A Quiet Eye Without a Target: The Primacy of Visual Information Processing

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A gaze strategy which repeatedly has been found to be related to superior motor performance is the so-called Quiet Eye (QE) which is defined as the final fixation on a specific object before the unfolding of movement execution (Vickers, 2007). Explaining this phenomenon it has been assumed that the QE supports information processing underpinned by studies showing that its efficiency depends on processing demands of the task to be solved (e.g., Klostermann et al., 2013). However, the question remains whether the suggested mechanism also holds for processes referring to stimulus identification, in particular, for visual information processing. Consequently, in the study at hand visual processing demands were manipulated by comparing full visibility vs. no visibility conditions within two conditions of differing QE durations. Performance enhancing effects of long QE duration were expected to be revealed as a function of increased information processing duration only.

Method

20 participants attended on two days with a training session on the first (10 blocks of 16 trials) and a test session on the second day (4 blocks of 16 trials). The goal was to throw balls as accurately as possible at a virtual target disk. Performance data were measured with a VICON-T20 system (200 Hz) and gaze behaviour was recorded with an integrated mobile eye tracker (EyeSeeCam, 220 Hz). The participants' QE was manipulated by controlling the movement phases using audio tones and the fixation onset which was evoked either earlier or later in time relative to movement unfolding by a flicker cue. Additionally, manipulating visual processing demands, within the differing QE periods the target disk was presented either immediately or delayed at the position of the flicker cue (see Figure 1). As variables, the averages of QE onset and offset as well as radial error were calculated and analysed with a 2 (fixation onset) x 2 (target onset) ANOVA with repeated measures and planned paired-samples t-tests.

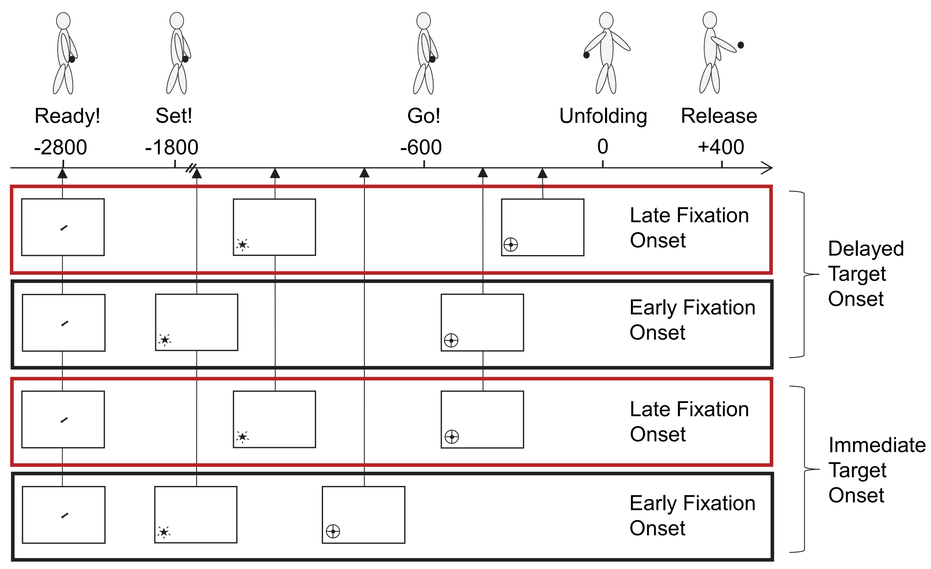
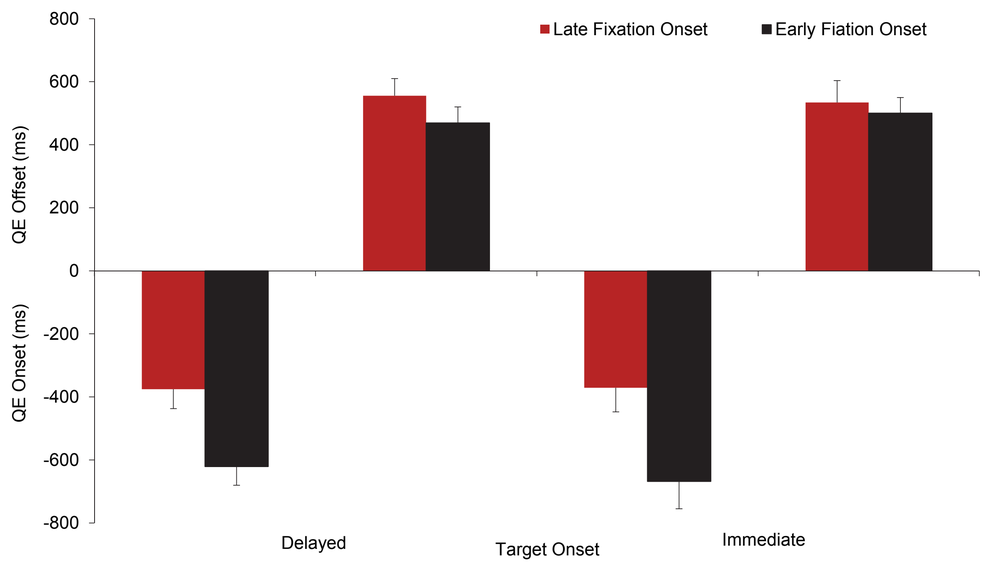


