

Number Processing in Mandarin Quantity Phrase Production: A Behavioral and ERP Study

Ziheng Cheng¹, Jenny Doetjes¹ & Niels O. Schiller^{1,2}

¹Leiden University, ²City University of Hong Kong

Abstract:

This study investigates whether the lexico-syntactic feature number is activated and selected during the production of quantity phrases in Mandarin Chinese, a language in which numerosity is expressed through numeral–classifier–noun phrases rather than obligatory nominal number inflection. Twenty-nine native Mandarin speakers participated in a picture-naming experiment in which they described displays containing either one or three identical objects, such as 一个苹果 “one apple” and 三个苹果 “three apples”. Each target picture was paired with distractors varying in semantic relatedness and number congruency, including semantically related or unrelated bare nouns and plural phrases.

Behavioral results showed no reliable effect of number congruency on naming latencies. In contrast, naming was significantly slower in semantically related conditions than in unrelated conditions, indicating robust semantic interference. Phrases referring to three objects were produced faster than those referring to one object, but this effect did not interact with either number congruency or semantic relatedness. ERP analyses further revealed an N400-like effect, with more negative deflections for semantically unrelated distractors, consistent with differential semantic processing. However, no significant ERP effect of number congruency was observed.

Together, these findings suggest that number information in Mandarin quantity phrase production may not be automatically selected in the same way as semantic information under the present experimental conditions. More broadly, the results support a distinction between semantic processing and number-related lexico-syntactic processing in Mandarin speech production, and they raise the possibility that number behaves differently in languages without obligatory nominal number marking.

Keywords: Mandarin Chinese; number processing; quantity phrase production; picture-word interference; ERP; N400

Figures and Tables

Table 1 - An example of a target picture presented with a distractor in each condition. Distractors either match or mismatch the plural (N) or semantic category (S) of the target picture name.

condition					condition				
Target picture name	N-S+	N-S-	N S+	N S-	Target picture name	N+S+	N+S-	N S+	N S-
一个苹果 /yi1ge4ping2guo3/ one classifier apple 'one apple'					三个苹果 /san3ge4ping2guo3/ three classifier apple 'three apples'				
Distractor	十个桃子 /shi2ge4tao2zi/ ten classifier peach 'ten peaches'	十个鱼缸 /shi2ge4yu2gang1/ ten classifier fish tank 'ten fish tanks'	桃子 /tao2zi/ peach 'peach'	鱼缸 /yu2gang1/ fish tank 'fish tank'	Distractor	十个桃子 /shi2ge4tao2zi/ ten classifier peach 'ten peaches'	十个鱼缸 /shi2ge4yu2gang1/ ten classifier fish tank 'ten fish tanks'	桃子 /tao2zi/ peach 'peach'	鱼缸 /yu2gang1/ fish tank 'fish tank'

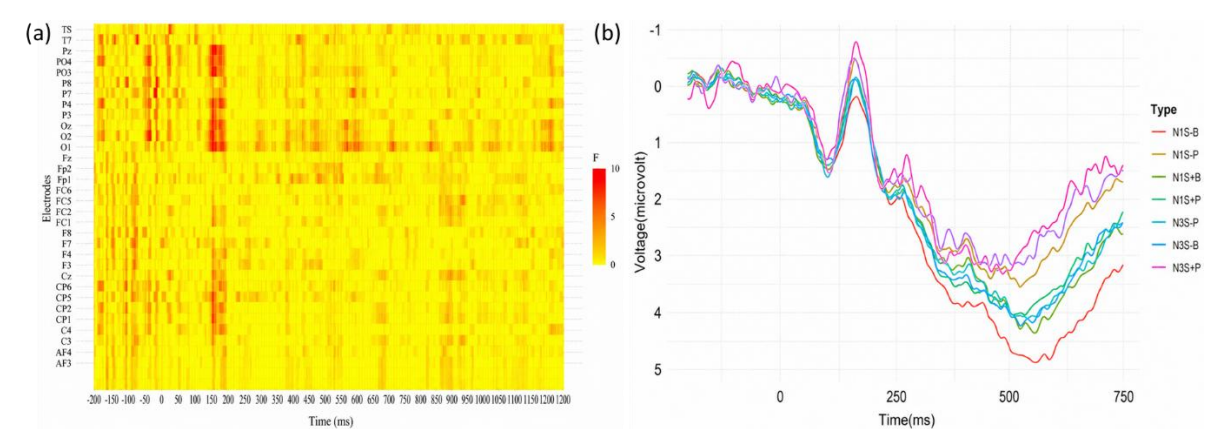


Figure 1. (a) Electrode-wise time-resolved statistical map. (b) Grand-averaged waveforms for different conditions.

(a) ROI for the 330–529 ms time window:
CP5, CP6, Oz, O1, T7

(b) ROI for the 539–697 ms time window:
O1, O2, Oz, P7, PO3

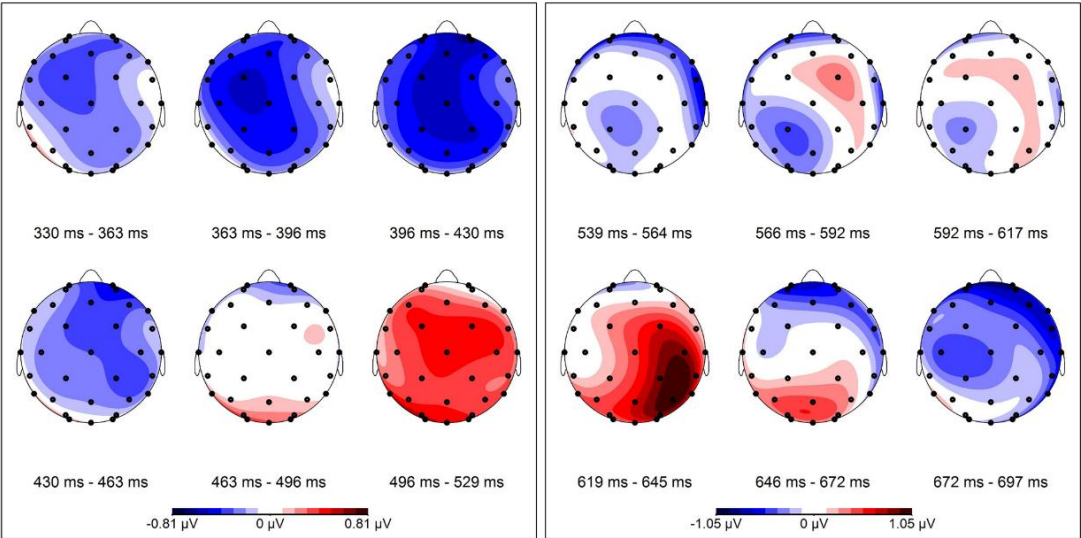


Figure 2. (a) Voltage distributions from 330–529 ms. (b) Voltage distributions from 539–697 ms. Blue and red indicate negative and positive amplitudes, respectively.