Camping Tigers, Hiking Dragons: Dangling Modifiers Do Not Add Processing Difficulty

Adrian Zhou[1], Matthew W. Lowder[2], and Fernanda Ferreira[1]
[1]University of California, Davis, [2]University of Richmond

In English, when the subject of the matrix clause is incongruent with its present participial verb modifier, this results in a construction known as a “dangling modifier”. For example: *Driving on the way to the store, a deer darted across the road*. This sentence may be considered ungrammatical because the subject, *a deer*, is incapable of performing the action described by the participial verb *driving*, thus leaving the modifier “dangling”. However, this prescriptivist decree of ungrammaticality operates on the assumption that the language processor tries to integrate *deer* with *driving* and checks their compatibility. Previous literature in formal linguistics have also suggested that the processor initiates a search for a suitable controller upon encountering such modifiers, starting with the matrix subject [1, 2].

The current study examines these assumptions and claims by using an acceptability judgement task and an eyetracking while reading experiment. Thirty-six experimental item sets were constructed as in Table 1. The design crosses the factors Modifier Type (PP vs. VP) and Subject Type (Human vs. Animal). The factor Modifier Type refers to whether the subordinate clause before the matrix clause is a PP (a, b) or VP (c, d). In the VP condition, the verb always describes an action that can only be performed by humans (*driving*, *reading*, etc.) and is the head of the same PP in the PP condition. The factor Subject Type refers to whether the subject of the matrix clause is a human (b, d) or an animal (a, c). The word length of the subject is the same within items and so is the word length of the verb that follows.

Exp 1. In the acceptability judgement task, 60 participants rated the acceptability of the experimental sentences on a Likert scale from 1 (Completely Unacceptable) to 7 (Completely Acceptable). Participants rated only one version of each item. A linear mixed effects model found a significant interaction between Modifier Type and Subject Type, with the VP + Animal condition receiving the lowest acceptability ratings (Figure 1). This result is consistent with our understanding of prescriptivist English grammar. When the task requires people to be on the lookout for ungrammatical elements, the dangling modifiers in the VP + Animal condition become fairly salient to a careful reader.

Exp 2. In the eyetracking experiment, 40 participants read the experimental sentences along with 60 filler sentences one at a time. Log-transformed reading times (first pass duration and regression path duration) were analyzed at the subject region and the verb (spillover) region. If the processor needs to integrate the subject with the modifier, then the VP + Animal condition would either fail the compatibility check or force a bizarre interpretation, presenting larger processing difficulty and resulting in longer reading times. However, such an effect was not observed in the data. Linear mixed effects models failed to find a significant interaction between Modifier Type and Subject Type for both first pass duration and regression path duration at both subject and verb regions (Figure 2). Bayesian regression models and computed Bayes factors provided strong evidence in favor of the null hypothesis, which posits no interaction between Modifier Type and Subject Type (Figure 3, BF_{10} = .00029 for regression path duration at subject region and BF_{10} = .00004 at verb region). Only a main effect of Subject Type for first pass duration at the verb region was significant (b = .07, p = .0016), with animal subjects receiving longer first pass reading times than human subjects.

The absence of an interaction in the eyetracking experiment, combined with a significant interaction in the acceptability judgement task, suggests that the processing system may not necessarily attempt to integrate the subject with the modifier in real-time comprehension. Instead, the observed effects in the acceptability judgment task may reflect metalinguistic awareness or a post-hoc evaluation of grammatical norms, rather than automatic parsing difficulties. The main takeaway from the reading time results, in contrast, is that the primary determinant of processing difficulty is subject type, with animals being more difficult than humans.

(a) On the way to the store, a deer darted across the moonlit road. (PP, Animal)
(b) On the way to the store, a teen turned left in the wrong lane. (PP, Human)
(c) Driving on the way to the store, a deer darted across the moonlit road. (VP, Animal)
(d) Driving on the way to the store, a teen turned left in the wrong lane. (VP, Human)
Table 1. Example set of experimental sentences.

