

Predicting the unpredicted: No relationship between ‘the’-skipping and response inhibition

Francisco Rocabado¹

@Rocabado_F
jrocbado@nebrija.es

Bernhard Angele^{1,2}

bangele@bournemouth.ac.uk

J. Andoni Duñabeitia¹

@jdunabeitia
jdunabeitia@nebrija.es

¹ Centro de Ciencia Cognitiva (C3), Nebrija University

² Department of Psychology, Bournemouth University, Fern Barrow, Poole BH12 5BB, United Kingdom

Introduction

Word skipping helps make reading more efficient. We know that skilled readers tend to pass over short and high frequency words, which are easy to process, without fixating them. In English, the best example for an easy to process, high-frequency word is the article “the”.

There are two primary sources of information readers may be able to use in order to decide whether to skip a word:

- They can use visual information that is already available about the upcoming word.
- They can also use information about the preceding sentence context that has already been processed (e.g., Rayner et al., 2011).

Surprisingly, readers tend to skip parafoveal previews of the article “the” even if they are not compatible with the preceding sentence context (Angele & Rayner, 2013).

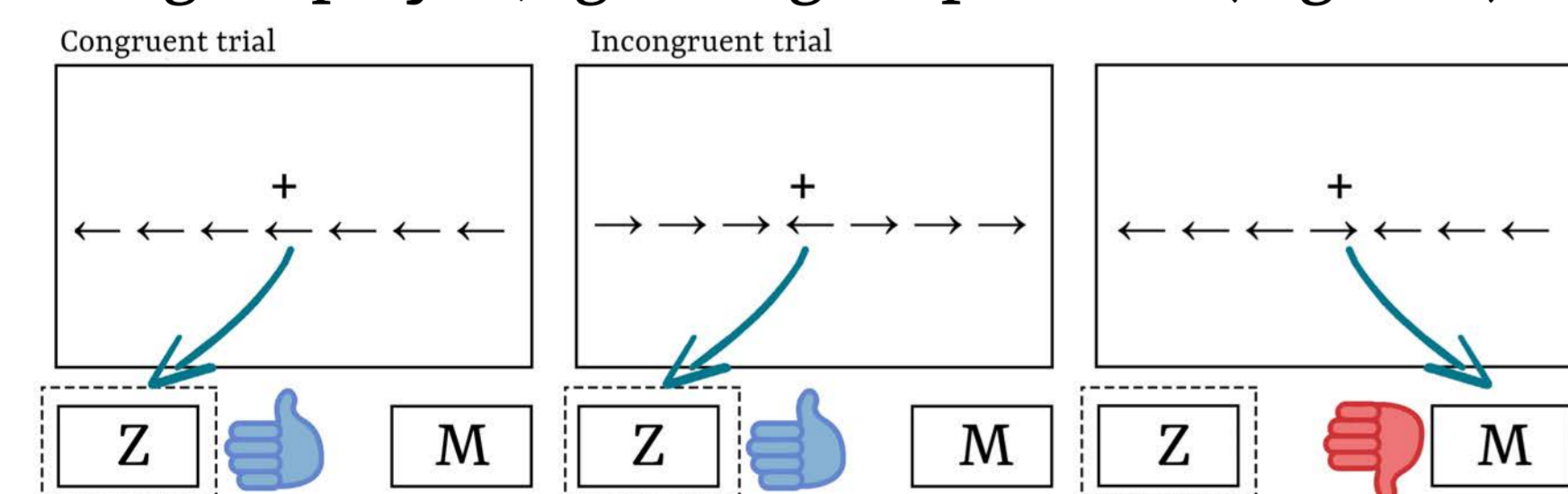
However, it is not clear how the decision to skip or fixate a word relates to other decisions that individuals make. There has been extensive research on how individuals differ in their executive function and their capacity for response inhibition, both of which affect the speed and accuracy of decisions made in many behavioural tasks.

So far, no research has been done on the relationship between skipping and performance on response inhibition tasks.

