# Eye movements and motor programming in a Time-To-Contact task

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## 1 Introduction

In previous experiments investigating motor control in a Time-To-Contact task [Morya et al., 2003], events occurring 400-600 ms prior to contact (but not earlier or later) caused volunteers to anticipate their estimate of when contact occurred. Many such mislocalization or mistiming effects have been discussed in the literature [Nijhuan, 1994; van Beers et al. 2001]. In preliminary eye-tracking experiments [Morya et al. 2004], with a simplified version of the task, involuntary shifts in gaze suggested the presence of attentional shifts as volunteers prepared to respond, that might be associated with their anticipations. To better understand the factors involved in these observations, gaze was sistematically recorded changing the speed of the moving target, and with different instructions as to where the volunteers should look as they performed the Time-To-Contact task.

## 2 Methods

A computer screen presented two small circles, vertically aligned. The upper circle was always stationary, and at the beginning of each trial the lower circle started to move up with one of three possible velocities, so as to overlap with the upper circle 956, 1352 or 1911 ms later. Eight participants had their eyes tracked as they prepared to incline a joystick at the exact moment of the superposition of these two circles, under three diferent conditions: a) free gaze; b) fixating the stationary middle circle and c) following the moving lower circle with their eyes

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## 3 Results

With free gaze participants were most likely to be fixating the stationary circle when contact occurred. When asked to fix the stationary upper circle, participants had no trouble in following instructions. When asked to follow the moving circle, on most trials participants were not able to pursue the target all the way to contact, but switched their gaze to the stationary upper circle some time before contact. When the speed of the moving target was varied, the shift to the stationary target occurred at constant distance from the stationary target (t-test, $P=0.40$) and correspondingly different times before coincidence (t-test, $P<0.05$), rather than the other way around.

## 4 Conclusion

The spatial aspects of the task, which include the inhomogeneous distribution of receptors in the retina and the different processing mechanisms associated with different retinal areas, seem to be a more severe botttleneck than the temporal aspects of the task, more associated with central processing of both sensory input and motor programming.

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