed negligible effects ($F < 1.0$). The results from each task are addressed in turn.

Overall Recall Performance

For each subject, response protocols were scored, on an all-or-none basis, for the percentage of episodes (out of a possible 20) that were correctly recalled. Most subjects provided a 1–2-sentence description for each episode, and these were evaluated by three naive judges relative to the outlines in Appendixes A and B. Unanimous agreement was required among all judges for a given episode to be categorized as "correct." All errors within this overall analysis are strictly due to scene omission in that subjects never included a novel scene in their written protocols. Other errors due to the incorrect ordering of episodes and the inclusion of novel details are reported later.

The most important finding to emerge from this overall analysis is that the placement of commercials within filmed narratives exerts a significant impact on recall performance, $F(1, 72) = 95.12$, $p < .001$, $MS_e = 39.96$. As seen in Figure 2A, recall is significantly higher when commercials coincide with episode boundaries than when commercials occur within episodes to obscure the story's underlying organization. A set of Dunnett comparisons (p level set at .05) further indicates that the attentional highlighting of episode boundaries produces better recall than films with no commercials at all. However, performance in this latter condition is better than that of nonbreakpoint conditions, where commercials clash with the story's underlying structure.

The second notable finding from this analysis is that the number of commercials exerts a differential impact on conditions of commercial placement, $F(1, 72) = 10.0$, $p < .01$, $MS_e = 39.955$. Figure 2A reveals that performance significantly improves when an increasing number of commercials coincides with breakpoints demarcating the hierarchical arrangement of structure. Conversely, the opposite effect occurs in nonbreakpoint conditions. Here, an increasing number of commercials serves to obscure further the story's underlying organization, and recall declines significantly. These differences were confirmed with a set of Bonferroni post hoc comparisons (p level set at .05).

Recall of Episodes at Commercial Locations

From the perspective offered here, the impact of commercials on overall recall performance can be attributed to the more general effects of temporal accentuation. Temporal accents, in the form of commercials, are assumed to highlight corresponding nontemporal information and when these result in a joint accent structure, to thereby facilitate attending and subsequent remembering. Hence, it is of interest to examine recall performance at those locations where commercials originally occurred. This was done by performing two types of analyses. The first considers the recall of episodes that immediately preceded and followed a commercial at breakpoint locations. The second examines the recall of episodes in which a commercial occurred within the episode itself (i.e., at nonbreakpoint locations). Each is addressed in turn.

As the upper values of Table 1 illustrate, the recall of breakpoint episodes yields a significant interaction with both the placement and number of commercials, $F(1, 72) = 16.94$, $p < .01$, $MS_e = 58.37$. First, consider the breakpoint conditions where commercials occurred at the boundaries of these adjacent episodes. Recall is quite high here and in fact is 100% for episodes surrounding the three commercial breaks. Performance is somewhat lower for the 12 episodes surrounding the six commercial breaks but significantly so only for those subjects who viewed three commercials in their original film version (Bonferroni post hoc comparisons set at $p < .05$). Half of the episodes in this latter condition were not attentionally highlighted by commercials, and so recall is significantly lower relative to the six-breakpoint condition, where all episodes were accentuated.

