Paper Title Should Typographic Signaling Be Included in Expository Spatial Texts?

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Session Title Considerations in Literacy Comprehension

Session Type Roundtable Presentation

Presentation Date 4/18/2020

Presentation Location Online

Descriptors Comprehension, Discourse Processes, Reading

Methodology Quantitative

Unit SIG-Research in Reading and Literacy

DOI https://doi.org/10.3102/1574761

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Abstract

Typographic signaling, memory for word location and visual imagery are three visuospatial dimensions of a text the reader must attend to in order to achieve textual coherence. In this study, participants had to recall the location of italicized and non italicized words, after reading two texts, one with a spatial content and one with a non spatial content. Results indicate that memory for word location is improved by typographic signaling, but only for non spatial text. At a theoretical level, this interaction advocates for the implication of the visuospatial sketchpad in typographic signaling processing. On the practical side, it may suggest that expository texts writers should take into account the nature of the text content in their signaling choices.

Keywords: text signaling, memory for word location, visual imagery

Introduction

Traditionally when reading expository texts, readers may encounter specific signaling devices that the author uses in order to reveal the text structure (the main ideas and their relationships) and the importance of specific information in the text (Meyer, 1975). Text signaling devices are very diverse (Lemarié, Lorch, Eyrolle, & Virbel, 2008). Some of them are rather verbal like “Let me stress that” or “this chapter has three main parts”, and others are typographic (boldface, italics, underlining) and spatial (vertical and horizontal spaces).Thus, different signaling devices (for instance, an outline and an overview) may fulfill the same function (revealing text structure). According to the literature, text signaling facilitates text comprehension (for a review, see Lorch, 1989) and comprehension of illustrated texts (for a review, see Richter, Scheiter, & Eitel, 2016). Signaling would support selection of important information and mostly organization of information during text processing.

If these effects are fairly well documented in the literature, there have been few scientific studies comparing the efficiency of verbal signaling with typographic and spatial devices (Lorch, Lemarié, & Chen, 2013). Yet, this issue seems relevant to investigate for at least one reason: if signaling has proved to improve text comprehension and multimedia learning, it is not clear for an author whether she should use typographic, spatial or rather verbal signaling devices. Thus, it seems useful to construct knowledge about the conditions (i.e. text characteristics, reader’s parameters and type of task) that may moderate the signaling effect on text comprehension.

What are the differences between typographic, spatial signaling and verbal signaling and what cognitive consequences may that have for text processing? At a descriptive level, verbal signaling devices differ from typographic and spatial signaling on many aspects. First, verbal signaling is explicit, whereas typographic and spatial signaling is more implicit and relies on writing and reading conventions that readers have to learn (Meyer, 1999). Secondly, the medium to convey information about the text (structure and importance of information) differs: verbal signaling uses language (more precisely, a specific part of language that refers to the text and not to the world the text describes), whereas non verbal signaling uses space (vertical and horizontal spaces, line breaks, etc.) and typographic cues (underlining, bold, italics, bullets, etc.). Thus, verbal signaling adds verbal content to the text primary content,

whereas typographic and spatial signaling uses the physical properties of the text. Note that in the case of typographic cueing, most of the times the cues are combined with the text primary content.

At the perceptual stage, both types of signaling address the visual modality, but the nature of the cognitive processes associated to their processing during reading may be very different. In a working memory perspective, the processing of verbal cueing during reading could involve the phonological and semantic components of working memory, whereas processing of typographic and spatial signaling could imply the visuospatial component. Therefore, a possible advantage of typographic and spatial signaling over verbal devices would be to dissociate processing of text primary content and of text structure in different components of working memory. For instance, Lorch et al. (2013) have shown that headings are more efficient than topic sentences for topics identification in a text.

If typographic and spatial signaling processing implies the visuospatial component of working memory, what happens when the text content and/or task require visual imagery? Indeed, visual imagery is a typical service provided by the visuo-spatial sketchpad (Zimmer, 2008). In this experiment, we used memory for text location as an indicator of text signaling processing. Memory for word location refers to the observation that readers are able to remember where information she has read (or wrote) is located in a text above chance level (e.g., Inhoff & Weger, 2005; Le Bigot, Passerault, & Olive, 2009; Rawson & Miyake, 2002; Rothkopf, 1971; Therriault & Raney, 2002). According to Kennedy spatial coding hypothesis (1992), remembering word location would help readers to control regressive saccades toward specific information, when readers encounter difficulties to build local coherence during reading.

The present study aims at testing two main hypotheses: 1. Signaling specific words in a text should improve memory for their location; 2. This signaling effect should be reduced or even disappear when the text content is spatial and the task requires visual imagery.

