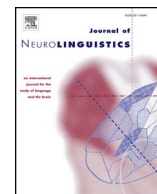


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## Importance conveyed in different ways: Effects of hierarchy and focus

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### ABSTRACT

In a continuous discourse, the importance of information can be conveyed both implicitly and explicitly. Global discourse hierarchy can convey importance implicitly, such that information at higher hierarchy levels is more important than those at lower hierarchy levels. In contrast, focus can mark importance explicitly, with information in focused positions being more important than that in non-focused positions. In this event-related potential study, we investigated whether the processing of implicitly highlighted information and explicitly highlighted information involved different neural mechanisms during online discourse processing. Three-clause discourses were constructed to implement hierarchy manipulation. For the discourses in the high-level condition, the first two clauses were subordinate clauses that formed a sentence, while the last clause formed a sentence independently. Whereas for the discourses in the low-level condition, the first clause formed a sentence independently while the following two clauses formed a sentence together. The last clause of each discourse thus differed in its status in the high and low-level condition and within it a critical word was embedded. For each discourse, a preceding wh-question was added to project a focus position in the discourse so that the critical word was either in the focused or non-focused position. Our results showed that the critical words elicited a smaller N400 when they were located at the higher than at the lower hierarchy level, whereas they elicited enhanced P2 and P3b when they were located in the focused than in the non-focused position. These results suggest that both hierarchy and focus facilitated the integration of highlighted information in the discourse. However, these factors influenced discourse integration in different temporal dynamics and involved different cognitive processes.

### 1. Introduction

Devoting attention to important information during language processing is an important aspect of successful reading (Kendeou, Van Den Broek, Helder, & Karlsson, 2014; Van Den Broek, Helder, & Van Leijenhorst, 2013). It is a basic capacity for skilled readers to distinguish between important information and peripheral information (Brown & Smiley, 1977; Miller et al., 2013; Miller & Keenan, 2009, 2011).

There are several cues that readers can use for identifying important information during language processing, one of which is hierarchy establishment. Both linguistic and psycholinguistic theories have long emphasized hierarchy as an internal feature of discourse organization (Grosz & Sidner, 1986; Kintsch, 1988; Taboada & Mann, 2006). According to Rhetorical Structure Theory

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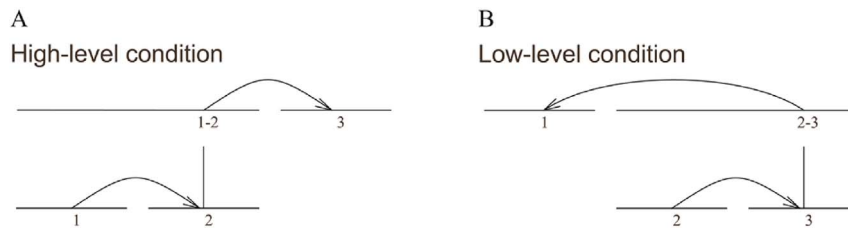


Fig. 1. Hierarchical structures for example discourses.

(RST), one of the most influential linguistic theories, readers construct hierarchical structures of discourses so that information located at higher hierarchy levels is more important than that located at lower hierarchy levels (Louis, Joshi, & Nenkova, 2010; Mann & Thompson, 1988; Taboada & Mann, 2006). Consider the following example:

- (1) 小李最近常去田径场, (Recently, Xiaoli has been going to the track frequently,)
- (2) 不断在那里练习跑步。 (to practice running there.)
- (3) 他在准备入伍体能测试。 (He is preparing for a military fitness test.)

The first two clauses are combined in a circumstance relation, because (1) provides the time and place for the interpretation of (2). These two clauses then connect with (3) in an elaboration relation because they provide additional details for (3). The relationships among the three clauses can be visually depicted by the RST diagram in Fig. 1A. As shown in the diagram, the aforementioned discourse is hierarchically structured. The first two clauses are located at the lower level of the discourse hierarchy, while the last clause is located at the higher level of the discourse hierarchy.

