Temporal relations electrified: An ERP study on the perfective marker *-le* in Mandarin Chinese

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ABSTRACT

The concept of time may be seen as fundamental among human cognition. Indeed, humans are able to think about events that occurred in the past, will take place in the future, or are holding at the present time. At the linguistic level, temporal information can be encoded with various ways. Semantically, (i) tense, defined broadly as the "expression of location in time", and (ii) aspect, referring to "different ways of viewing the internal constituency of a situation", are the main devices to assert temporal relations in languages [1-2]. Tense and aspect can be expressed through grammatical means (verbal morphology/auxiliary verbs), lexical means (temporal adverbials, inherent features of lexical verbs/*Aktionsart*), or discourse principles [3]. Furthermore, the above linguistic devices can interact with each other in a sentence.

Such an encoding of time is also manifested by cross-linguistic variations [4]. For example, in tense-prominent languages such as French, tense is systematically, obligatorily and grammatically marked, while it can be optional for some aspect- or mood-prominent languages, such as Koromfe and Kayardild. It is even argued that some languages (e.g., Mandarin) do not have grammatical tense [5-6]. Then, for so-called tenseless languages, the concepts of past, present and future would be expressed using lexical temporal adverbs, aspectual markers and/or pragmatic principles, *inter alia* [7-8, among others].

In contrast to the abundant linguistic research on such topics, little is known concerning the neuronal processing of temporal information in Mandarin (see [9] for reference). Thus, the aim of the present paper is to compare the neuronal processing of aspect and time reference in Mandarin, using Event-Related Potentials (ERP). For the experimental materials, the post-verbal perfective morpheme *-le* was placed in (i) an incongruent temporal context (future time context + perfective morpheme), and (ii) an incongruent aspectual context (progressive + perfective morphemes; see Table 1). The morpheme *zai* was used such that the sentences of the two conditions were equally constrained (both incongruent sentences can be saved by a following clause). The *Aktionsart* of the verbs was also controlled, using only activity verbs, to avoid aspectual coercion due to the progressive morpheme. Two pilot tests were conducted to match the sentences on these criteria. Finally, the experimental sentences were also tested with an acceptability judgment test.

Table 1. Sample items from the ERP experiment (35 per condition, total of 140 experimental sentences).

Condition	Example			
(1) Time condition	Mama mother 'Yesterday/#Tomorrow, mom washed the clothes.'	zuotian / #mingtian yesterday / #tomorrow	xi-le wash-PFV	yifu. clothes
(2) Aspect condition	Mama mother 'Mom already/#PROG washed the clothes.'	yijing / #zai already / #PROG	xi-le wash-PFV	yifu. clothes

The results from 23 native speakers of Mandarin showed different patterns for time reference and aspect processing in Mandarin (see Figure 1). While the time incongruent condition elicited a left anterior negativity (LAN) at the 300-500 ms time window when compared to its baseline, the aspect incongruent condition elicited a broadly distributed P600 (500-700 ms time window). The LAN found at the time condition can be interpreted as a failure to place the event in time in a logical way. The P600 can be analyzed as a failure to access the temporal structure of the event, since two contradictory pieces of information are present in the sentence.

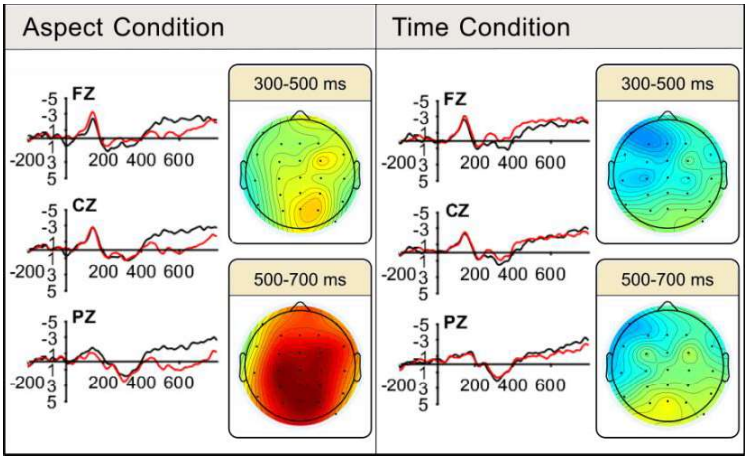

Figure 1. ERP waves of the conditions at *-le* (black = congruent, red = incongruent) and topographic maps of the difference wave (incongruent *minus* congruent; mean amplitude from -2.5 μv (blue) to +2.5 μv (red)).

As a conclusion, the main finding of this paper is that even in a tenseless language like Mandarin, time reference and aspect are processed qualitatively differently in the brain, showing that aspectual processing and time reference processing induced from the same aspectual marker can be teased apart when it comes to the perfective marker *-le*.

KEYWORDS

Time processing, Mandarin perfective, Neurolinguistics

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