

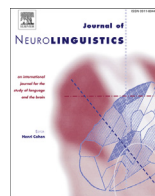


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# Effects of semantic constraint and cloze probability on Chinese classifier-noun agreement

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## ABSTRACT

This study aims to examine when and how readers make use of top-down information to predict or integrate upcoming words by utilizing the characteristics of Chinese classifier-noun agreement, as measured by event-related potentials (ERPs). Constraint strength of classifiers (strong and weak) and cloze probability of the pairing noun (high, low, implausible) was manipulated. Weakly constrained classifiers elicited a less positive P200 and an enhanced frontal negativity than strongly constrained classifiers, suggesting that readers used the preceding classifier to predict the upcoming noun, even before the pairing noun appeared. For ERPs elicited by the pairing nouns, there was a significant interaction between semantic constraint and cloze probability for the N400. For nouns following the weakly constrained classifiers, there was a graded cloze probability effect on the N400 (High < Low < Imp). For nouns following the strongly constrained classifiers, both low cloze and implausible nouns elicited larger N400s than high cloze nouns; however, there was no difference between low cloze and implausible nouns. The critical comparison for the constraint effect of low cloze nouns was found for the N400 but not for frontal

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positivity, suggesting that the N400 reflects a joint effect of both benefit and cost of prediction.

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## 1. Introduction

Studies have demonstrated that processing a word can be influenced by its preceding context. Readers are usually faster and more accurate in processing words that are congruent with their preceding context (Duffy, Henderson, & Morris, 1989; Stanovich & West, 1981). By recording eye movements during natural reading, fixation and gaze durations are usually shorter for highly expected words than for unexpected words that are embedded in the sentences (Dambacher, Goellner, Nuthmann, Jacobs, & Kliegl, 2008; Kliegl, Grabner, Rolfs, & Engbert, 2004; Rayner, Ashby, Pollatsek, & Reichle, 2004). These findings suggest that contextual information plays an important role in language comprehension. However, it remains unclear *when* and *how* readers make use of contextual information to predict or integrate the meaning of upcoming words. The present study aims to address this issue by using the unique characteristics of Chinese classifier-noun agreement with event-related potentials (ERPs), which provides great temporal resolution. Additionally, several ERP components (such as P200, N400, and frontal positivity) can be used to index various stages of cognitive processing.

In the ERP literature, contextual effect is usually evaluated by manipulating the degree of fit or semantic congruency between the context and upcoming words (Kutas & Hillyard, 1980a, 1980b, 1984), word predictability (Dambacher & Kliegl, 2007; Dambacher, Kliegl, Hofmann, & Jacobs, 2006; Van Petten & Kutas, 1990), or sentential constraint (Federmeier, Wlotko, De Ochoa-Dewald, & Kutas, 2007; Hoeks, Stowe, & Doedens, 2004; Wlotko & Federmeier, 2007). Despite the various ways to evaluate contextual influences, empirically they are determined by the cloze probability, which is measured by calculating the percentage of people who complete a sentence frame with a particular word (Taylor, 1953). A well-replicated finding indicates that N400 amplitudes are inversely proportional to the cloze probability. The reduction of N400 amplitude is found with words that can be easily integrated into the preceding word, sentence, or discourse context (van Berkum, Hagoort, & Brown, 1999; Kutas & Hillyard, 1980a, 1980b; Van Petten & Kutas, 1990, 1991). When a word in a context has a higher cloze probability, there is more of a reduction in N400 amplitude when compared to an unexpected word (Kutas & Hillyard, 1984).

However, the reduced N400 for high cloze probability words in sentences may either reflect the use of contextual information to predict and pre-activate the upcoming word (predictive view), or the ease of integrating a word into its preceding context (integrative view). The major difference between these two views is that the predictive view assumes contextual information can be used in an anticipatory or predictive manner to exert its effect starting from the early processing stages of word recognition, such as early perceptual features analysis, to the later stages of lexical activation and selection (Federmeier, 2007; Lee, Liu, & Chou, 2013; Lee, Liu, & Tsai, 2012), whereas the integrative view assumes that language comprehension is mainly based on the post-lexical semantic integration of each embedded word in the sentence (Fodor, 1983; Schwanenflugel & Shoben, 1985; Van Petten & Luka, 2012).

To further examine how contextual constraint affects the processing of unexpected words, Federmeier and Kutas (1999) manipulated the sentential constraint and degree of semantic overlapping between an unexpected ending word and its best competition. For example, the sentence, "They wanted to make the hotel look more like a tropical resort, so along the driveway, they planted rows of ..." can be completed by one of the three ending types: (1) the expected final word, established by cloze probability, e.g., *palms*; (2) within-category violation, an unexpected item from the expected semantic category, e.g., *pin*; or (3) between-category violation, an unexpected item from a different semantic category, e.g., *tulips*. Based on the integrative view, there would be no difference between within- and between-category violations, as both contain features that are not coherent within the context. However, the data from this study demonstrated not only that the expected item elicited a smaller N400 than either violation type, but the within-category violation also elicited a smaller N400 than the between-category violation. Moreover, this pattern was mainly found when the final words were

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