Empirical studies have demonstrated that hierarchy establishment can convey the importance of information (Louis et al., 2010). In addition, it influences multiple aspects of discourse processing. First, hierarchy affects the mental representation of discourses. Compared with information at the low level, information at the high level has a better memory representation (Wu, Yang, & Yang, 2016). This has also been evidenced by prosodic studies, in which researchers found that speakers tend to insert longer preceding pauses for sentences located at the high level than for those located at the low level (Den Ouden, Noordman, & Terken, 2009; Yang & Yang, 2012). Second, hierarchy influences the depth of discourse integration. In one study, Yang, Chen, and Yang (2014) found that discourse-incongruous words were read for longer times than discourse-congruous words only when the critical sentences and the preceding sentences were located at the same hierarchy level, but not when they were located at different hierarchy levels.

In addition to hierarchy establishment, however, readers also use explicit cues to evaluate the importance of input information, such as focus marking. The methods of focus marking include question-answer pairs (e.g., *What is Xiaoli preparing for?/He is preparing for a test.*), syntactic structure (e.g., *It is a test that Xiaoli is preparing for.*), word order (e.g., *For A test, Xiaoli is preparing.*), focus-marking particles (e.g., *Xiaoli is only preparing for a test.*), and pitch accent (e.g., *Xiaoli is preparing for a TEST.*) (Wang, Li, & Yang, 2014 for a review of this topic). All these ways highlight certain information (i.e., *test* in the examples) and make the information the focus (important) and the other information in the contexts the background (peripheral) (Halliday, 1967).

Previous research has found that focused information attracts more attention than background information (non-focused information) (e.g., Chen, Wang, & Yang, 2014; Cutler & Fodor, 1979; Kristensen, Wang, Petersson, & Hagoort, 2013; Price & Sanford, 2012; Sturt, Sanford, Stewart, & Dawydiak, 2004; Wang, Bastiaansen, Yang, & Hagoort, 2012). However, how the increased attention for focused information influences online language processing is inconclusive. By using an eye-tracking technique, several studies found that the increased attention on focused information led to faster reading, which was interpreted as an indication of easier integration of focused than non-focused information (Birch & Rayner, 2010; Chen & Yang, 2015; Chen, Li, & Yang, 2012; Morris & Folk, 1998). In contrast, several other studies revealed that the increased attention on focused information resulted in longer reading times, which reflected deeper encoding for focused than non-focused information (Birch & Rayner, 1997; Lowder & Gordon, 2015).

The neural responses for focused and non-focused information also differ. Some studies found that compared with non-focused information, focused information elicited a larger positivity (P3b), which was interpreted as a more effortful delivery of focused information and integration of focused information into prior contexts (Bornkessel, Schlesewsky, & Friederici, 2003; Chen et al., 2014; Cowles, Kluender, Kutas, & Polinsky, 2007; Reichle & Birdsong, 2014). However, instead of the P3b effect, Wang, Hagoort, and Yang (2009) reported that focused information elicited a smaller N400 than non-focused information, and interpreted this result as evidence of easier integration of focused than non-focused information. Different manipulation of focus might be the reason for the discrepant results. In the study of Wang et al. (2009), the target words of the non-focused condition were not the expected answers to the preceding wh-questions. However, they provided new information that made the information in the preceding wh-questions more specific. In this case, the target words might be integrated into the contexts of the preceding wh-questions. Thus, as with the focused condition, the process of information delivery also took place in the non-focused condition. Consequently, the P3b effect was not observed when comparing the focused to the non-focused condition. Although the target words were integrated in both the focused and non-focused conditions, due to the focus manipulation, the amount of cognitive resources that were allocated to the target words were different (Wang et al., 2009). Thus, integration difficulty, which was reflected in the N400 amplitude, differed between the two conditions. In another study, in addition to the P3b effect, Chen et al. (2014) also reported that focused information elicited a larger P2 than non-focused information and interpreted this result as evidence that more attention was allocated to focused than non-

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