

When readers pay attention to the left: A concurrent eyetracking-fMRI investigation on the neuronal correlates of regressive eye movements during reading

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Predictive coding postulates that saccades are used to actively test hypotheses about the causes of sensory input (Friston et al., 2012). Accordingly, refixations in sentence reading may be triggered by prediction errors as indicators of the need to update one's internal model of the world. Refixations follow regressive inter-word saccades after changes in attentional re-orientation (Apel et al. 2012). The presence/absence of prediction errors and leftward attention shifts predict qualitatively different activation patterns for regressive and progressive saccades in brain regions involved in reading. We tested this hypothesis using concurrent fMRI-eyetracking. Twenty-three native German speakers read semantically anomalous and non-anomalous sentences. Progressions and regressions were identified via eye-movements and temporally correlated to BOLD signal changes. Onsets and durations were modeled separately per saccade type. At the group level, we contrasted regressive and progressive saccades and examined amplitude modulation differences by saccade length. Activation patterns differed substantially between saccade types. Progressions reveal bihemispheric deactivation especially in frontal regions with only sporadic activations at temporal sites (e.g. left MTG). Regressions engender broad bihemispheric activations within a fronto-parietal-temporal network, including regions of attention control. These findings suggest that neuronal activation for regressions correlates with resolution of prediction error and changes in attention direction.

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