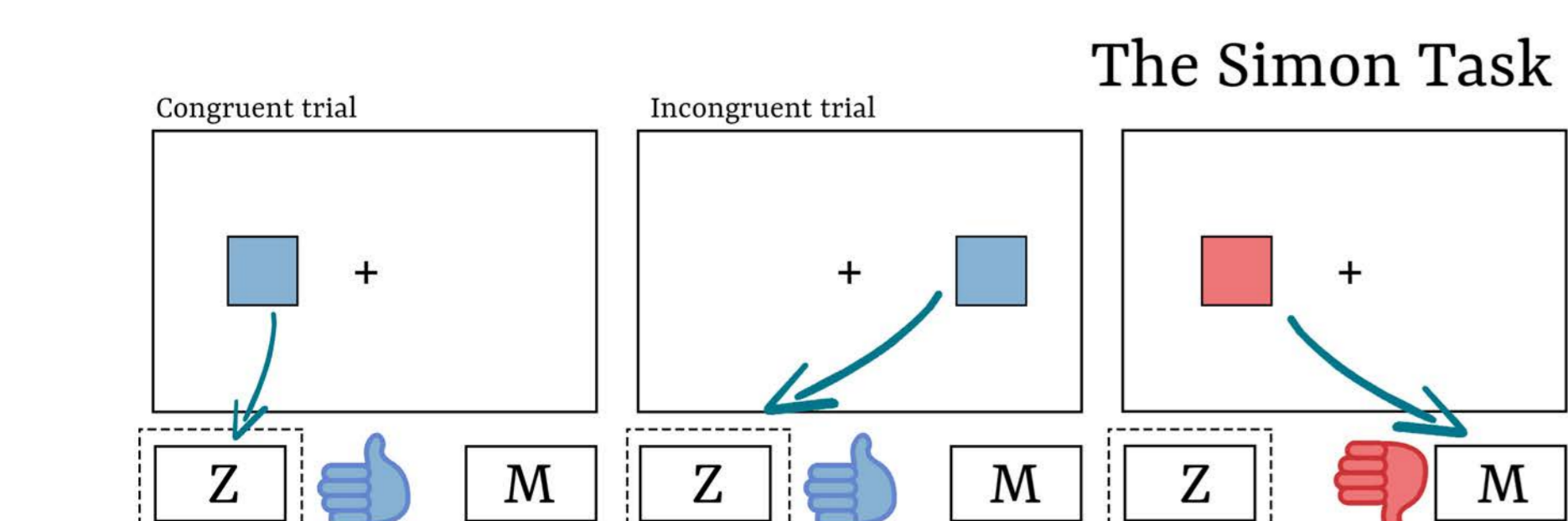
Research question: Are skipping decisions related to general cognitive control or are they special?

Method

All the tasks were programmed and run using the OpenSesame software (Mathôt et al., 2012). A sentence reading experiment using a gaze-contingent display change paradigm (Rayner, 1975) was programmed (Figure 2). We also administered two cognitive control tasks were also programmed: First, we implemented modified version of The Eriksen Flanker Task (Eriksen & Eriksen, 1974) on which participants had to make a decision based on the pointing direction of the middle arrow. Second, we implemented the Simon Task (Simon, 1967), in which participants had to press one of two key corresponding to the colour of the square being displayed, ignoring its position (Figure 1).



Eriksen Flanker Task



The Simon Task

Figure 1: Procedure for the Flanker and Simon tasks.

In order to obtain a measure of inhibition, we calculated the difference in accuracy (in percent) between the two conditions (incongruent - congruent) for each task. Our overall inhibition measure is the mean congruency effect across the two tasks.

