Sentence-initial adverbials and text comprehension.

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Abstract:
In the last thirty years, numerous linguists have stressed the discourse functions of adverbials. More specifically, sentence-initial temporal and spatial adverbials are often seen as signals that highlight the beginning of a new discourse unit for which they provide the setting. These expressions are thus supposed to affect the reading processes. This paper reports psycholinguistic experiments in which the impact on comprehension of sentence-initial adverbials has been specifically studied. In the first section, we summarize the two discourse functions these adverbials should play according to linguistic theories: signalling the beginning of a new textual unit (the segmenting function) and setting the frame of reference for the whole textual unit that they preface (the framing function). The main conclusion is that inserting an adverbial in sentence-initial position must be seen as a strategic decision of the author of the text for the benefit of the reader. In the next sections, we report several experiments that show that, contrarily to sentence-final adverbials, sentence-initial adverbials enable readers to initiate a set of procedures specific to a topic change and induce them to keep in active memory the setting expressed by the adverbial so that it can regulate the processes of knowledge mobilization required for the interpretation of the sentences that are under its scope. In the conclusion, several avenues for further development are discussed.
In the last thirty years, numerous linguists have stressed the discourse functions of adverbials. More specifically, sentence-initial temporal and spatial adverbials are often seen as “grammatical signals” that highlight the beginning of a new discourse unit for which they provide the setting (Brown & Yule 1983; Chafe 1984; Charolles 1997; Longacre 1979; Sarda, Carter Thomas, Fagard & Charolles, this volume; van Dijk 1982; Virtanen 1992, this volume). These expressions are thus supposed to affect the cognitive processes during the reading of a text.

During the same period, psycholinguistics has made important progress in the descriptions of the mental representations that readers build. It is now widely accepted that readers construct not only a mental representation of the text itself, but also one of the situation it describes (Grässer, Millis & Zwaan 1997). Called a situation model, this representation of what the text is about is enriched by the reader’s relevant knowledge. The word situation emphasizes the fact that this model is structured according to several dimensions (for instance, causal, temporal and spatial, among others) that connect events and entities mentioned in the text. Many studies have shown that readers pay attention to these dimensions during the reading of a text and that they update their mental representation when a shift occurs in any of them (Tapiero & Blanc 2001; Zwaan, Langston & Grässer 1995).

Until now, these two lines of research have been pursued in a largely independent way in spite of their obvious complementarities. Particularly, temporal and spatial adverbials have received little attention in psycholinguistics, in contrast to the temporal and aspectual information expressed by verbs (Magliano & Schleicher 2000). The aim of this paper is to partially fill this gap by reporting psycholinguistic experiments in which the impact on comprehension of sentence-initial adverbials has been specifically studied. In the next section, we summarize the discourse function these adverbials should play according to linguistic theories. Then, several experiments that test the psycholinguistic corollaries of these linguistic hypotheses are reported.

1 The discourse function of sentence-initial adverbials

As Crompton (2006, this volume) emphasizes on the basis of a critical analysis of the literature, positioning an adverbial at the beginning of a sentence should have two main effects: “to give [adverbials] scope not just over a single clause but over larger discourse spans” and “to signal boundaries between spans of discourse” (Crompton 2006: 249). In the following excerpt from a news article on progress and setbacks of death penalty (Belay, 2013), these two functions are clearly exemplified by the sentence initial spatial adverbial "In Africa":

Only 21 countries were recorded as having carried out executions last year – this is the same number as in 2011, but down from 28 a decade earlier in 2003.

A longer historical perspective makes the change even more striking – when we first started campaigning for abolition of the death penalty some 35 years ago, the world’s 16 abolitionist countries were a clear minority. Now 97 countries have completely abolished the death penalty in law, while 140 in total are de facto death penalty free.

