Analysis of eye movements data Using Mixed Effects Modeling and Poisson Regression
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Pronoun resolution has been an important issue in reading research. The purpose of this study is to provide a new analysis framework for eye movement data in reading research. Many studies found the phenomena of first mention advantage in pronoun resolution, but some studies challenged the first mention advantage by questioning the percentage of first visits critical characters and the number of fixations on critical characters at different time sets. Eye movement data are often not normally distributed. In this work we applied a mixed modeling approach and a Poisson model to examine eye movement data we have collected for a psycholinguistic experiment by an SR Research EYELINK Experimental Builder version 1.4.562 eyetracker was used. The study used 2×2 design of order-of-mention (first- and second-mentioned) and gender cue (he/she), we recruited 32 native Chinese-speaking undergraduate students at a university in southern Taiwan. Thirty-six short texts were constructed and each contained two sentences and an interrogative question. The first sentence included had two characters of different genders, and the second sentence started with a pronoun with a gender cue, referring to one of characters in the first sentence. The third sentence was an interrogative question to test if readers could determine the pronoun by gender cue provided in sentence two. Reader then answer the question by pressing either the “D” key for “O” (Yes) or the “K” key for “X” (No). All named characters bear stereotypical gender cues and being tested by second graders. Additional six practice texts served as practice trials. There were 36 fillers in total. The entire experiment took approximately 30 minutes for each participant.

We have two main findings in the current study. First, by using a mixed model for reading time, we found that there is no significance in the order effect, but the first gaze duration of sentence 2 significantly predicted the effect. Second, when we examined the fixation counts while readers rereading the first sentence, we did not find any order effect. The results from the new analysis approach are clearly incompatible with the first mention advantage, which previous researches of pronoun resolution. However, we attempt to provide a better approach to analyzing eye-movement data. This finding suggested that the mixed modeling analysis with a Poisson model could potentially be useful for eye movement data analysis.