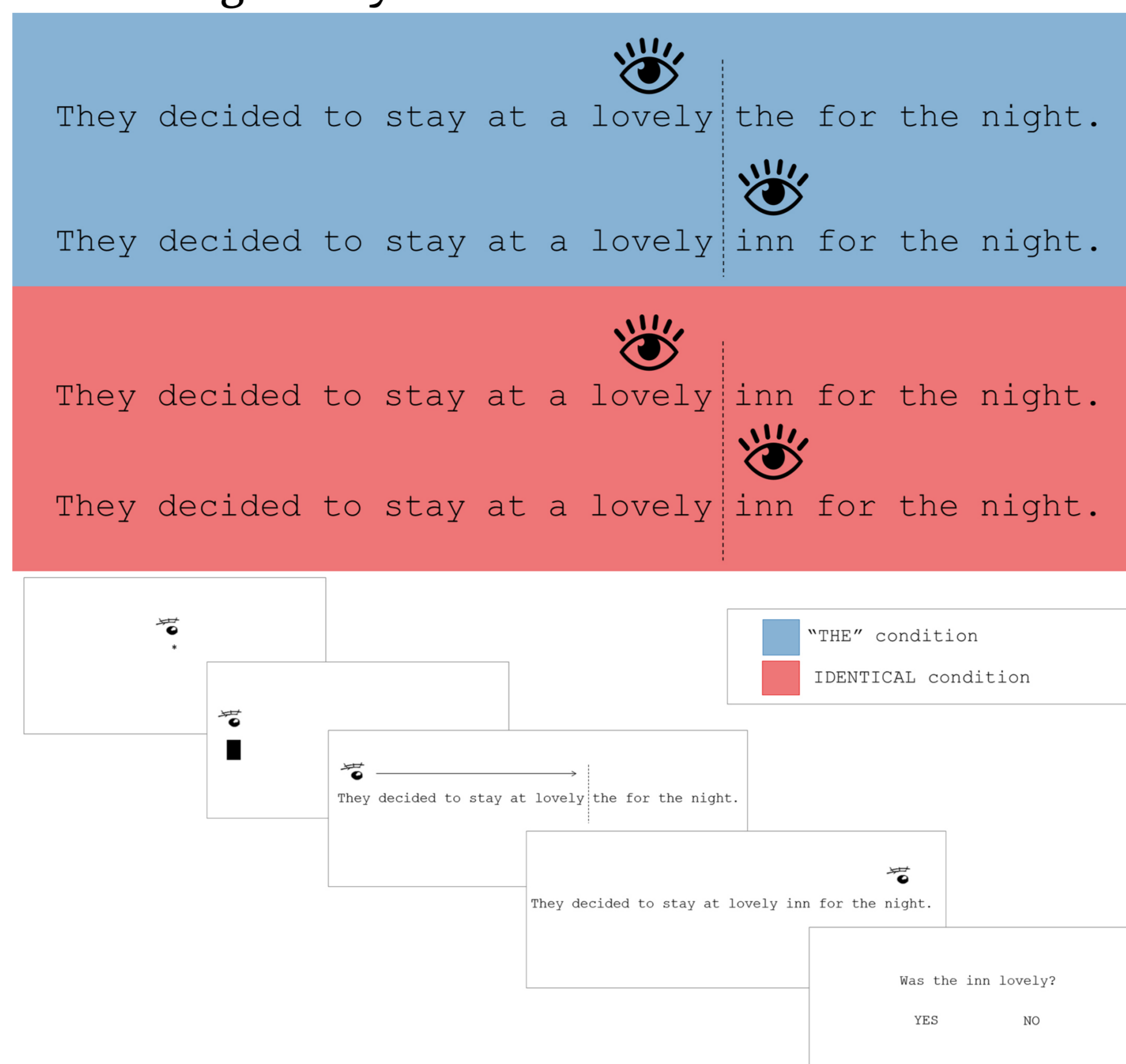


Figure 2: Display and procedure for an example trial.

Results

Just like Angele and Rayner (2013), we found a standard preview benefit effect on the target word (“inn”, Figure 3), with longer gaze durations being observed in the “the” preview condition than in the identical preview condition ($b = 26.78$, $SE = 6.399$, $t = 4.185$, $p < 0.05$).