Figure 1. Timeline of the experiment for the delayed vs. immediate target onset and the late vs. early fixation onset conditions, respectively. Example: The flicker cue evokes a fixation at the bottom left corner position either later or earlier in time and the target is presented at the flickered position either delayed or immediately.

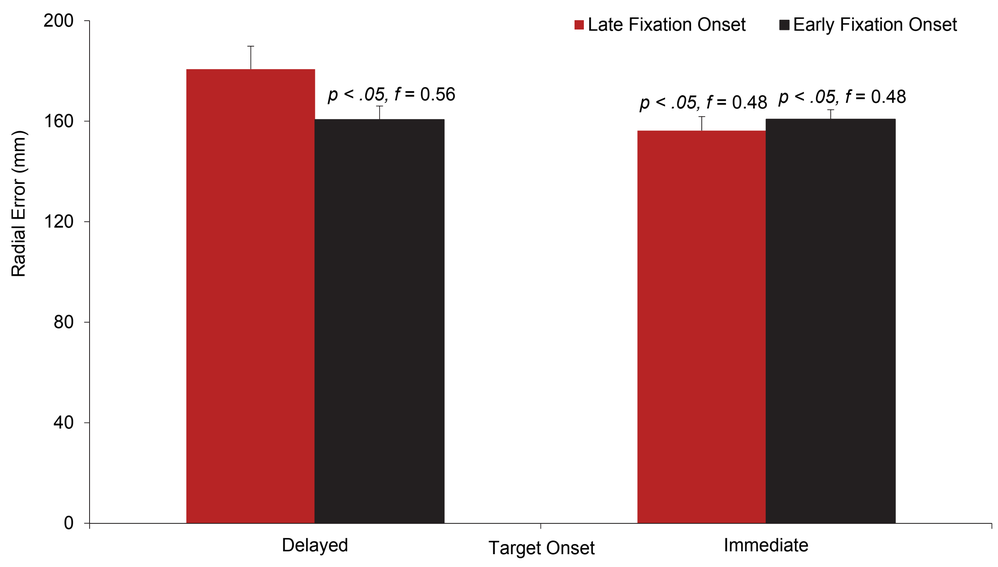
Results

QE onset and offset (*M* and *S.E.*, in ms)



Fixation onset: QE onset, $F(1,19) = 34.75$, $p < .01$, $f = 1.33$

Radial error (*M* and *S.E.*, in mm)



Target Onset, $F(1,19) = 4.64$, $p < .05$, $f = 0.49$
Fixation Onset x Target Onset, $F(1,19) = 5.36$, $p < .05$, $f = 0.53$

Discussion

The results support the suggested link to visual information processing since an increased efficiency of long QE durations was found under shortened processing duration only. Furthermore, the findings indicate that extending the QE period above a task relevant threshold does not amplify its functionality. In summary it can be said that the assumed mechanism behind the QE phenomenon seems to be rooted in a cognitive domain.

References

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Vickers, J. N. (2007). *Perception, cognition, and decision training. The quiet eye in action*. Champaign, IL: Human Kinetics.