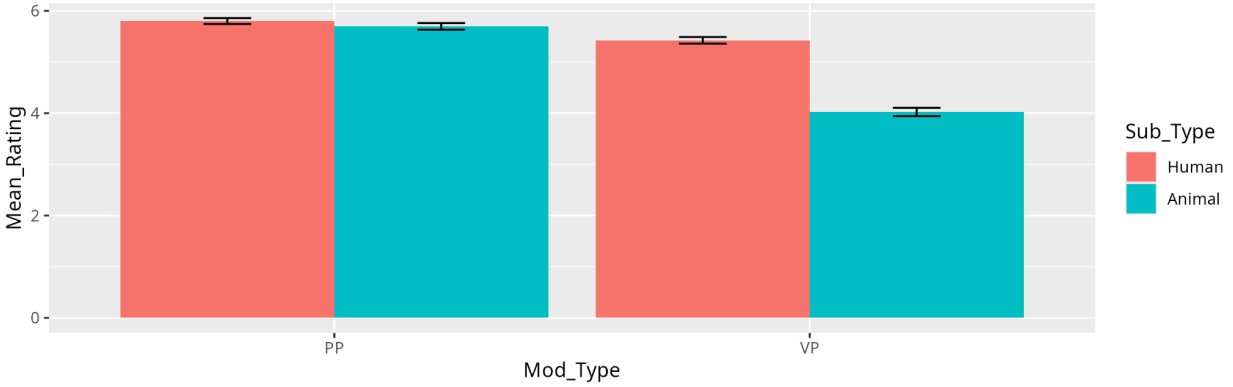

Figure 1. Average acceptability ratings in Exp 1. Error bars represent 95% CI. Significant interaction between Mod_Type and Sub_Type.

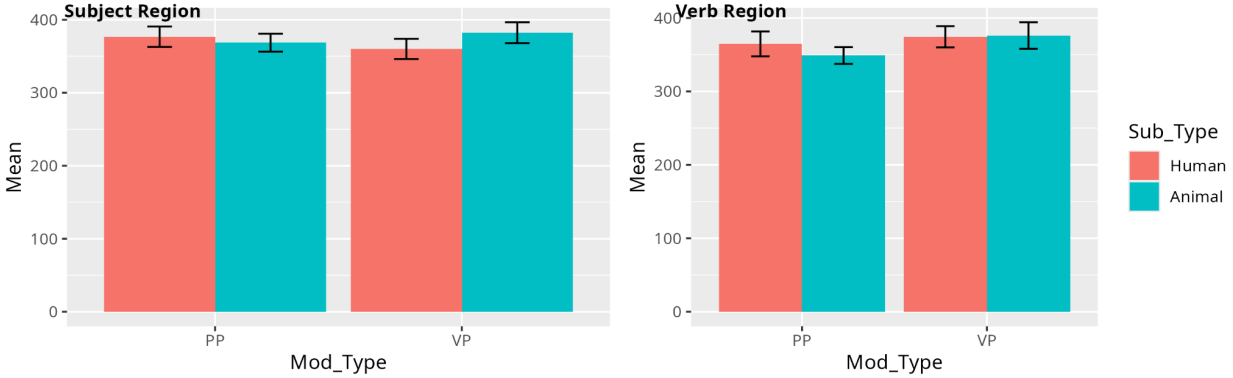

Figure 2. Average regression path durations in subject and verb regions in Exp 2. Error bars represent 95% CI.

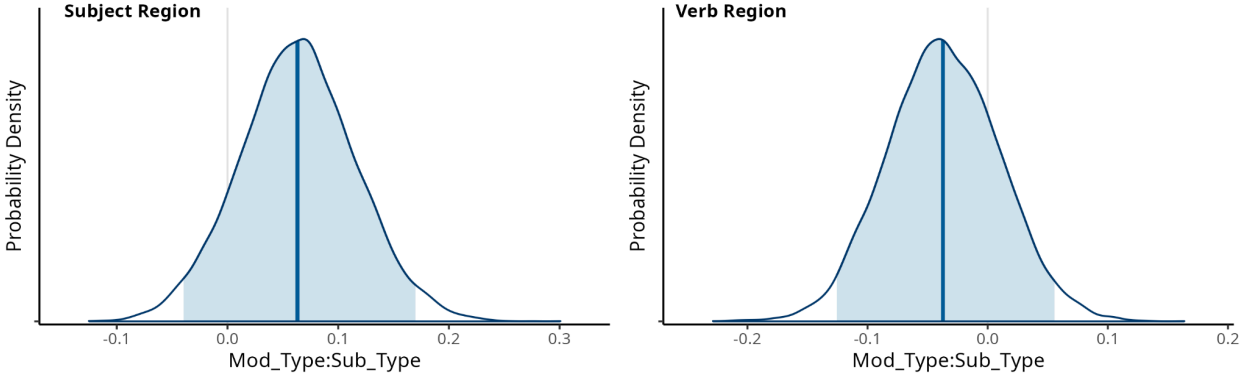

Figure 3. Posterior distribution of interaction term for regression path durations in Exp 2. Shaded regions represent 95% credible intervals.

[1] Donaldson, J. (2021). Control in free adjuncts: the dangling modifier in English.
[2] Kortmann, B. (1991). Free Adjuncts and Absolutes in English: Problems of Control and Interpretation