Method

Population

Sixty-two undergraduate students (*M* = 23 years, *SD* = 6.5; 4 men) of the University of Toulouse Midi-Pyrénées (France) took part to the experiment.

Materials and procedure

Participants were asked to read 3 texts (two experimental texts, one distractor). One experimental text had a spatial content, i.e. it described the spatial organization of a fictive university building, whereas the other had no spatial content, since it described the history of the Sorbonne university. The spatial nature of the text content was elaborated following Brooks recommendations to include high-imagery words and spatial connectors. Participants were instructed to read the spatial text in order to visually figure out the spatial organization described, whereas they had to read the non spatial text in order to understand it. Both experimental texts were one page long. In each text, 12 words were selected: each text page was divided into 6 zones (2 horizontal and 3 vertical) and 2 plain words were selected per zone. One word was italicized and the other not.

After each experimental text reading, participants had to relocate specific words of the text on an empty grid page by writing directly each word on the page. Participants were not aware before reading of the location task. The distractive text was followed by comprehension questions but not by the location task, what aimed at avoiding any expectancy effect concerning the location task for the second experimental text. To measure memory for location, we counted the mean number of words correctly located respecting the procedure described by Le Bigot, Passerault, & Olive (2012) and the mean location error (Euclidean distance between the real and recalled location). After the location task, in order to assess readers' involvement in the reading task, participants had to answer questions about the text. For the spatial text, readers had to choose between several pictures representing the spatial organization of the university described in the text. For the non spatial text, readers had to answer 7 comprehension questions. At the very end of the experiment, participants had to say whether they had noticed the italicized words in the text in order to determine whether possible effects of typographic signaling (here italics) on memory location was related to the consciousness of its presence in the text or not.

In sum, the study followed a factorial within-subjects design with signaling and text content as within factors. To control for possible effects of the presentation order of both experimental texts and the group of italicized words, an across subjects counterbalancing was used.

Results

Preliminary analyses

The performances for word location are above chance level, for the spatial text, $t(61) = 4.892$, $p < .001$, as for the non spatial text, $t(61) = 8.215$, $p < .001$.

The comprehension performances indicate that participants were globally engaged in the task, since they obtained 80% of correct responses for the non spatial text and 68% of them chose the correct picture representing the spatial organization described in the spatial text (the risk of choosing the right picture by chance represents 33%).

Main analyses

The results concerning the mean number of words correctly located as a function of the text content and the words' typographic signaling are represented figure 1. A repeated-measures ANOVA reveals no main effect of signaling but a main effect of text content, $F(1,61) = 6.897$, $p = .0109$, $\eta_P^2 = 0.15$. However, this main effect was qualified by an interaction effect between typographic signaling and text content is significant, $F(1,61) = 9.914$, $p = .003$, $\eta_P^2 = 0.14$. Pairwise comparisons indicate that the location of italicized words is better recalled than those of non italicized words for the non spatial text, $p = .006$. For the spatial text, the number of correctly located words is less important when they are italicized than where they are not signaled, but the difference is not significant. The results dealing with the mean location error follow exactly the same pattern.

Concerning the moderator effect of the signaling awareness, it appears that the above mentioned effect of signaling on the number of correct locations for the non spatial text is true when the typographic signaling was noticed by participants, $t(27) = 3.773$, $p = .001$, $d = 0.96$, but remains unsignificant when participants were not aware of the italics signaling, $t(33) = 0.649$, *ns*. As far as the spatial text is concerned, the lack of effect of words typographic signaling is not influenced by participants' awareness of typographic signaling.

Discussion

In this study, we investigated three visuospatial aspects that could be involved in reading: typographic signaling, memory for word location and visual imagery when the text has a visuospatial content. Participants were instructed to read two texts and had then to recall the location of 12 specific words. Six words were signaled by italics, the other six were not. One of the texts had a spatial content and was supposed to mobilize visual imagery, whereas the other not.

Memory for word location is better than random for both texts, in agreement with all the literature on the subject: readers have a location memory of the words (Rothkopf, 1971).

The analysis of performances at the memory task of word location indicates, as hypothesized, that typographic signaling significantly improves memory for word location but only for the non spatial text. The benefit of typographic signaling disappears in the spatial text.

The positive effect of typographic signaling on memory for word location in the non spatial text is an original contribution to the field of text comprehension, since, to our knowledge, it is the first time that it has been observed. A possible explanation of this influence is that typographic cues acts as landmarks that facilitate the spatial coding of the words in the page (Baccino & Drai-Zerbib, 2015). Another possible explanation is that typographic cues activate specific processes during reading (reading deceleration, focused attention, etc.) and readers tend to memorize these locations, as they may be strategic places to return to later.