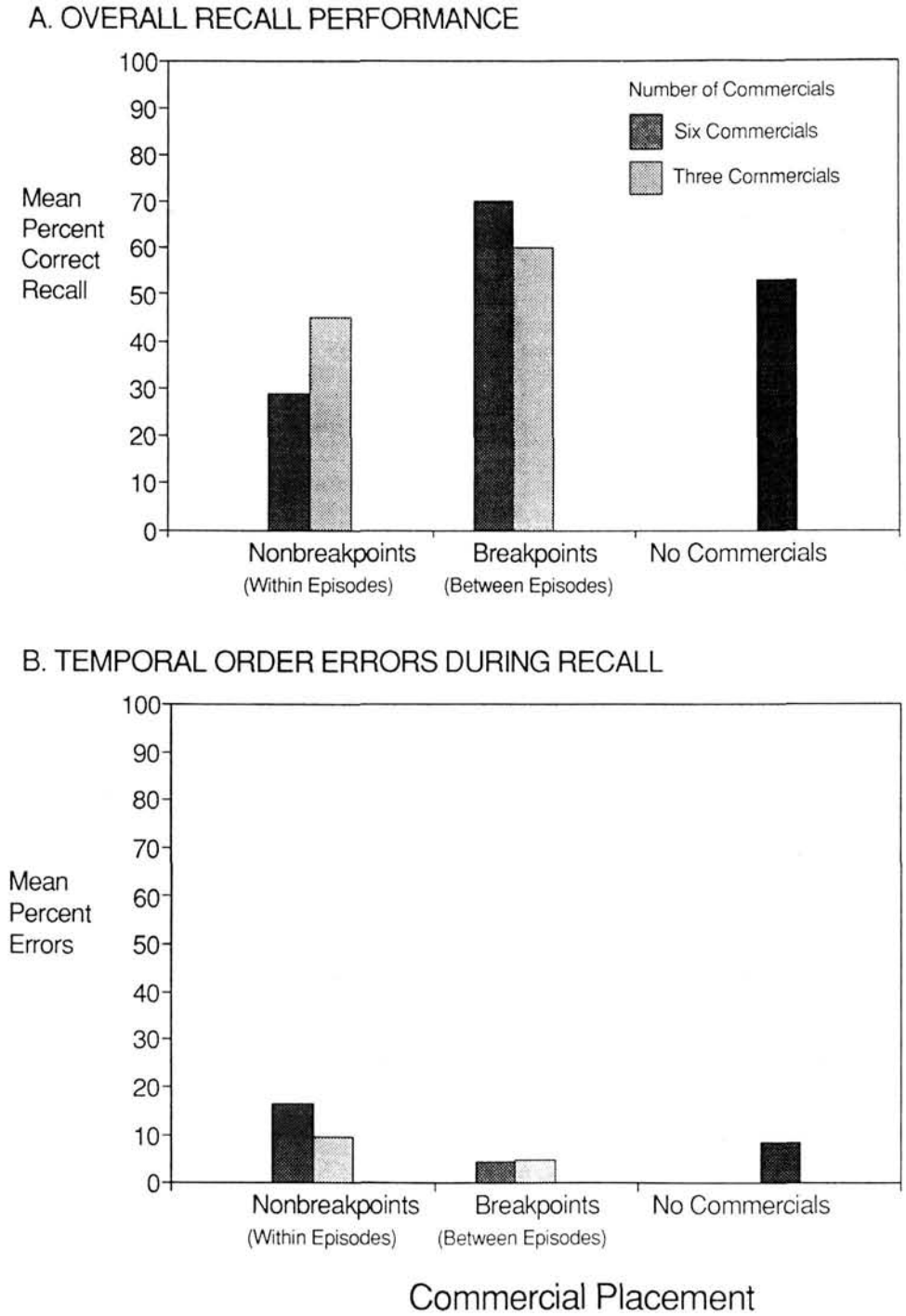

Figure 2. Panel A depicts mean percentage correct recall for episodes as a function of the placement and number of commercials. Panel B illustrates the mean percentage of episodes that were misordered during the serial recall task.

A different pattern of results emerges in the nonbreakpoint conditions in which commercials did not highlight the episodes of interest. As seen in Table 1, recall of breakpoint episodes is significantly worse here and ranges between an accuracy level of 35% to 47%. Subjects viewing six commercials in their original film version show significantly lower recall than those viewing only three commercials, suggesting that a greater number of ill-timed accents further obscures important elements within the story's scheme. Finally, a series of Dunnett comparisons ($p < .05$) were conducted to assess performance in the no-commercial condition. Results indicate that although recall is significantly lower than that of the

Table 1
Mean Percentage of Recall of Episodes at Breakpoint and Nonbreakpoint Locations as a Function of the Placement and Number of Commercials

Episode	Commercial placement: Breakpoints, Three	Breakpoints, Six	Nonbreakpoints, Three	Nonbreakpoints, Six	No commercials
Recall of breakpoint episodes					
Episodes before and after the three breakpoints	100%	100%	47%	38%	58%
Episodes before and after the six breakpoints	83%	92%	45%	35%	61%
M	92%	96%	46%	37%	60%
Recall of nonbreakpoint episodes					
Three nonbreakpoint episodes	83%	89%	54%	56%	47%
Six nonbreakpoint episodes	77%	86%	43%	47%	45%
M	80%	88%	49%	52%	46%

breakpoint conditions, it is nevertheless significantly better than that of nonbreakpoint conditions.

The lower panel of Table 1 depicts the memory for nonbreakpoint episodes in which commercials appeared. A main effect for commercial placement was obtained, $F(1, 72) = 10.42$, $p < .01$, $MS_e = 62.44$; it reveals that the memory of these episodes is significantly better when commercials originally coincided with breakpoint locations. Thus, this indicates the accentuation of nonbreakpoint episodes does not lead to better memory performance. Although commercials occurred within these episodes in the nonbreakpoint conditions, performance is significantly worse here than in the breakpoint conditions and comparable to that of the no-commercial condition.

In sum, this latter set of results indicates that rhythmic accents do not always serve to attentionally highlight and facilitate subsequent remembering. It is only when accents coincide with nested levels of nontemporal information that performance benefits. Joint accent structures not only improve the memorability of major episodes within a story (i.e., breakpoint locations), but they also yield a better memory for less important episodes (i.e., nonbreakpoint loci) than do conditions in which these latter episodes are attentionally highlighted by commercial placement.

The next analyses assess the kinds of errors that occur in recall performance as a function of the experimental manipulations. Of most interest is the extent to which the temporal ordering of episodes is preserved in memory as well as details from the story's plot.

Errors of Temporal Order

Within this analysis, response protocols were scored by the three judges for the percentage of episodes that were misordered during serial recall. This scoring technique was a fairly lenient one in which any given episode recalled out of sequence relative to other episodes was simply counted as one error. For example, if a sequence of episodes was recalled as ABFDEGHCI, then only the C and F episodes were considered errors. Similarly, the transposition of two adjacent episodes (e.g., HG) was counted as one error and not two. The results of this analysis are depicted in Figure 2B as a function of the experimental manipulations.

An overall ANOVA revealed a main effect for commercial placement, $F(1, 72) = 17.37$, $p < .001$, $MS_e = 25.07$, and showed that scene order is better remembered when commercials coincide with breakpoints than with nonbreakpoint locations. Films containing no commercials yield an intermediate level of performance such that significantly more errors occur than in breakpoint conditions but significantly fewer errors occur than in nonbreakpoint conditions. Figure 2B also reveals a significant interaction between placement and number of commercials, $F(1, 72) = 16.7$, $p < .001$, $MS_e = 25.07$. When commercials coincide with episode boundaries, the number of commercials exerts no impact on the frequency of temporal order errors. However, this variable does influence memory when commercials occur within episodes. In this case, six commercial breaks yield significantly more errors than three breaks.

