**Figure 1. Gaze visit rates.** The distribution of gaze locations, normalized (min-max) per trial and averaged across trials and subjects, for Large shapes with Natural viewing (**a**; 5 participants x 4 trials); Large shapes with Tunneled viewing (**b**; 5 participants x 6 trials); Small shapes with Natural viewing (**c**; 5 participants x 4 trials) and Small shapes with Tunneled viewing (**d**; 5 participants x 10 trials). Color maps were normalized for each panel.

**Figure 2. Kinematics of saccades and drifts.** **(a)** Changes in mean saccadic rates between Natural and Tunneled viewing for Large (blue) and Small (magenta) image sizes. Data for each participant (left) and their mean (right most) are presented (\*, p<0.05, t-test). **(b)** Distributions of mean drift speeds per trial in the four experimental conditions; data as in (a) (\*, p<0.05, Wilcoxon rank sum tests). **(c)** Mean within-trial instantaneous drift speeds presented in two time scales, each in a pair of panels. Color code as in (b); error-bars denote SEMs. **(d)** Mean drifts speeds versus pause durations in the four experimental conditions (variances and SEMs: in the right most figures).

**Figure 3. Eye trajectories. (a)** Example of eye trajectories in single trials with Natural (left) and Tunneled viewing. Saccades, lighter blue; fixational pauses, dark blue; traces, horizontal and vertical components as a function of time next to each example. Movies of these examples are in **Supp\_Video1-5**). **(b)** Fractions of border-following saccades in the four experimental conditions in each subject (small dots) and their means (large colored dots). **(c)** Distributions of curvature indices (see Methods) of border drift trajectories (brown) and non-border drifts, in the four experimental conditions ().

**Supplementary Figure 1. Variations of the saccadic main sequence.** The maximum velocity of a saccade linearly depends on its amplitude in all experimental conditions (R^2 is 0.66 (large) and 0.69 (small); 0.70 (large) and 0.74 (small), for the Natural and Tunneled conditions, respectively). The figure shows the residuals of the linear fit of the main sequence in each condition. Dashed line denotes the amplitudes from which on the difference is significant (shaded area are SEMs).

**Supplementary Table 1. Control for trial duration differences.** The analyses described in Fig. 2a,b,d were repeated for the first 3 s of the tunneled conditions, a time period equal to the duration of natural viewing trials. P values represent the probability that the values measured in the relevant tunneled condition were drawn from the same distribution as those measured in the natural viewing conditions.

**Supplementary Movies 1-5. Demonstrations of the eye trajectories presented in Fig. 3. S**lowed down 2.4 times.

**Extra Figure 1. Instantaneous drift speed. (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.