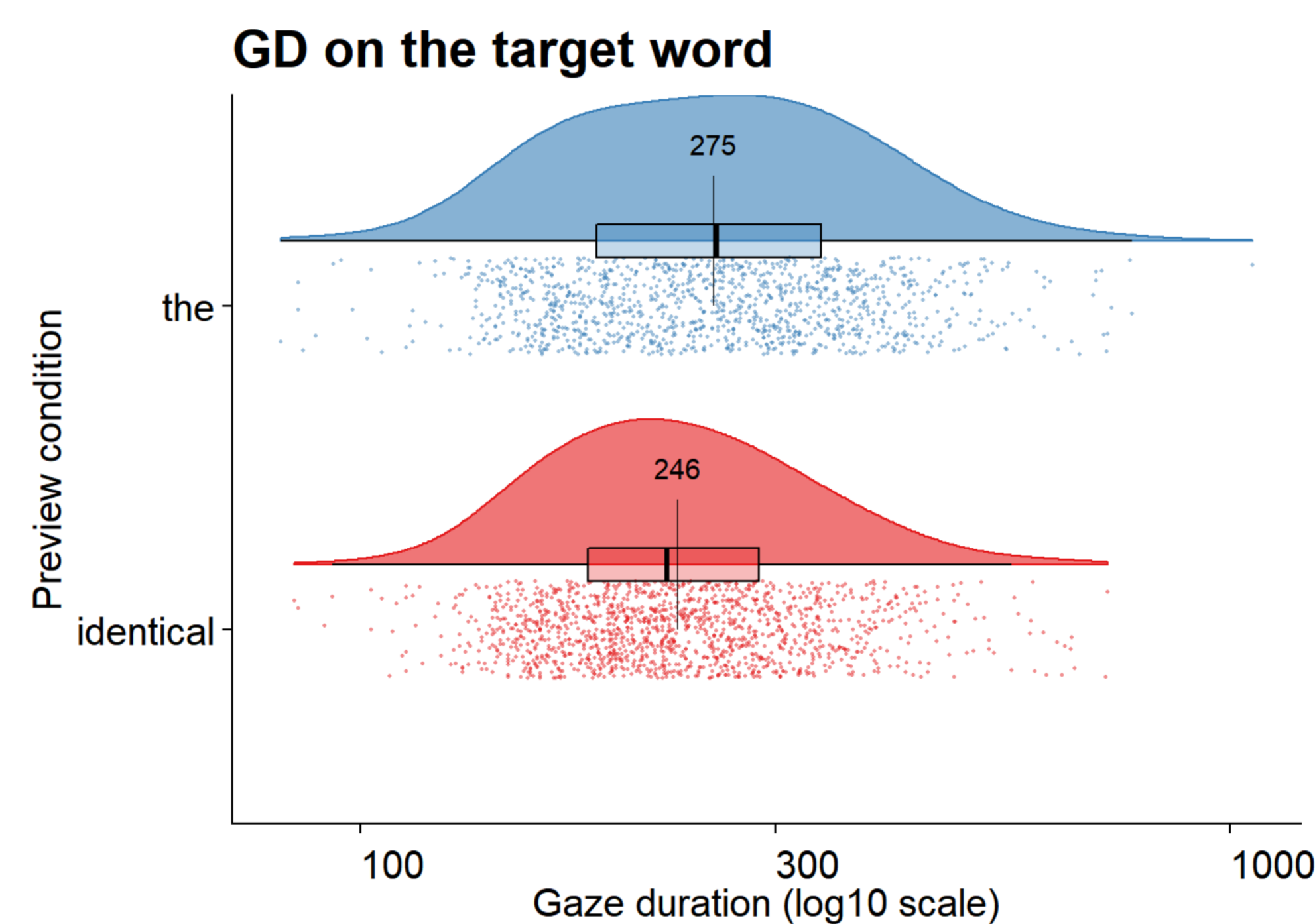


Figure 3: Raincloud plot (Allen et al., 2019) for gaze duration on the target word by preview condition. The boxplot represents the median and the 1st/3rd quartile; the thin vertical line represents the mean.

There was also evidence of later disruption in total viewing time on the post-target word (Figure 4), with the “the” preview condition being associated with longer total viewing times ($b = 41.51$, $SE = 9.462$, $t = 4.387$, $p < 0.05$). Neither of these effects of the experimental manipulation interacted with the combined inhibition measure (all $ps > .05$).