Recall of Erroneous Details

This final analysis assessed the frequency with which erroneous information occurred within recall protocols. Three judges, who were naive to the purpose of the experiment, were asked to identify any false details that appeared when scoring the recall data. Although the total number of errors across all subjects was relatively small, the judges were able to discern three distinct categories of errors that were independent of one another. The most common class, accounting

for 45% of the total number of errors, involved confusions about which particular character performed a given action. The next most frequent errors reflected erroneous inferences about characters' motivations and why a particular action was performed (29%) or where a given episode occurred (18%).

An overall ANOVA shows that these three types of errors are not differentially distributed across experimental conditions but that the total number of errors does vary with commercial placement, $F(1, 72) = 21.25$, $p < .001$, $MS_e = 1.12$. Errors are more frequent within nonbreakpoint ($\bar{x} = 1.75$ errors per subject) and no-commercial conditions ($\bar{x} = 1.31$) than within breakpoint conditions ($\bar{x} = 0.375$). The number of commercials exerts no significant effects within this analysis.

Recognition Memory

Results from this task are predicted to converge with the recall data and indicate that scenes immediately preceding and following a breakpoint are better recognized than scenes surrounding a nonbreakpoint. This was evaluated through two types of analyses. The first examined percentage of correct recognition for old and new scenes. The second assessed unbiased recognition accuracy through Ag scores. This analysis incorporated confidence ratings into nonparametric receiver operating characteristic values and yielded measures of sensitivity and bias (Davison & Jagacinski, 1977).

Recognition accuracy. First, consider the percentage accuracy data presented in Table 2 as a function of scene type, placement, and number of commercials. As the column means illustrate, recognition memory varies with the placement of commercials, $F(1, 72) = 42.46$, $p < .001$, $MS_e = 0.501$ such that commercials occurring between episodes yield better overall performance than those occurring within episodes. Dunnett comparisons ($p < .05$) reveal that the no-commercial condition once again produces an intermediate level of accuracy. There is also a main effect for scene type, $F(3, 72) = 18.6$, $p < .001$, $MS_e = 0.628$, in which new scenes are better recognized than old scenes and, more important, old breakpoint scenes are better remembered than old nonbreakpoint scenes (Bonferroni, $p < .05$). This latter finding, however, interacts significantly with both the placement and number of commercials, $F(3, 72) = 5.07$, $p < .01$, $MS_e = 0.551$. As shown in Table 2, when commercials coincide with episode boundaries, scenes surrounding old breakpoints yield higher performance than those surrounding old nonbreakpoints. This is also true in the no-commercial condition. This effect, however, does not maintain when commercials occur within episodes where recognition accuracy is comparable across the two old scene types. Results also indicate that subjects in the nonbreakpoint conditions are significantly more accurate at identifying new scenes than old scenes. This suggests the mediation of response bias effects, where subjects are simply more apt to say new on a given trial. Finally, the number of commercials within a film exerts a significant impact on performance, although this is localized within the nonbreakpoint condition. When commercials occur within episodes, three commercial breaks yield higher recognition accuracy than six commercials for both old breakpoint and nonbreakpoint scenes. The number of commercials, however, has no impact within the breakpoint condition.

Ag analysis. Given that the recognition accuracy data appear to be influenced by response bias effects, an *Ag* analysis was conducted to obtain independent measures of bias and sensitivity. This analysis relies on a technique developed by Davison and Jagacinski (1977) that pools old and new responses relative to confidence ratings. Values of 1.00 reflect perfect discrimination, whereas values of .50 represent random guessing. Bias scores estimate the median confidence level for a given condition when the 7-point confidence scale is converted to a 14-point scale ranging from sure-old (1) to sure-new (14). Thus, a score of 7.00 reflects no bias.

The results of this analysis are depicted in Table 3. Consistent with the recognition accuracy data, discriminability varies across conditions of commercial placement, $F(1, 72) = 59.6$, $p < .001$, $MS_e = .769$, such that commercials occurring between episodes yield better performance than those occurring within episodes. An intermediate level of discriminability is found within the no-commercial condition. The overall ANOVA also reveals a significant interaction between placement of commercials and scene type, $F(3, 72) = 23.9$, $p < .001$, $MS_e = .582$. As seen in Table 3, breakpoint scenes are better recognized than nonbreakpoint scenes when commercials occur at episode boundaries. This effect, however, does not emerge when commercials are either absent from a film or occur within episodes; here, discriminability is comparable across break and nonbreakpoint scenes. Although there was a tendancy for the number of commercials to exert a similar influence as found in the recognition accuracy data, the effects of this variable were nonsignificant.

Table 2
Mean Percentage of Recognition Accuracy as a Function of Scene Type, Placement, and Number of Commercials

	Commercial placement				
	Breakpoints		Nonbreakpoints		No commercials
Scene type	Three	Six	Three	Six	
Old breakpoints	96%	97%	73%	62%	81%
Old nonbreakpoints	82%	85%	73%	60%	71%
New breakpoints	98%	97%	85%	84%	95%
New nonbreakpoints	95%	92%	86%	88%	90%
M	93%	93%	79%	74%	84%

Response bias scores are also depicted in Table 3 and show that bias effects do vary as a function of commercial placement, $F(1, 72) = 31.4$, $p < .001$, $MS_e = .632$. Relative to the breakpoint conditions, scores are significantly higher in the nonbreakpoint conditions and indicate that subjects are more inclined to produce "new" judgments across all experimental trials.

In summary, recognition memory performance within this experiment closely converges with that of episode recall. Results indicate that the accentuation of story structure yields not only better recall of the story's episodes but also better recognition of scenes that occur both between and within episodes.