In Africa, we could see progress in many countries, not just in Sierra Leone. Benin ratified and Madagascar signed a key UN treaty committing the country to abolishing the death penalty; the government of Ghana moved towards banning capital punishment in its new Constitution; and no death sentences were imposed in Benin and – unlike in 2011 – Burkina Faso or Malawi.
These two functions are at the heart of Virtanen’s and Charolles’ research. Virtanen (1992, 2004, this volume) is more specifically interested in chains of sentence initial adverbials of time and place, such as “On Monday..., On Tuesday...,” or “Beyond the taverns,...,” or “In the room at the rear of...,” which frequently occur in narrative and descriptive texts. Through an in-depth corpus analysis, she shows that these chains are “text-strategic markers” that fulfill two functions: they signal text segmentation by highlighting the boundaries of textual units, and simultaneously, they create coherence between these units by participating in the chain of adverbials. Since they provide the temporal or spatial setting for the textual unit they introduce, their scope encompasses the whole unit. When these adverbials occur non-initially in a sentence, their scope is narrower and they do not act as transitional expressions between textual units. Virtanen gives a specific status to a spatial or temporal adverbial that occurs at the very beginning of a text. In agreement with Grimes’ analyses (1975), these adverbials are expected to provide the general setting of the text and thus to extend their scope on the whole text unless their scope is cancelled by a new adverbial.

Charolles (1997, 2005; Sarda et al., this volume) argues that preposed adverbials should have a significant impact on comprehension. According to his discourse framing hypothesis, these devices mark the beginning of a discourse frame (Martin 1983; see also Fauconnier’s (1985) concept of mental space). A discourse frame groups together several propositions that are linked by the fact that they must be interpreted with reference to a specific criterion expressed by a preposed adverbial that acts as a frame-introducing expression. For instance, a spatial adverbial (Sarda 2005) such as “In China”, a temporal one (Terran 2002) such as “During the nineteenth century” or a mediative one (Schreper-André 2006) such as “According to the Secretary of State” provide an essential element for the interpretation not only of the proposition that follows them, but also potentially of several subsequent propositions. These adverbials open a frame, a sort of file into which several sentences can be gathered under the index they provide. It follows that readers are expected to keep in mind the frame introducer for the processing of the host sentence and beyond, until the occurrence of some indicators that signal the end of its scope. These signals are mainly another sentence-initial adverbial or a typographical cue like a new paragraph (Charolles & Vigier 2005).

Both Virtanen and Charolles stress the fact that inserting an adverbial in sentence-initial position must be seen as a strategic decision of the author of the text. When speakers or writers decide to begin a sentence with a potentially framing adverbial, they show their intention to exploit its organizing power. In the following sections, we discuss the effects sentence-initial adverbials should have on comprehension due to these two discourse functions: the segmentation function and the framing function.

2 The segmentation function of sentence-initial adverbials

The first discourse function attributed to sentence-initial adverbials is to signal the beginning of a new textual unit. Such a function is obviously better fulfilled by a guidepost (Chafe 1984) put at the very beginning of a segment than at the end of a sentence, something which has been confirmed by many corpus analyses (e.g, Bestgen & Costermans 1997; Hasselgård 2010; Piérard & Bestgen 2006; Prideaux & Hogan 1993; Redeker 1991, 2006; Virtanen 1992, this volume). For instance, in a corpus analysis of forty daily events, Costermans & Bestgen (1991) observed that speakers inserted temporal adverbials in front of sentences that introduce a theme shift in the activities. These observations were extended and confirmed in experimental studies in which subjects were given the gist of narratives that they had to communicate either orally or in writing (Bestgen 1992; Bestgen & Costermans 1994; Costermans & Bestgen 1991). Even young children and second language learners use these

