

# **Implication of attention on the appearance of an aberrated target in the isoplanatic patch of central vision**

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## **Purpose**

Our goal is to investigate visual processing of targets without ‘conscious’ attendance to the stimuli, and test the role of awareness in the appearance of aberrated stimuli within the isoplanatic patch of central vision.

## **Methods**

A high contrast tumbling ‘E’ visual acuity test, in black on white, was assessed with an adaptive psychophysical procedure, in photopic conditions using a green monochrome OLED microdisplay. Seven observers participated to this experiment, all undilated and, with a viewing pupil, in consequence, restricted to a diameter of 5 mm. By using an adaptive optics system, the ocular aberration was both measured and corrected in infrared light at a frame rate of about 10 Hz. The average rms wavefront error reaches below 0.1 microns (excluding tip and tilt) and the corrections demonstrate a bandwidth varying between 2 and 5Hz according to the subject, when the gain was fixed at 0.2. The subjects’ vision were modified in order to meet three types of viewing condition that would mimic the system as (i) free of aberration, (ii) in natural condition (after removal of the spherical component), and (iii) affected with a random phase profile. The best focus of the subject was determined using a cyclopledged subject with normal vision entirely corrected, who subjectively was able to report the sharpest image of a tumble E of 10 arcmin presented on the green display. Three experimental protocols were studied.

The first tests were split into two main procedures: one using a post-target stimulus mask, with a relatively broken pattern consisting of moving dots of various sizes fluctuating between 0.5 to 1 arcmin of diameter, randomly re-arranged; and one without. The role of the stimulus was to capture the attention of the subject and disrupt the ongoing visual processing of the image. The stimulus appears after the offset of the target with a certain time delay. Two comparative stimuli were employed one acted as a primer, presented just before the onset of the target, and the other was concomitant with the target it overlapped.

In a second experiment, we tried to measure the possible role of attention in the efficiency of the post-stimulus by lowering the target contrast and introducing cues at the beginning of the test, just before onset of the target. The cues consisted of multiple dots, of about 5 arcmin of diameter, flashing in the periphery in random directions, for about 58 ms.

In order to test further the effect of anticipation, a third experiment was designed which combined the two former tests for random off-axis positions of the target presentation within the two degrees of field of view subtended by the display.

## **Results**

The first experiment shows a differential effect of the stimulus on the discrimination task by a factor up to 0.15 arcmin for aberrated target. This effect tends to act differently with phase profile: inhibitory, in the case of natural aberration while, facilitatory, in the case of the random pattern. Interestingly, this effect was absent in the free aberration viewing conditions. Note that

the magnitude of those effects was equal between stimuli. Although subjective report converges to a decrease of visibility of the target and difficulty of responses at their threshold, the effect of masking was not systematic across subjects suggesting that attention, memory and subject strategy could overcome the action of the stimulus. As a matter of fact, unattended target have been shown to increase efficiency of masking and it is probably that, in our study, attention was modulated in reaction to the masking agent. Yet, in high photopic range, our test using peripheral cues and moving target, neither at high contrast nor low contrast, did confirm this hypothesis and the disturbance was easily discarded by the subject. On the other hand, more recent results suggest that the effectiveness of the post-stimulus could be better highlighted by mesopic conditions.

### Conclusions

Tumble E discrimination tasks are resistant to attention disturbance in both low and high contrast photopic for black on white target. The stimulus seems to have an effect both on subjective and objective measurement. Its varying effect for aberrated target may indicate variation in time processing and interference from the post stimulus mask with the target. However, the stimuli manipulated have strong energy (knowledge, duration...) that may prevail upon and the nature of an objective test is probably too basic to reflect target appearance. As a consequence, efforts are oriented towards adoption of better masking, and more appropriate visual task.

## Experimental procedure

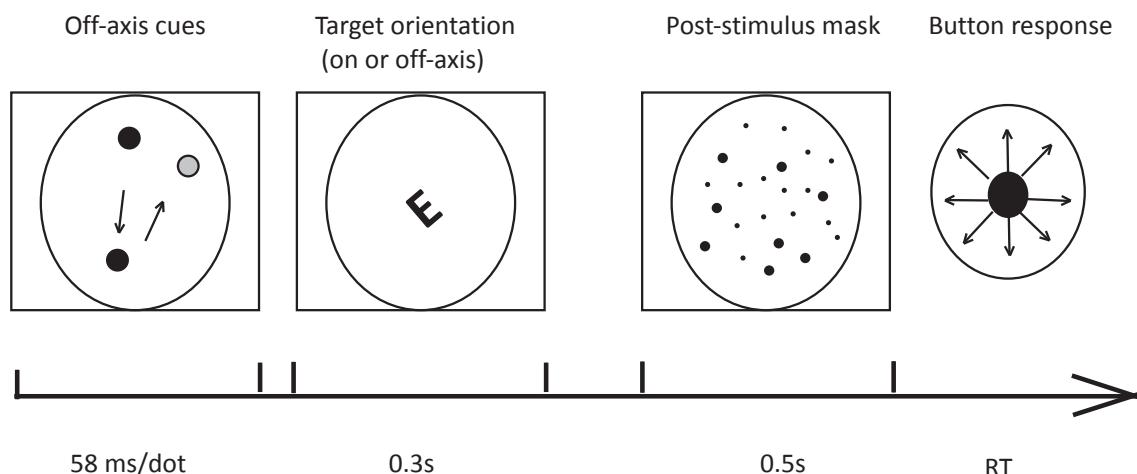


Fig.1- Time sequence of the third experiment. RT stands for the response time of the observer.