This positive effect of typographic signaling on memory for word location may also be related to the classical effect of signaling on the recalled of the signaled information (e.g. Cashen & Leicht, 1970). However, if some studies obtained a positive relation between the recall of word locations and the recall of the words themselves (e.g., Lovelace & Southall, 1983), some other research works failed to observe it (e.g., Zechmeister, McKillip, Pasko, & Bespalec, 1975).

The results also show that this positive effect of typographic signaling on memory for word location disappears when the text describes a spatial organization. This result is compatible to our hypothesis and leans support for the idea that typographic signaling is processed in the visuospatial component of working memory. When the task and/or the text content does not require additional processing in the visuospatial component, typographic signaling may play its role. However, when the task and the text content requires visual imagery, it may interfere with reader's processing of typographic signals in working memory and thus reduce its potential effect.

The implication of these results for education, more precisely, for expository text writing could be to recommend avoiding the use of typographic and spatial signaling when the text and the task requires visual imagery and to use rather verbal signaling in this case. However, this research line needs further investigation to be able to produce reliable and accurate recommendations. Particularly, it would be a natural follow-up to compare the effects of verbal and typographic signaling for spatial and non spatial texts on text comprehension.

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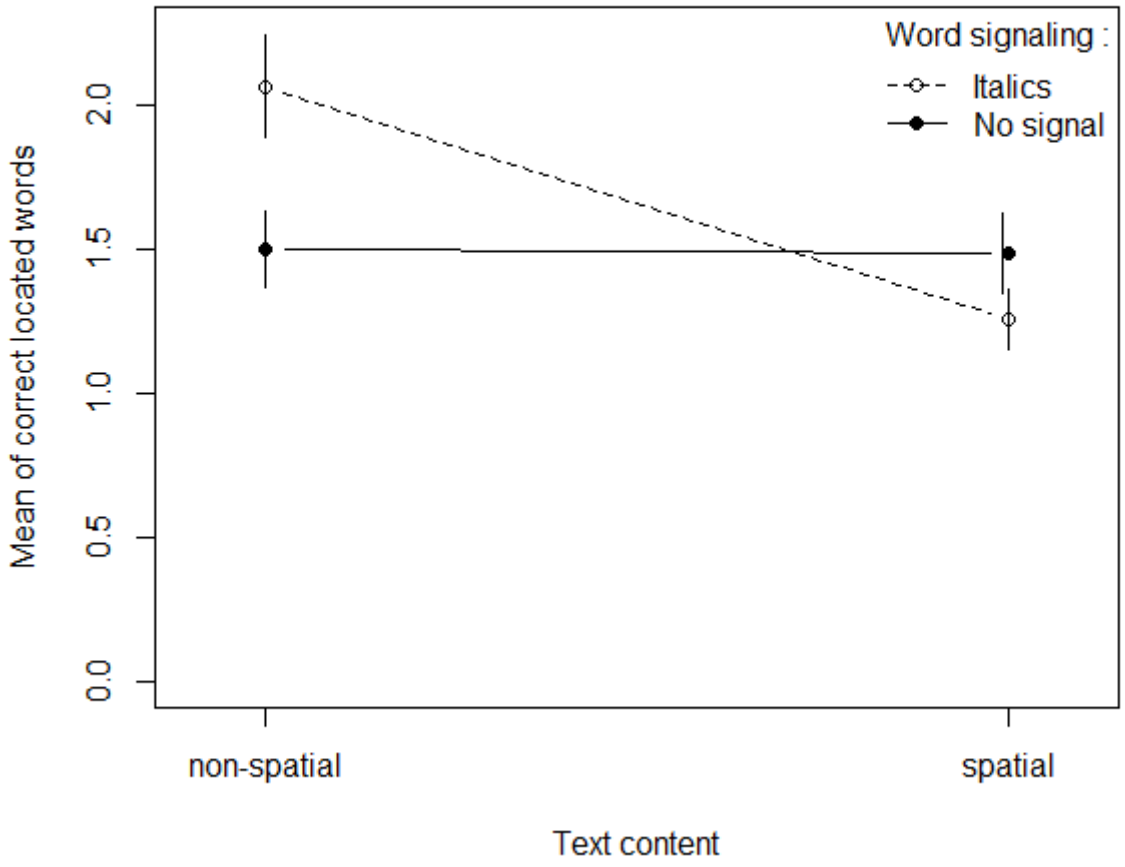

Figure 1: Mean number of correct word locations as a function of text content and word signaling