Supplementary Methods

Additional behavioural measurements  The following experiments were carried out in a dimly lit room. Stimuli were presented on a 23 inch flat panel LCD screen (Apple Cinema Display) using custom Java software. Image size and viewing distance were adjusted to match the angular size in the fMRI experiment. Only one observer completed all the experiments described below, but multiple subjects participated in at least one experiment. The results for the single subject are summarized in the figure below which shows the magnitude of the perceptual effect defined as the percent increase in diameter of the back sphere compared to a perceptually equivalent front sphere for each of the following experiments (error bars = s.e.m.).

Two Interval Forced Choice (2IFC): Rendered images of front and back spheres within the same hallway were presented separately in time (first sphere for 400ms, hallway-only for 200ms, second sphere for 400ms). The observer's task was to indicate which sphere appeared to have a larger angular size. The trial types were decided by a one-up one-down interleaved staircase procedure. The point of subjective equality was estimated with maximum likelihood analysis of the data. The perceptual effect was then computed as the percent difference between the sizes of the front and back spheres at this subjective equality point.

Two Interval Forced Choice with flickering spheres (2IFC Flicker): In order to better mimic the conditions of the fMRI experiment we repeated the above 2IFC method using counterphase, flickering checkerboard texture mapped spheres.

Two Alternative Forced Choice (2AFC): Two rendered images of hallways each with a single sphere in different positions were briefly and simultaneously presented side by side on the monitor. The observer's task was to indicate the scene containing the sphere with the larger image size. The same staircase and analysis procedures as in the 2IFC experiments were used.

Two Alternative Forced Choice with flickering spheres (2AFC Flicker): Same as the above 2AFC, except that the spheres were texture-mapped and flickered as in the fMRI experiment.
Two Alternative Forced Choice with flickering spheres in the same hallway (2AFC Flicker Same Room): Same as the above 2AFC method, except that the spheres were presented in the same 3D hallway context.