**Figure 1: Creating a visual experiment with limited spatial bandwidth.**

In the ‘Tunneled Vision’ parts of the experiment only a small window around the participant gaze was revealed throughout the task. Two sizes of shapes and windows were used: The Large shapes occupied 10.80±0.15x10.80±0.15 deg with a window of 2.90±0.15x1.90±0.15 deg, the Small shapes occupied 0.90±0.03x0.90±0.03 deg with a window of 0.24±0.03x0.16±0.03 deg.

**Figure 2: Visit rates heat maps.**

**(A)** The percent of time per trial participants spent in each region of the image for the Large shapes experiment, Natural vision (average of 5 participants x 4 trials). **(B)** Same as in (A) for the Large shapes experiment, Tunneled vision (average of 5 participants x 6 trials). **(C)** Same as (A, B) for Small shapes, Natural vision experiment (average of 5 participants x 4 trials). **(D)** same as in (A, B, C) for the Small shapes, Tunneled vision experiment (average of 5 participants x 10 trials). Differences between each same shape in the two Tunneled vision tasks were found to be significantly smaller than the differences between any Tunneled vision and Natural vision tasks (One-way ANOVA, p<0.001).

**Figure 3: Trajectories of saccades and drifts.**

**(A)** Example trials for the different shapes – circle, parallelogram, rectangle, square and triangle, from the Large Tunneled task. The saccadic movement (lighter blue, fixational pauses in dark blue) was detected using a velocity based algorithm (see Methods). The horizontal and vertical movement is presented next to each example trial (full trial movies in sup). **(B)** Each saccade was characterized by its trajectory to Border (start and end near the border of the shape), Horizontal or Vertical. The data is presented for each participant separately and for all together in the sixth column. In the Large Tunneled task most of the saccades were border-following.

**Figure 4: Motor characteristics of saccades and drifts.**

**(A)** Saccadic rate in the four experimental conditions, for each participant separately and all together. In both Tunneled vision experiments the rates of saccades decreased significantly compared with the Natural task. A decrease in the saccadic rate was significant also when comparing Large shapes with Small shape trials (asterisks, t-test, p<0.05). **(B)** Populations of drift velocities in in the four experimental conditions, for each participant separately and all together. In both Tunneled vision experiments the velocities of drift increased significantly for the entire group as well as for 3 out of 5 participants separately in the Large task (one showed a reversed effect, see red asterisk) and 5 out 5 in the Small task (asterisks, Wilcoxon rank sum test, p<0.05). The size of the shapes did not affect drift velocities.

**Figure 5: Variations in the saccadic main sequence and drift velocity.**

**(A)** The maximum velocity of a saccade linearly depends on its amplitude in all experimental conditions (mean R^2 is 0.68 and 0.72 for the Natural and Tunneled conditions, respectively). Each column presents the linear fit for each of the participants and the last column shows the residuals of the fit for all participants together. The residuals from the fit of both Tunneled experiments are larger in the range of 6-12deg saccades amplitude. **(B)** Mean drift velocity has greater variance in the Tunneled vision conditions compared with the Natural ones.

**Figure 6: Instantaneous drift velocity.**

**(A)** Autocorrelations of the instantaneous drift velocity (horizontal and vertical) in Natural vision tasks. The upper row shows the sum of significant correlation values for each time step. The lower row shows trial by trial significant correlation values. The percent of single periodic trials (higher significant correlation at 100ms compared with earlier and later time steps) is presented above the lower row. **(B)** Same as (A) for the Tunneled vision tasks. A peak in the autocorrelation can be seen in 100ms time step for both horizontal and vertical movements in both Large and Small conditions, as well as the presence of many more single periodic trials. **(C)** Autocorrelations of the distance traveled by each drift (horizontal and vertical) in the Natural (black) and Tunneled (blue and magenta) tasks. The decay of the sum of significant correlations is faster for both horizontal and vertical movements in both Large and Small conditions, as indicated by the Tau decay of the exponential fit presented.