In contrast to the numerous data about the use of these devices by speakers and writers, their impact on comprehension has been scarcely studied. Even though many researchers have used temporal and spatial adverbials in a sentence-initial position to introduce situational breaks into narratives (e.g., Claus & Kelter 2006; Ditman, Holcomb & Kuperber 2008; Levine & Klin 2001; Rinck, Hahnel & Becker 2001; Speer & Zacks 2005; Therriault, Rinck & Zwaan 2006; Zwaan 1996), only one study, to our knowledge, has directly compared the impact of the position of the adverbial on its function as a segmentation marker (Bestgen & Vonk 2000). This study rests on current conceptions of discourse comprehension that see text understanding as an incremental process in which new sentences are integrated, by default, with the preceding ones. This strategy can be stated in the form of a default principle of comprehension, called the nextness principle (Ochs 1979: 62-66), or the principle of continuity: “Readers assume, by default, that continuity is maintained” (Segal et al. 1991: 32). However, when there is a topic shift in a text, the use of the nextness strategy is ill-advised. Readers have to begin the construction of a new partition in their discourse representation (Vonk, Hustinx & Simons 1992). According to the Gricean maxims of communication, writers are expected to inform readers that the continuity with the preceding part of the text is not preserved, that there is a topic shift, and that special action should be taken. They can do this by using the segmentation function of a sentence-initial adverbial. This line of reasoning predicts that an adverbial introduced at the beginning of a topic-shift sentence should be beneficial for readers, allowing them to bypass the search for continuity. The same adverbial in sentence-final position should not have this impact.

Bestgen & Vonk (2000) conducted several experiments to test these predictions. They measured the reading time of sentences that began with a temporal adverbial, ended with such an adverbial or did not include any adverbial at all. The sentences were presented in continuous and discontinuous contexts. As expected, readers took more time to read a topic-shift sentence than a continuous sentence when there was no adverbial or when the adverbial was in the sentence-final position. These experiments also showed that a sentence-initial adverbial cancelled this effect. With a preposed adverbial of time, discontinuous sentences were not read significantly more slowly than continuous ones. This result is fully compatible with the hypothesis that readers try to relate new information by default to preceding information. Sentence-initial adverbials act as segmentation markers: they direct readers to bypass the search for continuity and to start immediately constructing a new partition in their discourse representation.

3 The framing function of sentence-initial adverbials

Setting the frame of reference for the whole textual unit that they preface is the second function of sentence-initial adverbials. Even though a series of corpus analyses showed empirical support for this function (Charolles 2006; Sarda 2005; Schrepfer-André 2006; Vigier 2005; Virtanen 1992), a study by Crompton (2006, this volume) reported contradictory results. Through the analysis of 40 argumentative texts, Crompton observed that sentence-initial and sentence-final adverbials have scopes of similar length. It is difficult to pinpoint the origin of the divergence between Crompton’s study and the others because because they take into account largely different types of adverbials and genres of texts. Nevertheless, this study at least raises the question of the generality of the multi-sentence scope of any types of adverbials in any discourse genre.
The impact of the scope of an adverbial on text comprehension has received very little attention despite the procedural and cognitive importance of this function (Charolles 1997). To shed some light on this issue, we conducted, in collaboration with Michel Charolles and Laure Sarda, two experiments in French. In the first one, two factors were manipulated: the position of a spatial adverbial that could occur either at the beginning or at the end of the first sentence of a text and the congruence or incongruence between this spatial adverbial and a locative subject that introduced a target sentence, for which reading times were measured. We predicted an interaction between the adverbial position and the congruency factor. It is only when the adverbial is sentence-initial and incongruous with the locative subject that the readers should encounter difficulties processing the target sentence. This result would confirm the importance of the sentence-initial position for the framing function of adverbials.