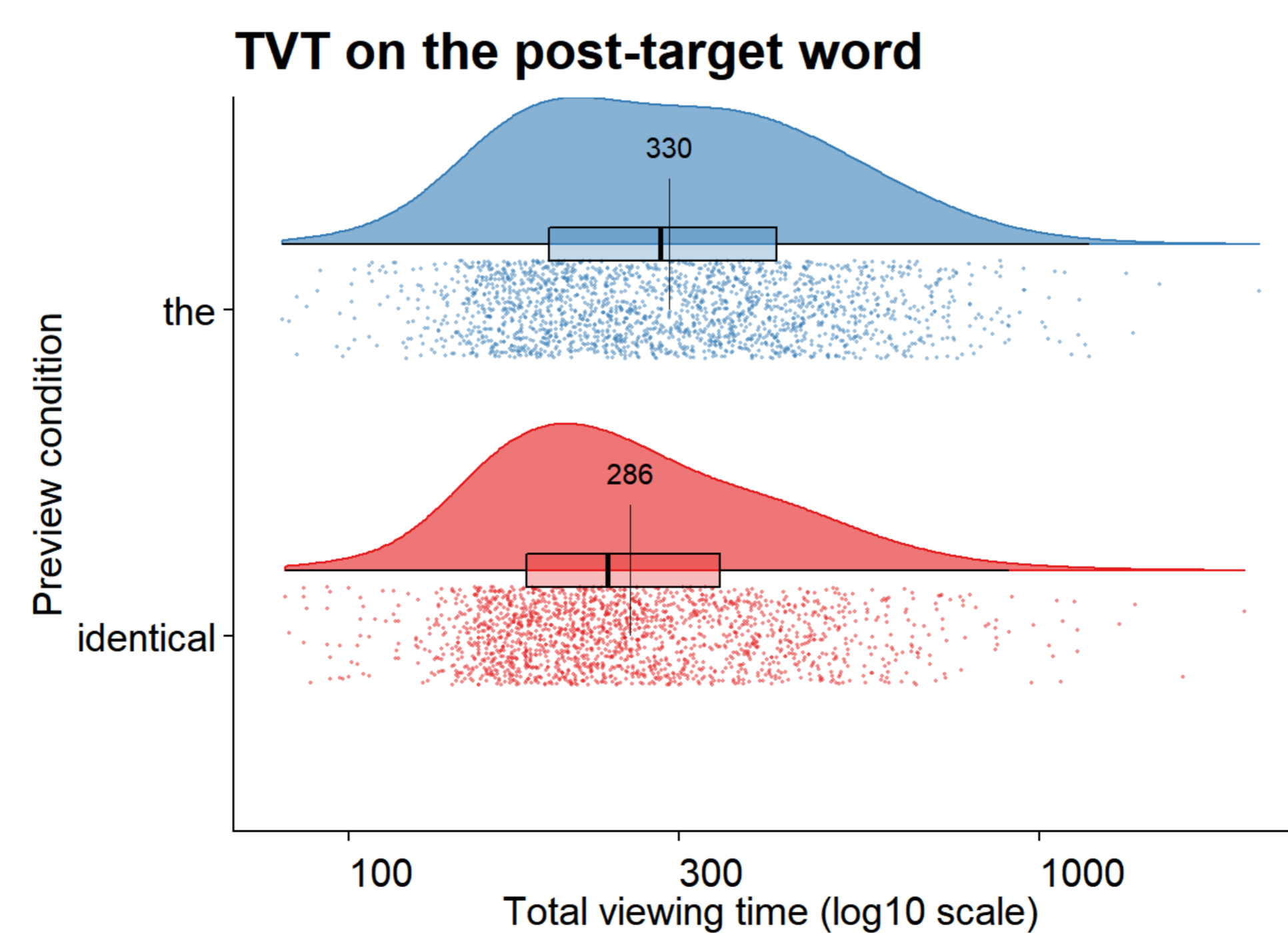


Figure 4: Raincloud plot (Allen et al., 2019) for total viewing time on the posttarget word by preview condition. The thick line on the boxplot represents the median; the thin vertical line represents the mean.

In terms of the probability of skipping the target word (Figure 5), we again replicated the effect observed by Angele and Rayner (2013): infelicitous “the” previews lead participants to skip the target word more often than identical previews ($b = 0.4486$, $SE = 0.0973$, $z = 4.611$, $p < 0.05$).

