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A DYNAMICAL MODEL FOR COMPUTING THE POSITION OF AN OBJECT FROM ITS RETINAL LOCATION AND EYE POSITION.

A. Pouget, T. Albright* and T.J. Sejnowski. The Salk Institute, La Jolla, CA 92037.

The position of a visual object with respect to the viewer, the egocentric position, can be computed by adding the retinal position of the object with the position of the eyes. An experiment performed by Matin et al. (Science, 248, 1965) suggests that humans use this simple algorithm when localizing visual objects. The task was to localize a point of light briefly flashed (<1 ms) on a screen during a saccade. The subjects could accurately localize the position of the flash in the absence of any other visual stimulus which suggests that the eye position was apparently available to the observer. Additional experiments, however, showed that humans tend to make a systematic localization error in the direction of the saccade (Mateef, Psych. Perc., 24, 1978). Furthermore, the size of the error was a function of the retinal position on which the flash impinged (O'Regan, Psych. Perc., 36, 1984). Thus, the perceived egocentric position of an object is not a static linear sum of the retinal position and eye position.

We have developed a biologically plausible model that computes egocentric position by dynamically combining the retinal position of an object with eye position. The model accurately locates an object when it is presented for a long duration (>100 ms) with the eyes at rest. However, for brief presentations while the eyes are moving, the model exhibits a pattern of errors identical to that reported in humans. Taken together with recent physiological and psychophysical results (Gauthier et al., Science, 249, 1990), our model suggests that the eye position is used for object localization. (Supported by the Howard Hughes Medical Institute).