Recognition of Temporal Order Information

In this task, subjects were presented with pairs of scenes and asked to identify which had occurred first in the original presentation of the film. Results are predicted to converge with the recall data and show that breakpoint scenes are more effective referents for remembering temporal order information.

As illustrated by the column means of Table 4, the overall level of accuracy on this task varies with commercial placement, $F(1, 72) = 43.02$, $p < .001$, $MS_e = .478$. When commercials occur between major episode boundaries, performance is significantly higher than when commercials occur within episodes to obscure the story's underlying organization. A set of Dunnett comparisons ($p < .05$) further indicates that the no-commercial condition yields an intermediate level of accuracy. The more interesting finding within this analysis involves a significant interaction between commercial placement and type of scene pairing, $F(3, 216) = 27.4$, $p < .001$, $MS_e = .587$. In the breakpoint conditions, notice that fewer errors occur when the referent of a pair is a breakpoint scene. Although the particular comparison scene of a pair does not differentially affect the level of accuracy, pairs containing an initial breakpoint scene yield fewer errors than those containing an initial nonbreakpoint scene (Bonferroni, $p < .01$). A similar effect is also found in the no-commercial condition. The nonbreakpoint conditions, however, reveal a very different pattern of results. Here, the overall level of accuracy is quite low and does not vary as a function of scene pairing. Breakpoint scenes are no longer effective referents for remembering and in fact yield comparable levels of performance as nonbreakpoint scenes that were attentionally highlighted by commercial placement. Finally, there was a tendency for the number of commercials to yield a similar set of results as found in the recall data, but this variable was only marginally significant ($p < .06$).

Memory for the Location of Commercials

This last analysis examines subjects' memory for the location of commercials in their respective experimental condition. The percentage frequency of the following four types of judgments was evaluated: correct responses; errors involving major episode boundaries where breaks had occurred in the six- but not three-commercial condition; errors involving the remaining, less important episode boundaries where commercials had never occurred; and errors involving locations within an episode (i.e., nonbreakpoints).

As illustrated in Figure 3, response type varies across the two conditions of commercial placement, $F(3, 144) = 72.97$, $p < .001$, $MS_e = 516.42$. First, consider those subjects in the breakpoint conditions in which commercials originally occurred at major episode boundaries. Correct recall of these locations is quite high and is the most frequent type of judgment (Bonferroni, $p < .05$). When errors do occur, they are made by subjects in the three-commercial condition who erroneously identify the remaining major episode boundaries as commercial loci. Only on rare occasions are commercials misremembered as occurring at the boundaries of less important episodes (where commercials had never occurred) or within an episode itself. A somewhat different pattern of results emerges when commercials originally occur at nonbreakpoint locations. Here, the correct recall of these locations is quite low. In addition, subjects apparently were not aware that commercials originally occurred within an episode because the misremembering of other nonbreakpoint locations is also very low. Instead, subjects erroneously remember commercials as occurring at episode boundaries. As seen in Figure 3, the percentage frequency of these responses is evenly divided among both major episode boundaries where com-

Table 3
Mean Ag and Bias Values as a Function of Scene Type, Placement, and Number of Commercials

	Commercial placement				
	Breakpoints		Nonbreakpoints		No commercials
Scene type	Three	Six	Three	Six	
Breakpoints					
Ag	.906	.972	.674	.611	.768
Bias	6.86	6.98	9.21	9.79	9.21
Nonbreakpoints					
Ag	.811	.843	.692	.625	.752
Bias	7.98	8.01	9.67	9.14	9.92
Mean					
Ag	.859	.908	.683	.618	.760
Bias	7.42	7.50	9.44	9.47	9.57

Table 4
Mean Percentage of Errors in the Recognition of Temporal Order Information as a Function of the Number and Placement of Commercials, and Type of Paired Scenes

	Commercial placement				
	Breakpoints		Nonbreak-points		
Type of pairing	Three	Six	Three	Six	No commercials
Breakpoint–breakpoint	15%	10%	39%	45%	30%
Breakpoint–nonbreakpoint	18%	14%	40%	47%	28%
Nonbreakpoint–nonbreakpoint	32%	26%	42%	46%	42%
Nonbreakpoint–breakpoint	28%	27%	38%	48%	39%
M	23%	19%	40%	47%	35%

mercials had occurred in the breakpoint conditions and less important episode boundaries where commercials had never occurred. This latter finding, then, suggests that subjects in the nonbreakpoint conditions are unable to discern the hierarchical importance of story episodes.

General Discussion

The results of this experiment illustrate the effects of joint accent structure on memory behavior. Within the total time span of a film, commercial breaks create a pattern of temporal accentuation relative to the story's underlying conceptual scheme. Depending on where these commercials occur, comprehension and subsequent remembering is either facilitated or disrupted relative to situations where no commercials occur at all.

The most important finding of this experiment concerns the role of breakpoints in cognitive behavior. Although action boundaries can be defined at any given level within the hierarchical arrangement of story structure, breakpoints were

