Parafoveal and foveal information serve different purposes in reading: Parafoveal is used for saccade programming, foveal for comprehension

Recent work by Schotter and Leinenger (2016) suggests that parafoveal information is mostly used for saccade programming purposes by "hedging a bet" that the word *will be* identified before it fully is. This leads the reading system to not only skip over words, but also to make *forced fixations* on them (i.e., short single fixations due to the pre-initiation of upcoming saccade programs away from a word before it is fixated; Morrison, 1984). They argue that forced fixations can explain standard preview benefit effects, which have thus far been explained via linguistic integration (see Rayner, 2009; Cutter, Drieghe, & Liversedge, 2015) rather than oculomotor preplanning, and also the *reversed preview benefit* effects that they observed in which durations are *longer* following identical previews than different previews (when they are easier to process—higher frequency). An open question is whether, in forced fixation cases in display change conditions, readers might misrepresent the words they read in the sentence. That is, had readers hedged their bets that the word that they will fixate would be the parafoveal preview (leading to a forced fixation) but then actually fixated a different word, it may be possible that they would misrepresent the fixated word as the different preview word.

To investigate this, we had 24 subjects read 150 experimental sentences and used the gaze contingent boundary paradigm (Rayner, 1975) to dissociate the parafoveal preview and the foveal target. We designed the sentences so that the two words (the preview and target) were plausible at the point they were encountered, but neither, one, or both of them became implausible later (Figure 1). The sentences consisted of 75 pairs of sentences such that in one of the pairs the high frequency word was the target and in the other half the low frequency word was the target; thus the preview frequency and the plausibility manipulations were orthogonally crossed. A critical region at the end of the sentence instantiated the plausibility manipulation and an intervening buffer region remained neutral. Regressions out of the critical region should be sensitive to the reader's understanding of the sentence; there would be more regressions in conditions where the preview was implausible if that word were encoded whereas there would be more regressions in conditions where the target was implausible if that word were encoded.

Our analyses provided evidence for forced fixations in that fixation durations were shorter on the low frequency target when the preview was a different (i.e., higher frequency) preview than when it was an identical (i.e., low frequency preview, $p < .05$; Figure 2). These forced fixations are also seen in a lower tendency to make a regression out of the target region (i.e., higher tendency to move forward) when the preview was high frequency compared to low frequency ($p < .001$), regardless of whether the display changed or did not (Figure 3, left panel). The critical region showed only an effect of the plausibility manipulation with respect to the target word ($p < .001$; Figure 3, right panel), suggesting that understanding of the sentence by the time that region was encountered was only determined by the fixated word and not the parafoveal word or the display change.

Together, these data suggest that immediate eye movement behavior (e.g., fixation behavior when words are first encountered) is based on "hedged bets" initiated by low-fidelity information in parafoveal vision. However, emerging linguistic processing (i.e., word recognition and sentence processing) occurs mostly based on the higher fidelity information obtained from foveal vision. When ongoing understanding of the sentence breaks down (e.g., due to implausibility), the comprehension system can intervene, causing regressions. Thus, reading can be considered a two stage process in which parafoveal information is used for saccade programming to maintain reading speed (e.g., by skipping or pre-initiating eye movements) but has little effect on the reader's ultimate understanding of the words in sentences because the system takes advantage of high acuity information to maintain reading accuracy.

Figure 1. Example sentences used in the experiment with experimental conditions for sentence 1 labeled to the left (sentence 2 shows only Preview Implausible) and analysis regions labeled above. Note: first word in the target regions is the preview and second word is the target.

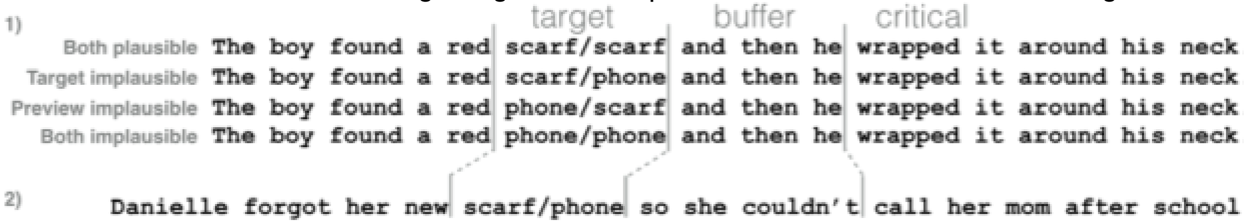

Figure 2. Single fixation duration on the target word as a function of target frequency and display type (identical vs. change). Error bars represent +/- 1 standard error of the mean.

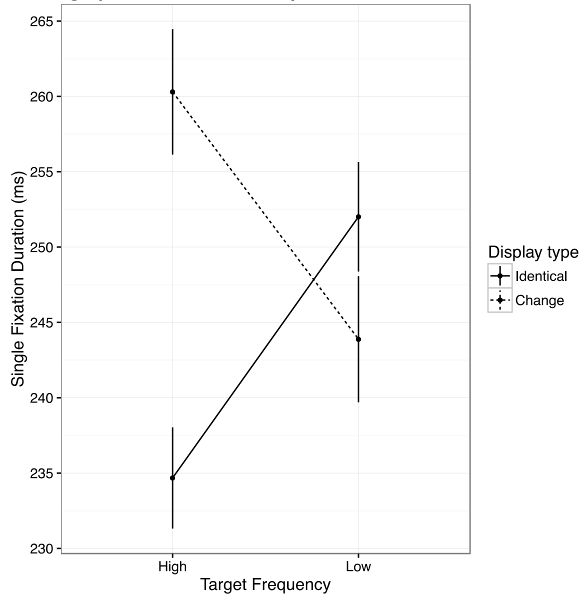

Figure 3. Probability of making a regression out of two regions of the sentence (target and critical) as a function of which word (preview/target) was implausible once the critical region was encountered (x-axis) and preview word frequency (closed circles = high frequency, open triangles = low frequency). Note that the central two conditions in each panel are display change conditions and the outer two conditions are identical conditions.