# Neuroscientists disprove idea about brain-eye coordination

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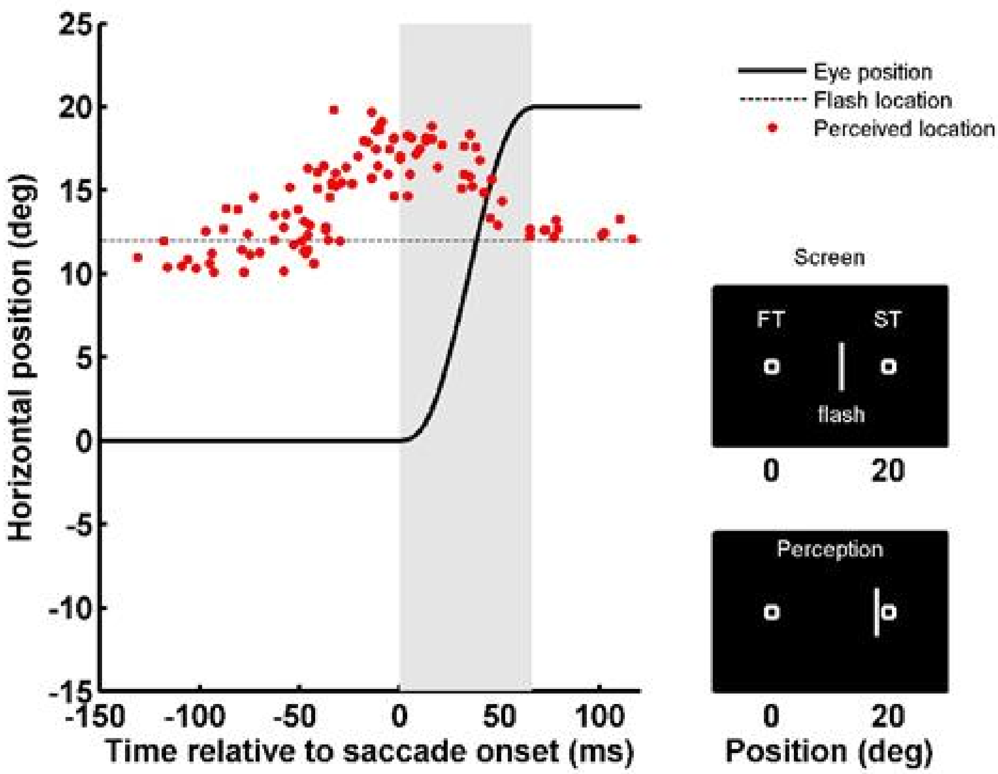


Figure 1. The black line indicates eye movements in the test subject over a period of time beginning at 0. The dotted line shows the actual location of the light flash. The red dots show on the vertical axis where test subjects localize the flashes light. The red dots show on the horizontal axis the moment of the light flash in relation to the eye movement. You can see that most mislocalizations take place when the flash appears at the moment the eye movement begins.

By predicting our eye movements, our brain creates a stable world for us. Researchers used to think that those predictions had so much influence that they could cause us to make errors in estimating the position of objects. Neuroscientists at Radboud University have shown this to be incorrect. The *Journal of Neuroscience* published their findings – which challenge fundamental knowledge regarding coordination between brain and eyes – on 15 April.

You continually move your eyes all day long, yet your perception of the world remains stable. That is because the brain processes predictions about your eye movements while you look around. Without these predictions, the image would shoot back and forth constantly.

## Errors of estimation

People sometimes make mistakes in estimating the positions of objects – missing the ball completely during a game of tennis, for example. Predictions on eye movements were long held responsible for such localization errors: if the prediction does not correspond to the eventual eye movement, a mismatch between what you expect to see and what you actually see could be the result. Jeroen Atsma, a PhD candidate at the Donders Institute of Radboud University, wanted to know how that worked. 'If localization errors really are caused by predictions, you would also expect those errors to occur if an eye movement, which has already been predicted in your brain, fails to take place at the very last moment.' Atsma investigated this by means of an ingenious experiment.

## Localizing flashes of light

Atsma asked test subjects to look at a computer screen where a single small ball appeared at various positions at random. The subjects followed the balls with their eyes while an eye-tracker registered their eye movements. The experiment ended with one last ball on the screen, followed by a short flash of light near that ball. The person had to look at the last, stationary ball while using the computer mouse to indicate the position of the flash of light. However, in some cases, a signal was sent around the time the last ball appeared, indicating that the subject was NOT allowed to look at the ball. In other words, the eye movement was cancelled at the last moment. The person being tested still had to indicate where the flash was visible.

## Remarkable findings

Even when test subjects heard at very short notice that they should not look at the ball – in other words when the brain had already predicted the eye movement – they did not make any mistakes in localizing the flash of light. 'That demonstrates you don't make localization errors solely on the basis of predictions', Atsma explained. 'So far, literature has pretty much suggested the exact opposite. That is why we repeated the experiment several times to be sure.'

The findings of the neuroscientists in Nijmegen are remarkable because they challenge much of the existing knowledge about eye-brain coordination. Atsma: 'This has been an issue ever since we started studying how the eyes function. For the first time ever our experiment offered the opportunity to research brain predictions when the actual eye movement is aborted. Therefore I expect our publication to lead to some lively discussions among fellow researchers.'

**More information:** 'No peri-saccadic mislocalization with abruptly cancelled saccades.' Jeroen Atsma, Femke Maij, Brian Corneil, Pieter Medendorp. *Journal of Neuroscience*, April 15, 2014

Provided by Radboud University Nijmegen