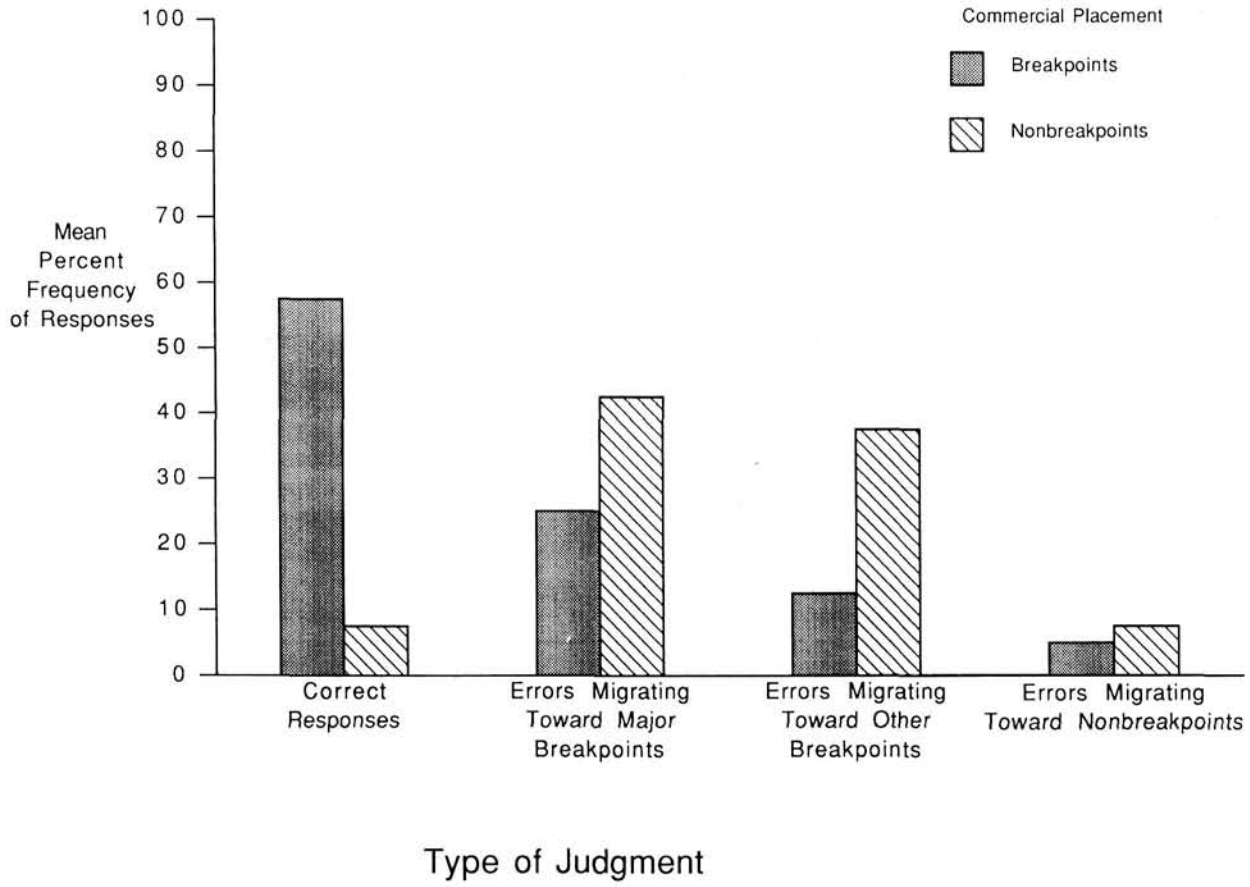

Figure 3. Mean percentage correct recall of commercial location as a function of the placement and number of commercials.

defined here as boundaries between higher level episodes. As indicated in a preliminary rating study, these episodes represented major idea units and displayed a resolution of activities that were particularly important to the story's overarching theme. The validity of these perceptual ratings was subsequently confirmed when an independent group of subjects was asked to remember films that varied in the placement and number of commercial breaks. Relative to films containing no commercials, the accentuation of breakpoints not only led to significantly higher recall and recognition performance but superior memory for temporal order information and details from the story's plot. The overall magnitude of these effects further increased when a greater number of commercials highlighted additional nestings of story structure.

There were also several sources of evidence suggesting that people use breakpoints as referents for attending and remembering. The selective recall and recognition of breakpoint scenes was markedly higher than that of nonbreakpoint scenes, even when the latter were accentuated through commercial placement. Breakpoints also provided anchors for recognizing the temporal ordering of scene pairs. When scenes marking episode boundaries acted as the initial referent of a pair, subjects could easily retrieve the temporal location of subsequent scenes. Conversely, performance was at chance level when the temporal ordering of scenes was relative to nonbreakpoint referents. These findings demonstrate the psychological reality of hierarchical structuring and suggest that remembering involves a top-down process. Breakpoints outline higher order levels of story structure and enable one to easily locate scenes from the same hierarchical level or move downward to the level of adjacent scenes within an episode. These lower level scenes, however, are too far removed from the overall gist of the story to guide the remembering of story elements and their temporal ordering. Finally, results of the commercial location task reveal further insight into the cognitive salience of breakpoint locations. All subjects in this experiment recalled commercials at episode boundaries, even when they actually "fragmented" an ongoing episode. People seem to expect commercials and other types of accents to reinforce the structure of a dynamic event, a finding that is consistent with the work of both Garret, Bever, and Fodor (1966) and Sloboda and Gregory (1980).

In summary, this overall set of results indicates that the boundaries of higher level episodes offer effective retrieval cues for the recapitulation of a film. By highlighting the hierarchical arrangement of structure, the story's underlying organization becomes more apparent and increasingly so with a greater number of commercials. This allows one to discern higher order relations among adjacent and nonadjacent episodes and to infer the motives of actions relative to a given goal. Joint accent structures thus serve to integrate the story into a coherent whole and aid processes of comprehension. In addition, temporal accents provide an effective retrieval scheme by returning viewers to episodes critical to the story's plot and overarching theme.

