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Figures and figure supplements

Disparate substrates for head gaze following and face perception in the monkey superior temporal sulcus

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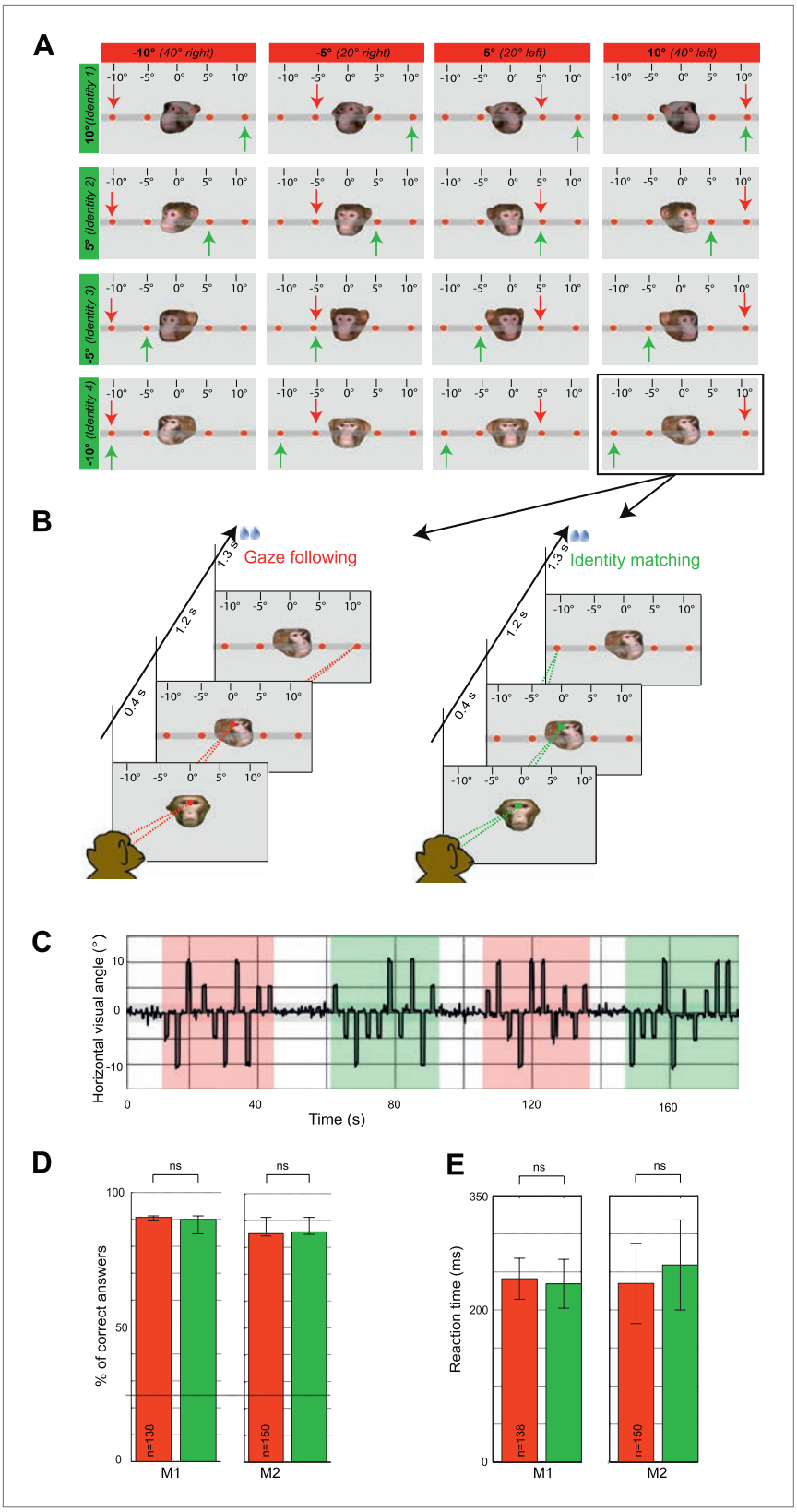

Figure 1. Experimental paradigm and behavioral results ('gaze following' paradigm). (**A**) Stimuli. 16 portraits used in the gaze following and identity matching tasks, arranged by the same identity (rows) or head orientations