4 Experiment 1

4.1 Method

Twenty French-speaking undergraduate students read 32 five-sentence expository texts (16 experimental and 16 filler texts) at their own pace on a computer screen upon which sentences appeared one by one. At the end of each text, they had to indicate whether a word displayed on the screen belonged to the text they had just read. We chose the expository genre because it allows manipulation of the spatial dimension independently of other situational dimensions whereas in narratives these dimensions are strongly interrelated (Rapp & Taylor 2004; Speer & Zacks 2005; Therriault & Rinck 2007). The fourth sentence of each experimental text was the target sentence for which the reading times were measured. It always began with a locative subject (Quirk, Greenbaum, Leech & Svartvik 1985: 747) and was 65 to 75 characters long. As shown in Table 1, four versions of each experimental text were written by manipulating only the spatial adverbial in the first sentence. The spatial adverb could occur at the beginning or at the end of the sentence ((the) position factor) and it could be congruent or not with the locative subject present in the target sentence ((the) congruency factor). The adverbial was considered as congruent if the geographical area to which it referred included the locative subject and as incongruent if it did not.

Four counterbalanced sets of materials were constructed. Each set contained four texts in each of the four experimental conditions obtained by crossing the two factors. Across the four sets, each text appeared once in each experimental condition. The four sets were given to four randomly selected groups of participants.

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Condition</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial-Congruent</td>
<td>In Switzerland, the bad weather of these last days paralyzed air traffic.</td>
</tr>
<tr>
<td>2</td>
<td>Final-Congruent</td>
<td>The bad weather of these last days paralyzed air traffic in Switzerland.</td>
</tr>
<tr>
<td>3</td>
<td>Initial-Incongruent</td>
<td>In Finland, the bad weather of these last days paralyzed air traffic.</td>
</tr>
<tr>
<td>4</td>
<td>Final-Incongruent</td>
<td>The bad weather of these last days paralyzed air traffic in Finland.</td>
</tr>
<tr>
<td>5</td>
<td>Filler sentence</td>
<td>Many planes are still delayed on the ground.</td>
</tr>
<tr>
<td>6</td>
<td>Filler sentence</td>
<td>The visibility is not optimal for landing.</td>
</tr>
<tr>
<td>7</td>
<td>Target sentence</td>
<td>Geneva saw the corridors of the airport being transformed into dormitories.</td>
</tr>
<tr>
<td>8</td>
<td>Filler sentence</td>
<td>A new wave of cold weather is expected next week.</td>
</tr>
</tbody>
</table>

Table 1: Sample Passage from Experiment 1 (Translated from French)
The texts were presented sentence by sentence in the middle of the screen of a computer. The presentation of each text was preceded by a sentence that prompted participants to press the space bar key. The key press caused the first sentence to appear on the screen, followed by the next sentence as soon as the same key was pressed. To familiarize themselves with the procedure, participants completed two practice texts before starting the experiment. After each text, participants were allowed to take a rest. All instructions and material were presented in French.

4.2 Results

Reading times for the target sentences were analysed after the outliers were removed; these were identified by means of the two step procedure advocated by Rinck, Hännel, Bower & Glowalla (1997; Bower & Rinck 2001). First, the participant’s median reaction time was subtracted from each of her or his reaction times. Second, separately for each experimental condition, the upper and lower 3% of these difference scores were considered as outliers and replaced by the participant’s median reaction time.

The reading times for the target sentences were analysed by means of a two-way analysis of variance (ANOVA) using a Latin Square Confounded design with lists of items counterbalanced across groups of subjects. Position and Congruency were both within factors in this analysis. Because item variability was controlled by counterbalancing, the ANOVA over subjects (F1) allows to determine whether the results generalize over both items and subjects simultaneously (Raaijmakers, Schrijnemakers & Gremmen 1999). Nevertheless, an ANOVA over items (F2) is also reported by convention. An alpha level of .05 was used for all statistical tests.

The ANOVA yielded a statistically significant interaction between the Position and Congruency factors (F1(1,16)=10.61, p=0.0050; F2(1,12) = 7.17, p=0.0201) while the main effects were not statistically significant. The mean reading times for the target sentences are displayed in Table 2. The 95% confidence intervals provided in the last column are the confidence intervals associated with the contrast between the two congruency conditions for each adverbial position and were computed according to Masson & Loftus (2003). When the spatial adverbial was in sentence-initial position, participants read the target sentence 241 ms more slowly in the incongruent condition than in the congruent condition (F1(1,16)=11.32, p=0.0039; F2(1,12)=9.91, p=0.0084). A reverse but statistically non-significant difference of 47 ms was observed in the sentence-final conditions (F1 and F2 <1).