These effects of temporal accentuation are in striking contrast to those that appear when commercials occur within episodes at nonbreakpoint locations. Here, the story's underlying organization becomes obscured, and relations among story elements are no longer apparent. This is particularly true when an increased number of commercials conflicts with the nontemporal markers of nested relations. Such structural arrangements impair recall and recognition to levels that are significantly worse than that of no-commercial conditions. People become confused about the order in which episodes originally appeared and are seemingly unable to integrate the story into a coherent whole. This gives rise to memory errors concerning the actions of particular characters and erroneous inferences about the motivations of various behaviors. Incompatible accent structures disrupt overall performance because there are no effective referents that can be used for attending and the subsequent retrieval of story elements. As the recall and recognition data indicate, breakpoints are not differentiated from nonbreakpoints, and the attentional highlighting of information within episodes does not persist in memory.

One issue worth considering is the extent to which this set of findings generalizes to other types of filmed narratives. In the present study, the films used as experimental stimuli displayed very salient breakpoints that were correlated with major shifts in scene setting. Furthermore, the plots were rather complex in that there were at least two co-occurring themes, one pertaining to the protagonist's activities as a double intelligence agent and another concerning personal relationships with his family. This type of story scheme is in contrast to one in which there is a single consistent theme and a minimum of shifts in scene setting. An extreme example of the latter is Alfred Hitchcock's *Lifeboat*, in which the setting of the entire film is confined to a small boat afloat at sea. It may be that the comprehension and remembering of such story schemes do not benefit from an increased number of commercials, and in fact performance may actually be higher when commercial breaks are entirely absent. In cases where the story's plot forms one continuous chunk with no discernable episode boundaries, the insertion of commercials would essentially disrupt the story line and correspond to the nonbreakpoint conditions of the present experiment. In summary, the optimal number of commercials within a film is predicted to depend on the number of major episode boundaries within the story scheme.

The overall pattern of results observed in this experiment is consistent with other manipulations of joint accent structure within natural events. In the realm of music, breakpoints arise from phrase endings and the reaffirmation of a melody's tonality scheme. As in the case of stories, the accentuation of these higher order units not only enhances overall recall but facilitates the retrieval of lower order relations. Conversely, recall declines with incompatible accent structures, and phrase endings no longer offer effective referents for remembering. Joint accent structures are also apparent in the production of various action schemes. Analyses of musical performances and routine behavioral sequences indicate that reductions in amplitude and rate of movement coincide with the boundaries of those same units used during perceptual pickup (Stetson, 1905; Todd, 1985). Similarly, the production of speech reveals prolonged pauses at grammatical phrase boundaries (Butterworth, 1975; Goldman-Eisler, 1972; Grossjean et al., 1979) and patterns of stressed intonation that coincide with high-content words (Martin, 1972).

These various examples from the natural environment indicate that the primary meaning of an event is often highlighted by temporal accent structure. In music, this meaning corresponds to a melody's tonality scheme, whereas in speech and conversations, it corresponds to important idea units. The accentuation of breakpoints within action sequences and filmed narratives yields a similar type of structural arrangement. Newtson and Engquist (1976) found that boundaries of constituent action units serve as summary points of a behavioral scheme in that a sequential presentation of breakpoint scenes provides enough information to accurately reconstruct an entire activity. Breakpoints within films may serve analogous functions. Given that breakpoints correspond to major episode boundaries, these loci may relate the primary gist of a story. In fact, these scenes may be those used by filmmakers to either preview or summarize a film to a viewing audience. Although the present experiment was not designed to test this latter issue, it did show that the attentional highlighting of breakpoints exerted a marked influence on cognitive behavior. Together, these various instances from the natural environment suggest that an individual producing an event tacitly ensures the communication of intended meaning through temporal accentuation. To a perceiver, these types of structural arrangements are highly adaptive because temporal accents will capture attending and direct it not only toward the central meaning of an event but also to the event's inherent organization.

Here, it is suggested that similar processes apply to the act of remembering. From this perspective, remembering is essentially an act of reperceiving in that the same structural relations used to guide attending over an event's time span are used to recapitulate the event's sequence of items. Joint accent structures offer particularly efficient retrieval schemes because the organization of event relationships is attentionally outlined. By recapitulating the array of temporal accents, remembering is directed toward major breakpoints or phrase boundaries within the event's structure. These offer effective referents for remembering in that they encapsulate the central meaning of an event and can be used to regenerate both higher and lower order relations. Unsuccessful retrieval schemes, on the other hand, are characterized by less coherent structures that often arise from incompatible relations between temporal and nontemporal information. These types of events are frequently found in the early stages of perceptual learning and are exemplified by the music of a novice pianist, the toddling walk of an infant, or the speech of a foreigner learning a new language. Given the lack of structural organization, attending is misguided, and there are no effective referents from which to subsequently remember event relations. This yields an array of disjointed information that cannot be integrated into a unified scheme, and because the underlying meaning of the event is obscured, people are forced to erroneously infer missing relations.

This view of remembering is supported not only by studies on story and melody recall but also by research on autobiographical memory. Robinson (1986), for example, found that the remembering of life experiences relies on temporal referents from one's work calendar. For a student, referents derive from the beginnings and ends of semester breaks, whereas those of an athlete correspond to the beginnings and ends of on- versus off-season activities. When subjects are asked to recall personal events from the past year, the frequency of remembered events is significantly higher at phrase boundaries. In addition, Robinson reported that in a paired-associate learning task, the subsequent recall of word lists is significantly enhanced when category boundaries coincide with referent months. Similarly, Linton (1986) found that memories of one's past are organized around temporal landmarks defined by transitions in the major themes of life, normally shifts in personal relationships and career objectives.