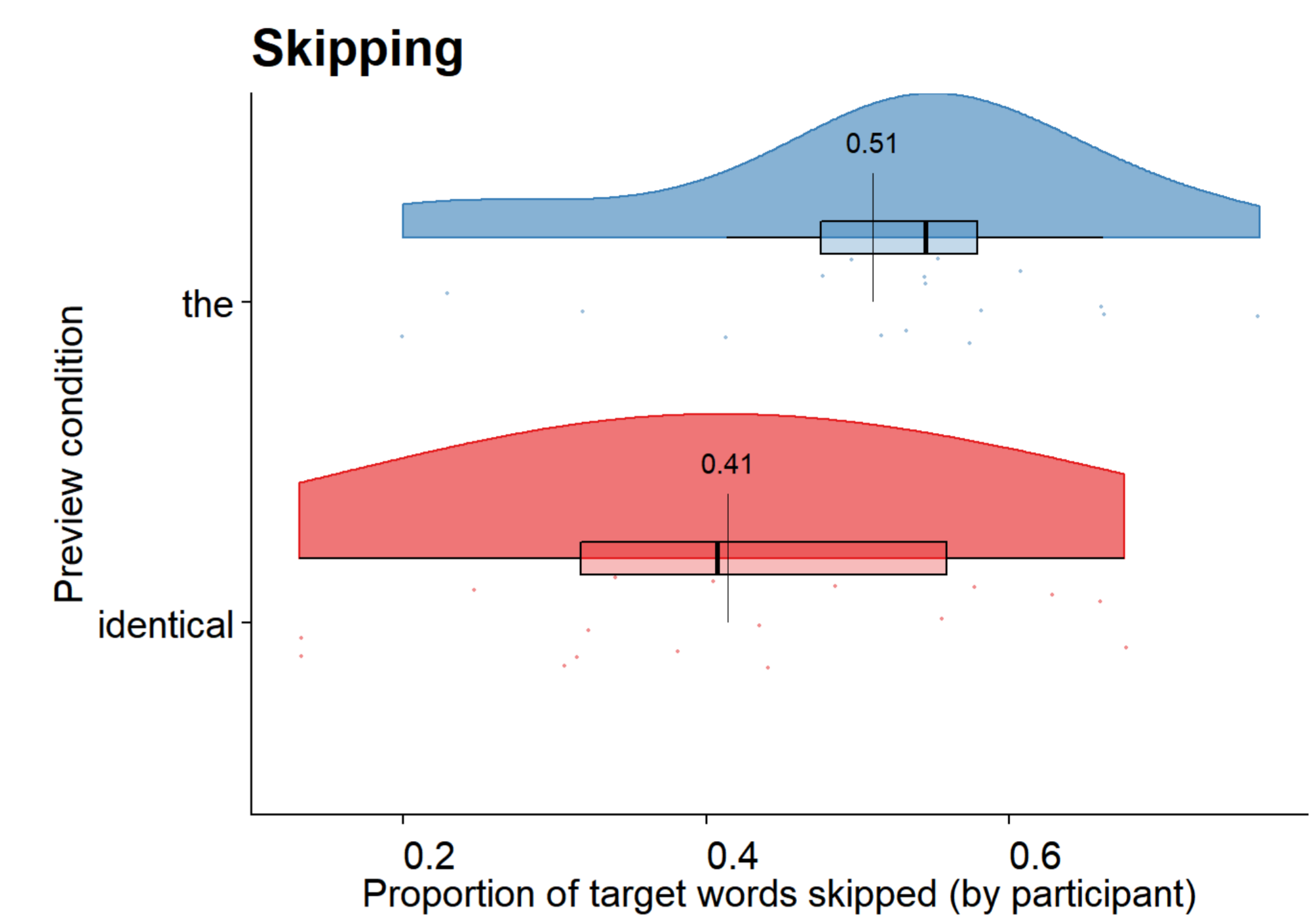


Figure 5: Raincloud plot (Allen et al., 2019) for proportion of skipped target words (by participant). The thick line on the boxplot represents the median; the thin vertical line represents the mean.

However, and critically, despite a trend in the correct direction (Figure 6) we did not observe an interaction between the inhibition measure and the “the” skipping effect ($b = 0.4486$, $SE = 0.08502$, $z = 0.8292$, $p = 0.41$).

