Supplementary Figure 1. Visual stimulus sets used in this paper. **(A)** James Bond stimulus. Gray bars denote epochs of blank gray screen (with a fixation spot still present). **(B)** Retinotopic localizer stimulus. **(C)** Disparity stimulus. All stimuli were random dot stereograms in which the 3D structure was defined solely by binocular disparity; monkeys wore red/green goggles. **(D)** Motion stimulus. The carrier consisted of a field of random dots. **(E)** Face localizer stimulus. **(F)** Color shapes stimulus. Different colored and achromatic shapes were shown in separate blocks, interleaved with epochs of a blank gray screen. **(G)** 3D paperclip stimulus. Epochs containing a 3D paperclip defined by disparity, motion, or both cues were shown in separate blocks, interleaved with epochs of blank gray.

Supplementary Figure 2. Artifactual and subcortical ICs. **(A)** Eight examples of artifactual ICs which were excluded manually. **(B)** Six examples of subcortical ICs. These were also excluded manually.

Supplementary Figure 3. Same data as in Figure 2 shown on a set of raw EPI slices. The anterior/posterior position of each slice relative to the interaural canal is indicated at the top.

Supplementary Figure 4. Spatial reproducibility of ICs, presented on inflated brains. **(A, B)** Same data as Figure 3B, C, rendered on inflated brains Top: IC, Bottom: Best Inter-session Correlator.

Supplementary Figure 5. Two anticorrelated clusters of networks. **(A)** A matrix showing the correlation between the response time courses (averaged across all runs from the session from which the IC was derived) of each of the 20 ICs in Figure 2. The numbers along the x- and y- axes correspond to the numbering in Figures 2 and 3. The black and magenta boxes indicate the two sets of ICs which are temporally anticorrelated to each other. **(B)** ICs corresponding to the two networks indicated by the magenta and black outlines in (A). Roughly, the magenta set corresponds to auditory, somatomotor, and peripheral visual cortex, and the black set corresponds to visual and prefrontal cortex. **(C)** Coronal slices showing IC 3 (first row in A, visual cortex) and IC 5 (bottom row in A, auditory cortex). **(D)** BOLD time courses from IC 3 and IC 5 (averaged across multiple runs) Gray bars denote blank epochs separating movie clips. Anticorrelation was especially strong during the blank epochs, and may represent release of attention from visual to auditory and other domains However, anticorrelation continued to be observed when blank periods were excised (Figure S6).

Supplementary Figure 6. Stimulus dependence of temporal anticorrelation between ICs. **(A-D)** Matrices showing the correlation between the response time courses of each of the 20 ICs in Figure 2 (conventions as in Figure S5A) Correlations computed from both average (A, C) and concatenated time courses (concatenated across all runs from the session from which the IC was derived) (B, D), using either all data points (A, B) or only non-blank data points (C, D). Anticorrelation is weaker for concatenated compared to averaged time courses. This suggests that a substantial component of the observed anticorrelation is stimulus driven.

Supplementary Figure 7. Spatial correlation between ICs under different visual stimulus conditions. **(A)** Matrix of spatial correlations between ICs obtained during the visual stimulus conditions indicated on the left and ICs obtained during the stimulus conditions indicated at the top. Correlation maps between different stimuli: for each IC from stimulus 1, a best inter-stimulus correlator was identified amongst the ICs obtained with stimulus 2. Correlation maps between same stimuli: for each IC from stimulus 1, a best inter-session correlator was identified amongst the bilateral, non-artifactual ICs obtained on different days (exactly same procedure as used for Figure 3). Many ICs were reproducible across different stimuli, though the highest correlation values were obtained for repetitions of the same stimulus. Data from monkey E. **(B)** Results from monkey M. **(C)** Results from monkey B.

Supplementary Figure 8. Classification of ICs based on reproducibility under different visual stimulus states (same conventions as Figure 5) The criterion for reproducibility was $r > 0.22$.

Supplementary Figure 9. Examples of ICs belonging to different reproducibility classes. **(A)** Sets of ICs obtained under different stimulus conditions, sorted according to the anatomical location of each set. The visual stimulus used for each IC is indicated by an icon (see legend at bottom). The single IC at the top left was bilateral but not reproducible with either the same or different stimuli. The two ICs in the middle and right columns of the first row were reproducible with the same stimulus but not with different

stimuli. The remaining sets of ICs were reproducible both with the same stimulus and with different stimuli (in each IC set, the original IC is shown at the top, the best inter-session correlator is shown on second row, and the highest correlating ICs from different stimuli are shown in the remaining rows). Data from monkey E. **(B)** Data from monkey M. Note the similarity between the reproducible networks in the two monkeys.

Supplementary Figure 10. Matrices of spatial correlation values between the real ICs obtained under the retinotopic localizer stimulus and blank (same conventions as in Figure 6C, D) **(A)** Analysis restricted to ICs in which at least 25% of the voxels responded significantly ($p=0.01$ for Monkey B and $p = 0.05$ for monkey M) to the retinotopic localizer stimulus. **(B)** Analysis restricted to ICs in which at least 25% of the voxels responded significantly ($p=10^{-4}$ for Monkey B and $p = 10^{-3.5}$ for monkey M) to at least one of the six localizer stimuli (stimulus conditions shown in Figure S1B-G)

Supplementary Figure 11. ICs obtained under complete darkness. **(A)** ICs from Monkey B (conventions as in Figure 2B) **(B)** ICs from Monkey M **(C)** Histogram showing the percentage of visually responsive voxels across ICs Visual responsiveness was defined by a significant ($p=10^{-4}$ for Monkey B and $p = 10^{-3.5}$ for monkey M) response to at least one of the six localizer stimuli.

Supplementary Figure 12. Temporal correlation between voxels within ICs under different visual stimulus and arousal states. **(A)** Left: Bar graph of the mean correlation between all pairs of voxels within an IC (all voxels with a Z-score > 4) (blue) and the

same quantity calculated using a random set of brain voxels matched in size (note that it is difficult to estimate the chance level of correlation exactly because spatial smoothing in preprocessing may have increased this value compared to that computed for random sets of brain voxels). Correlation computations were performed on concatenated time courses that were demeaned and detrended. Data obtained with retinotopic localizer stimulus. Error bars indicate standard deviation. Right: Mean temporal correlation between all voxel pairs within an IC as a function of pairwise voxel distance, computed separately for voxels in the left (blue trace) and right (green trace) hemispheres. Data were binned in steps of 1.25 mm. The red trace indicates the mean of the correlations computed from each of the random brain voxel control sets. **(B)** Correlation profile computed from data obtained while monkey viewed a blank screen. **(C)** Correlation profile computed from data obtained while the monkey was anesthetized. The pairwise voxel correlation decreased to that expected by chance in (C), but in (A) and (B) it decreased to a lower, above-chance level.