The perspective adopted here is one that links the acts of perceiving and remembering to a common attentional scheme. This grants a certain degree of parsimony to cognitive processing activities and reduces the need for independent theoretical constructs. The research reported here, however, points toward another source of parsimony that exists within the environment itself. This involves certain structural regularities that are common to many natural events. Such regularities can be found in the expression of emotion in which music (Levi, 1982; Scherer & Oshinsky, 1977), speech (Cosmides, 1983; Williams & Stevens, 1979), and walking gaits (Montepare, Goldstein, & Clausen, 1987; Sloman, Berridge, Homatidis, Hunter, & Duck, 1982) all rely on similar structural relations to relate particular moods. In addition, the endings of many natural events, including those of speech, music, and action sequences, are all characterized by a deceleration of tempo and reduced amplitude of movement (Todd, 1985). Here, joint relations between temporal and nontemporal accent structures were noted for a variety of events. These sorts of cross-modal invariants are adaptive from a cognitive–evolutionary perspective in that the same cognitive strategies can be uniformly applied to many different environmental events. This in turn reduces the burden of perceptual learning and allows organisms to cope more effectively with their environment.

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(Appendix follows on next page)

Appendix A

Episodes from *The Perfect Spy*

Cast of Main Characters

Magnus Pym. The story's main protagonist, who is an agent for British Intelligence but also supplies information to Czech Intelligence.

Axel. A spy in Czech Intelligence, who is Magnus's friend and contact.

Belinda. Magnus's first wife.

Mary. Magnus's second wife.

Rick. Magnus's father (who makes his living as a con artist).

Tom. The son of Magnus and Mary.

Jack. Magnus's supervisor, who is a section director in British Intelligence.

Sid. Rick's closest friend and business associate.

Seth. A friend from Magnus's childhood.

Episode IV

Summary

This particular episode focuses on Magnus's role in British Intelligence. He is extremely successful in obtaining information about Soviet activities, which, unknown to his superiors, is supplied by Axel. Also unknown to his superiors is the fact that Magnus is providing Axel with information from British Intelligence. The other major theme within this episode concerns Magnus's personal relationships, his marriage to Belinda and his relationship with his father, Rick.

Setting

The story opens in London during the 1960s and then later shifts to Prague and Berlin during the 1970s, where Magnus is stationed on assignment.

Episodes from the Story's Plot

Episode 1. Magnus and Jack are walking in a park and discussing Magnus's upcoming marriage to Belinda.

Episode 2. Magnus is questioned by a British Intelligence Committee about his past history, values, and patriotic beliefs. He's promoted as an active agent and told he will be soon sent to Prague on assignment. (Breakpoint 1: mean rating of 5.33; selected by 4 of the 6 raters.)

Episode 3. Magnus and Belinda discuss his career and future life.

Episode 4. Magnus and Belinda are at their wedding reception. During a speech by Belinda's father, Rick makes an uninvited appearance. (Nonbreakpoint 1: three-commercial condition.) He gives the couple a new car as a wedding present, which later turns out to be a stolen car. After the wedding, Magnus and Belinda are in a taxi, where the driver gives them a bouquet of poppies. This is a signal for Magnus to meet Axel. (Breakpoint 2: three-commercial condition; mean rating of 6.5; selected by 6 of the 6 raters.)

Episode 5. Magnus is in a small town near Prague. He walks to a stone fence near some abandoned buildings, removes a stone, and extracts a small package.

Episode 6. Magnus returns to his hotel room in Prague. Axel enters with a gun, and for the benefit of his colleagues and bugged microphones, pretends to arrest him for espionage. (Nonbreakpoint 2.) Magnus protests his innocence as he is led away by Axel and two other Czech agents.

Episode 7. Axel, who is responsible for questioning Magnus, takes him to an empty house belonging to Axel's aunt. Axel tells Magnus that the Czechs suspect him of being a British spy and the consequences if he is convicted. (Nonbreakpoint 3: three-commercial condition.) As they later walk in a meadow, Axel promises to protect Magnus and states that they must both quit spying and defect to the United States. (Breakpoint 3: three-commercial condition; mean rating of 6.83; selected by 6 of 6 raters.)

Episode 8. Magnus presents Jack and other superiors with photos of a Soviet nuclear facility. He is praised for his work and promoted to director of a spy network in Germany.

Episode 9. Belinda's father questions Magnus about his job. Magnus insists that he is an interpreter but the father suspects him of being a spy.

Episode 10. Axel and Magnus are in a car en route to Czechoslovakia, where they are to meet Axel's superiors. Magnus worries that he will be revealed as a British spy, and Axel reassures him that he will be safe.

Episode 11. Meanwhile, Belinda is alone at home, crying. She is frustrated that Magnus is always working and never spends time with her.

Episode 12. Magnus and Axel are in the house of Axel's aunt. Axel says he will introduce Magnus to a new contact who has access to information about the Czechs' industrial activities. (Nonbreakpoint 4.) This contact turn out to be Sabina, a woman that Magnus met long ago in the military and who is his ex-lover. (Breakpoint 4: mean rating of 5.33; selected by 6 of 6 raters.)

Episode 13. Jack and Magnus are in London, walking in a park. They discuss his new assignment in Berlin, where Magnus will pose as a British ambassador.

Episode 14. Magnus asks Belinda to go to Berlin with him. She says no and accuses him of ignoring both her and his father, Rick. She then asks for a divorce.

Episode 15. Magnus is at an outside cafe, where he meets with Jack.

Episode 16. Magnus and Axel are at a deserted restaurant. Magnus relates his earlier conversation with Jack concerning Soviet activities. They also discuss the woman, Mary, that Magnus is now dating. Magnus then discreetly gives Axel a cassette tape. (Breakpoint 5: three-commercial condition; mean rating of 5.83; selected by 5 of 6 raters.)