<table>
<thead>
<tr>
<th>Position</th>
<th>Congruency</th>
<th>Difference</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>Incongruent</td>
<td>3421</td>
<td>3180</td>
</tr>
<tr>
<td>Final</td>
<td>Incongruent</td>
<td>3194</td>
<td>3241</td>
</tr>
</tbody>
</table>

Table 2: Mean reading times (ms) for the target sentences in Experiment 1

4.3 Discussion

The results indicate that the position of a spatial adverbial at the beginning or at the end of a sentence affects the ease with which a reader will process a subsequent locative subject not easily integrable with this adverbial. Only when the adverbial is in sentence-initial position does the incongruence raise difficulties. These results thus support the framing hypothesis. However, an alternative interpretation of the results must be considered. The impact of the
adverbial position on comprehension could be explained not by its scope, which would normally be longer when it is in initial position, but by the salience this position confers upon this adverbial. It is indeed this kind of parameter that the memory-based view of comprehension (Myers & O’Brien 1998) calls upon to explain lengthened reading times observed for sentences that are incongruent with information presented in a distant sentence earlier in the text (Albrecht & O’Brien 1993; Clifton & Duffy 2001). This model proposes that a passive, automatic process occurring continually during comprehension activates information from long-term memory, which is related to concepts derived from the currently processed sentence as well as to information already present in working memory. Information reactivated by this resonance process (Myers & O’Brien 1998) can correspond to a reader’s general knowledge, but also to information provided earlier in the text. The probability that a piece of information is reactivated depends on many factors, one of which is its salience in the text (O’Brien & Myers 1999). The more salient the information, the higher the probability that it would resonate, and it is well-established that constituents inserted in a sentence-initial position receive more attention from the reader (Givón 1988; Talmi 2007; Virtanen 1992). It follows that the mechanism of resonance, which is started automatically when the reader processes the target sentence, and particularly the locative subject should more strongly reactivate the adverbial of the first sentence when it occurs in a sentence-initial position. The incongruence between this first adverbial and the locative subject should thus be more manifest, producing a more important slow-down in reading. Thus, contrary to the framing hypothesis, the memory view does not grant a specific function to the linguistic signals of situation changes (Magliano & Schleich 2000; O’Brien, Rizzella, Albrecht & Halleran 1998).

To determine if salience alone is sufficient to explain the effect of the position of an adverbial, we conducted a second experiment in which the texts were manipulated in such a way that, in one of the conditions where incongruity was present, a slow-down in reading should only be produced according to the salience explanation. To achieve this, the target sentence was manipulated (see Table 3) so that it started either with a locative subject, as in Experiment 1 (“Geneva”), or with a spatial adverbial pointing to the same location (“In Switzerland”) or incompatible (“In Finland”) with the location at the beginning of the target sentence. It must be noted that this adverbial was always sentence-initial and thus foregrounded.

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Condition</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Congruent</td>
<td>In Switzerland, the bad weather of these last days paralyzed air traffic.</td>
</tr>
<tr>
<td>1b</td>
<td>Incongruent</td>
<td>In Finland, the bad weather of these last days paralyzed air traffic.</td>
</tr>
<tr>
<td>2</td>
<td>Filler sentence</td>
<td>Many planes are still delayed on the ground.</td>
</tr>
<tr>
<td>3</td>
<td>Filler sentence</td>
<td>The visibility is not optimal for landing.</td>
</tr>
<tr>
<td>4a</td>
<td>Locative subject</td>
<td>Geneva saw the corridors of the airport being transformed into dormitories.</td>
</tr>
<tr>
<td>4b</td>
<td>Spatial adverbial</td>
<td>In Geneva, the corridors were being transformed into dormitories.</td>
</tr>
<tr>
<td>5</td>
<td>Filler sentence</td>
<td>A new wave of cold weather is expected next week.</td>
</tr>
</tbody>
</table>

Table 3: Sample Passage from Experiment 2 (Translated from French)

Note—Each participant read either Sentence 1a or 1b, and either sentence 4a or 4b.

