# Processing past time and aspect: Event-related potentials reveal different neuronal brain responses elicited by the Mandarin verbal morpheme *-guo*

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The processing of time in language is a topic attracting more and more attention from neurolinguists. This issue had been investigated using the ERP technique in tense-prominent languages (Dutch [1-2] and German [3], among others), and began to be explored in so-called "tenseless aspect-prominent languages" such as Mandarin Chinese [4]. One of the questions that still remain open is to determine to what extent the processing of "time" and "aspect" differ in aspect-prominent languages. Indeed, in Mandarin, the aspectual verbal suffix *-guo* is analyzed as expressing experiential aspect and exhibiting the property of *temporal hiatus* (i.e., the event and its results described by *-guo* do not hold at the time of reference [5]). On the other hand, *-guo* is also taken as expressing indefinite past tense in addition to its aspectual meanings [6-7]. Therefore, the research question of the present ERP study is: can the aspectual and temporal components of *-guo* be distinguished in the brain?

To investigate this question, *-guo* was placed in two configuration types (example sentences in Table 1): (i) temporal concord configuration (*-guo* placed after *zuotian* 'yesterday' (grammatical) or *mingtian* 'tomorrow' (ungrammatical)), and (ii) aspectual concord configuration (*-guo* placed after *yijing* 'already' (grammatical) or the progressive pre-verbal morpheme *zai* (ungrammatical)). 140 sentences were constructed and distributed in four lists using the Latin square design. Additional 140 filler sentences were added to counterbalance the grammaticality of the sentences. The 280 sentences were tested in a judgment acceptability task prior to the ERP experiment (99 participants). 25 participants who did not take part in the acceptability test (15 females; mean age 23.88 y.o., range 20-35) were recruited for the ERP experiment.

The ERP results were time-locked to the presentation of the adverbs and *zai* since the conditions started to differ at this segment (see Figure 1; results statistically verified). When compared to the grammatical counterparts, both the temporal and aspectual concord violations elicited a P600; however, the P600 evoked by the temporal violation was significantly smaller than that elicited by the aspectual violation.

The amplitude difference of the P600 reveals that the processing of temporal and aspectual concords with the aspectual suffix *-guo* is not equivalent. Note that the difference of amplitudes is unlikely to reflect processing difficulty since the accuracy rate for the aspectual concord conditions was higher than that for the temporal concord conditions (96.48% *vs*. 95.45%), and no difference of reaction time was found across the four conditions. Alternatively, one could argue that the aspectual concord violation also involves a temporal concord violation because of the progressive marker *zai*, hence the quantitative difference. Yet, we believe this is unlikely, as such an overlap of two types of information was not found in previous studies [4]. In sum, these ERP responses suggest different cognitive mechanisms underlying the processing of time and aspect with *-guo* in Mandarin. Further research using techniques with higher spatial resolution is in need to explore whether the quantitative difference found in the ERP pattern indeed involves qualitatively different brain mechanisms.

**Table 1.** Experimental design

| **Condition** | **Example sentence** |
|---|---|
| Temporal concord conditions | yufu zuotian/*mingtian diao-guo guiyu.<br>fisherman yesterday/*tomorrow fish-GUO salmon<br>'Yesterday/*Tomorrow, the fisherman fished salmons.' |
| Aspectual concord conditions | yufu yijing/*zai diao-guo guiyu.<br>fisherman already/*PROG fish-GUO salmon<br>'The fisherman already/*PROG fished salmons.' |

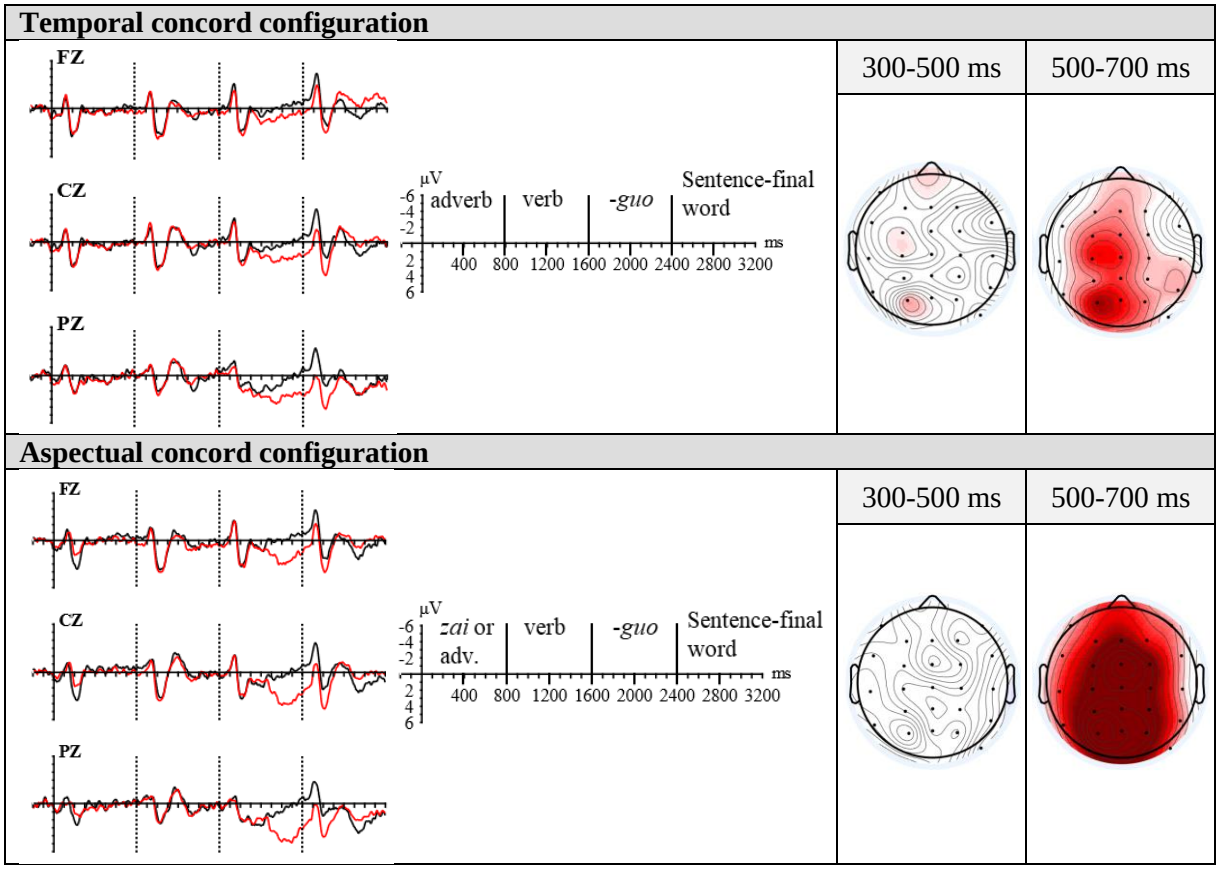


**Figure 1.** ERP waves of the temporal and aspectual concord conditions (black = grammatical, red = ungrammatical, negative voltage plotted upward), and topographic maps of the difference wave at *-guo* (ungrammatical *minus* ungrammatical; mean amplitude from -2.5 μv (blue) to +2.5 μv (red))

## References


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