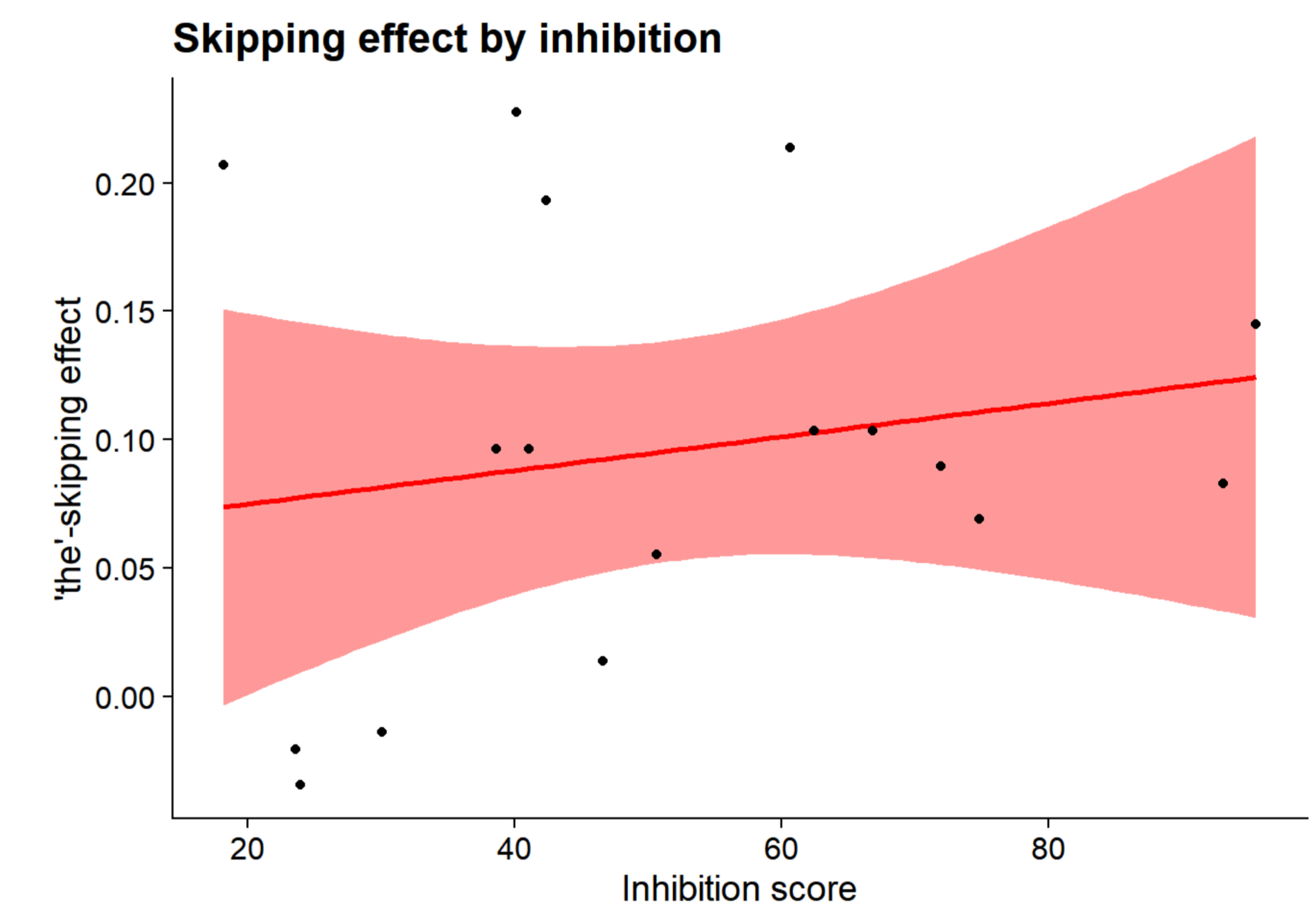


Figure 6: Difference in skipping proportion between the ‘the’ condition and the identical condition by participant’s inhibition score.

Discussion

- Although there is previous evidence from other studies that response inhibition can influence the quality and speed of decisions, we found that this is not the case for automatic skipping of short, high-frequency words.
- This may indicate that oculomotor control is fundamentally different from other kinds of motor control.
- It is possible that only some very specific cognitive processes such as word identification, but not response inhibition, may be able to influence whether a word is fixated or not.

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