EYE MOVEMENTS REVEAL HIERARCHICAL MOTION PROCESSING

((J. B. Mulligan)) NASA Ames Research Center, Moffett Field, CA.

Purpose:
In the analysis of visual motion, local features such as orientation are analyzed early in the cortical processing stream (V1), while integration across orientation and space is thought to occur in higher cortical areas such as MT, MST, etc. If all areas provide inputs to eye movement control centers, we would expect that local properties would drive eye movements with relatively short latencies, while global properties would require longer latencies. When such latencies are observed, they can provide information about when (and where?) various stimulus properties are analyzed.

Methods:
The stimulus employed was an elliptical Gabor patch with a drifting carrier, in which the orientations of the carrier grating and the contrast window were varied independently.
We have previously demonstrated that the directional percepts evoked by this stimulus vary between the "grating direction" (the normal to the grating's orientation) and the "window direction" (ARVO 91, 94), and that similar effects can be observed in reflexive eye movements (ARVO 95).
Subjects viewed such a stimulus while attempting to maintain steady fixation on the center of the pattern, and the small reflexive eye movements ("stare OKN") were recorded.
In the middle of the trial, the orientation of either the grating or the window was rotated smoothly by 30 degrees.

Results:
Responses to the shift of both grating orientation and window orientation are seen in the average OKN slow phase velocity. Grating rotations produce a rapid OKN rotation to the grating direction (100 ms latency, 300 ms time constant), followed by a slower rebound to the steady state perceived direction midway between the grating and window directions. Window rotations, on the other hand, evoke a slower response (200 ms latency, 500 ms time constant).

Conclusions:
The results demonstrate multiple cortical inputs to eye movement control: a fast, early input driven by orientation, and a slower input from higher areas sensitive to global stimulus properties.

Supported by NASA RTOP's 505-64-53 and 199-06-12-31. None.