According to the framing hypothesis, the second adverbial (“In Geneva”) closes the preceding frame and introduces a new one; it is thus not incongruent with the preceding frame even if this one is “In Finland”. No slow-down in reading should thus be observed when the second location is expressed by a sentence-initial adverbial. From the point of view of the salience
hypothesis however, whether the second location (in the target sentence) is presented in the form of a sentence-initial adverbial or of a location subject should make no difference. In both cases, the first adverbial is foregrounded, and thus the spatial information is salient. The reader should thus perceive an incongruence in both “In Finland - In Geneva” and “In Finland - Geneva”.

5 Experiment 2

5.1 Methods

Twenty French-speaking undergraduate students read the same texts as in Experiment 1, except that the texts were modified as explained above. None of them had participated in the first experiment. The design and procedure of this experiment was also identical to the ones used in Experiment 1.

5.2 Results

The ANOVA revealed a statistically significant interaction between the Type of spatial information in the target sentence and the Congruency factor (F(1,16)=13.99, p=0.0018). The mean reading times for the target sentences are displayed in Table 4. The 95% confidence intervals are based on the contrast between the two congruency conditions for each type of spatial information in the target sentence. When the target sentences started with a locative subject, participants read this sentence 304 ms more slowly in the incongruent condition than in the congruent condition (F1(1,16)=12.38, p=0.0029; F2(1,12)=17.41, p=0.0013). A reverse but statistically non-significant difference was observed when the target sentences started with an adverbial, with the participants reading this sentence 162 ms more slowly in the congruent condition than in the incongruent condition (F1(1,16)=2.93, p=0.1060; F2(1,12)=3.80, p=0.0742).

<table>
<thead>
<tr>
<th>Congruency</th>
<th>Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Sentence</td>
<td>Incongruent</td>
</tr>
<tr>
<td>Location Subject</td>
<td>3319</td>
</tr>
<tr>
<td>Adverbial</td>
<td>3241</td>
</tr>
</tbody>
</table>

Table 4: Mean reading times (ms) for the target sentences in Experiment 2

5.3 Discussion

The results of this second experiment indicate that the salience hypothesis is not sufficient to explain the impact of a sentence-initial adverbial on the reading times observed in Experiment 1. If the foregrounding of the spatial information resulting from the sentence-initial position was the only basis for the slow-down in reading time, one would have also observed a slow-down when the target sentence started with an adverbial incongruent with the initial one.

6 Conclusion

The aim of this study was to evaluate the impacts of sentence-initial adverbials on text comprehension. Linguistic research assigns two functions to these adverbials: to signal the beginning of a discourse unit and to determine its setting. It was predicted that signaling the
onset of a new unit should be beneficial for readers because it enables them to initiate a set of procedures specific to topic changes. The second function of these devices is to induce readers to keep in active memory the setting expressed by the adverbial so that it can regulate the processes of knowledge mobilization required for the interpretation of the sentences that are under its scope (Charolles 1997). These hypotheses were both supported by the studies summarized here. Particularly, the two experiments on the framing function showed that sentence-initial adverbials open a frame that can spread across several sentences and that a subsequent sentence-initial adverbial closes this frame. It would be now useful to study the framing functions of other types of adverbials, such as temporal and mediative ones. It would also be useful to study other kinds of texts, such as narratives. Lastly, our results stress the importance of taking into account the position of an adverbial in studies that compare the impact of various types of adverbials on situation model construction to avoid a bias favoring those adverbials that are inserted at the beginning of a sentence (Rinck & Weber 2003; Therriault, Rinck & Zwaan 2006).

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References


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