Episode 17. Magnus is sleeping and awakens to the sound of German police approaching his apartment. He quickly destroys all evidence linking him to espionage activities before admitting them to his home. The police tell him that the Police Commander wishes to speak with him downtown. (Nonbreakpoint 5.) Magnus enters his bedroom to get dressed.

Episode 18. Magnus talks with the Police Commander, who says that a man convicted of a major crime claims to be an acquaintance of Magnus. Magnus, fearing that it is Axel, discovers that it is Rick who is in a jail cell. (Nonbreakpoint 6.) Magnus and Rick are reunited after several years.

Episode 19. Magnus and Rick are having dinner at a restaurant when Rick asks Magnus to get him some gold that he can resell. Magnus refuses and has Rick promise he will never again be sent to prison. (Breakpoint 6: mean rating of 5.5; selected by 5 of 6 raters.)

Episode 20. Magnus and Axel meet in a deserted bar and Magnus presents pictures of Mary. Axel encourages him to court Mary because her father is a general in the U.S. military and may thereby facilitate their defection to America.

Appendix B

Episode VI

Summary

In this next to last episode of the miniseries, Magnus is experiencing increasing anxiety that he will be exposed as a double agent, as well as guilt from the various betrayals of his past. He flees to an isolated village, where he begins to write a journal of his past life and tries to explain why he betrayed his country and various loved ones in his personal life.

Setting

The story opens in the 1980s on the Greek island of Lesbos, where Magnus and his family are on vacation. They soon return to their home in Vienna, but shortly thereafter, Magnus leaves alone for London to take care of some business. He then goes to a small coastal town in Devon, where he rents a room from an elderly woman.

Episodes from the Story's Plot

Episode 1. Scenes from Lesbos, a Greek island in the Aegean Sea, where Magnus, Mary, and Tom are on vacation.

Episode 2. Magnus and Tom are watching a cricket match when Axel and some of his agents appear. Although Tom is concerned about who they are, Axel and Magnus go to the parking lot to talk. Axel insists that they must quit now before they are both caught.

Episode 3. Magnus, Mary, and Tom are at the beach. As Tom swims, Mary asks about the man (Axel) at the cricket match and demands to know who he is. Magnus lies and says he is a retired spy from British Intelligence.

Episode 4. As the family returns from the beach to their cottage, Tom once again sees the men from the cricket match. Magnus says he's mistaken. (Nonbreakpoint 1: three-commercial condition.) They all go inside for drinks.

Episode 5. Axel and Magnus meet at a cafe, where they discuss his family. Once again, Axel insists that they must quit spying and defect to the United States. (Breakpoint 1: three-commercial condition; mean rating of 5.4; selected by 5 of 6 raters.)

Episode 6. At the airport, Magnus and Mary send Tom back to school.

Episode 7. Back at the cottage, Magnus begins to write his memoirs. He goes to Mary and they talk about the "novel" he is presumably writing. Mary asks Magnus what's worrying him; he denies that anything is wrong and leaves for a walk.

Episode 8. Mary goes to Magnus's den and reads what he has been writing. She reads an excerpt addressed to Axel that discusses the concept of betrayal. Magnus walks in and announces that a telegram from Jack has ordered him back to his post in Vienna. (Breakpoint 2: mean rating of 6.17; selected by 6 of the 6 raters.)

Episode 9. Magnus and Mary are hosting a large dinner party. (Nonbreakpoint 2.) Guests leave. Afterward, Magnus begins to act strange and says that during the party, he received a call that Rick had died.

Episode 10. Magnus goes to London to the home of two prostitutes who have Rick stashed in their bathtub, on ice. Magnus gives them money and thanks them for their trouble.

Episode 11. Rick's casket is cremated and Magnus, alone, watches. (Breakpoint 3: three-commercial condition; mean rating of 5.4; selected by 5 of the 6 raters.)

Episode 12. Mary, home in Vienna, calls Jack in London and asks where Magnus is.

Episode 13. Magnus visits Sid and they reminisce about Rick. (Nonbreakpoint 3: three-commercial condition.) Sid asks Magnus why he has come and Magnus asks for Rick's old papers and files. (Breakpoint 4: mean rating of 5.0; selected by 4 of 6 raters.)

Episode 14. In London, Jack is on the phone with Mary and says that Magnus was last seen at Heathrow Airport.

Episode 15. Magnus visits Seth, whom he has not seen in years. They greet one another, and a valet brings them drinks. (Nonbreakpoint 4.) Magnus then begins crying and apologizes for a prank that he pulled on Seth in grade school. Magnus speaks of betrayal and says that this was his first. (Breakpoint 5: three-commercial condition; mean rating of 5.67; selected by 6 of 6 raters.)

Episode 16. At the Vienna home, Jack and Mary discuss Magnus's disappearance and whether he ever mentioned defection. (Nonbreakpoint 5: three-commercial condition.) Jack searches the room. (Breakpoint 6: mean rating of 5.5; selected by 4 of 6 raters.)

Episode 17. At a small coastal town in Devon, Magnus gives a present to an elderly lady. He knows her from past stays and is renting a room from her.

Episode 18. Back at the Vienna home, Jack reads Magnus's appointment book. (Nonbreakpoint 6.) Jack questions Mary.

Episode 19. Magnus and the elderly woman are having tea.

Episode 20. Jack and Mary go upstairs where others have discovered a hidden camera and a Czech codebook. Mary defends Magnus and fights with Jack.

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