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(columns, demonstrator's head orientation eccentricity indicated in brackets). The arrows point to the correct target dot in gaze following (red) and identity matching task (green). Arrows and the scale with the eccentricity of the target as seen by the observer were not visible during the experiment. Portraits and target bar were presented on an otherwise black background (here shown as gray for better visualization). (**B**) Sequence of events. Exemplary gaze following (left) and identity matching (right) trials. (**C**) Exemplary horizontal eye movements sampled during a typical fMRI run. The gray shaded horizontal area around 0° indicates the limits (±2°) of the fixation window, the red areas indicate gaze following blocks and the green ones identity matching blocks. White areas outline the 'fixation-only' blocks. (**D**) Median percentages of correct answers in gaze following (red) and identity matching blocks (green), pooled separately for each observer (M1: 138 blocks; M2: 150 blocks) in 'gaze following' paradigm. Error bars represent 95% confidence intervals. The difference was not significant (ns, Wilcoxon signed rank test: p=0.67 [M1], p=0.43 [M2]). Dashed line indicates the chance level in each task (25%). (**E**) Mean reaction times in gaze following (red) and identity matching blocks (green), pooled separately for the two observers (M1:138 blocks; M2: 150 blocks) in 'gaze following' paradigm. Error bars represent standard errors. The difference was not significant (ns, paired samples *t* test: p=0.08 [M1]; p=0.22 [M2]).

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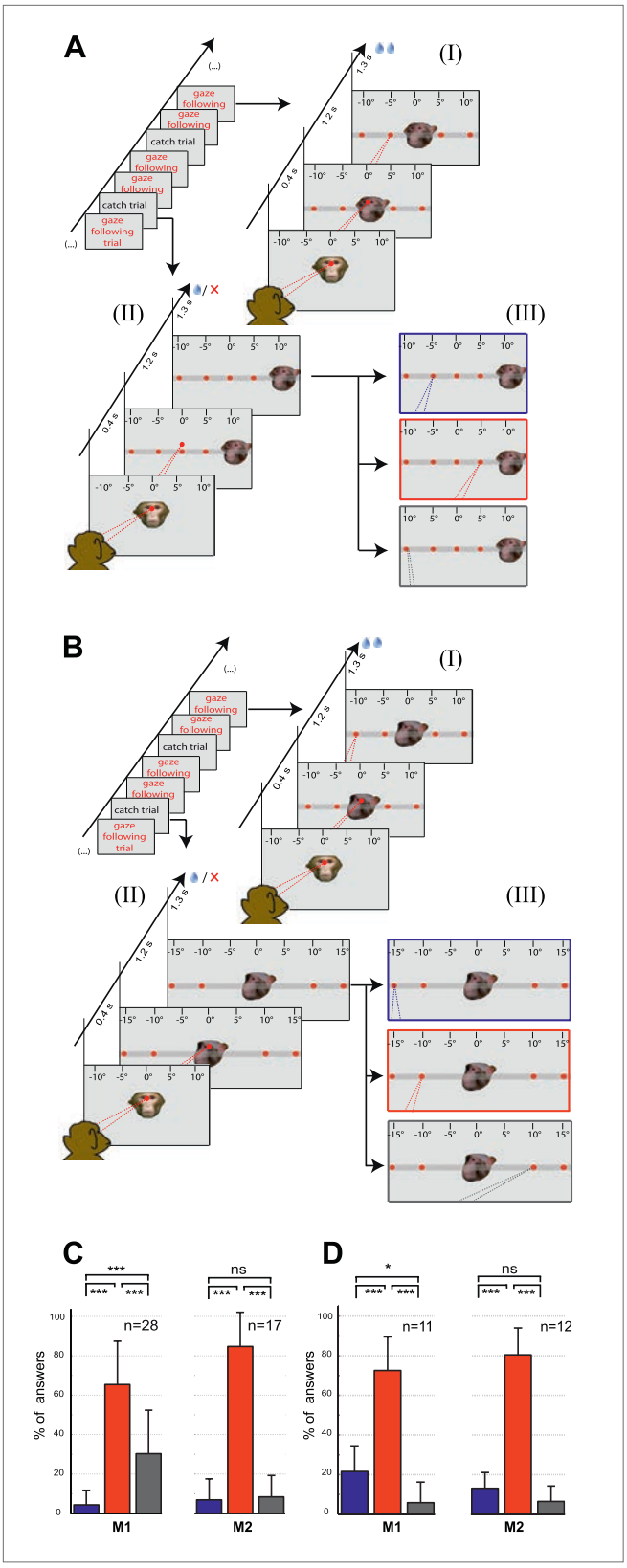

Figure 2. Control experiments. (**A**) Testing for learned associations between head orientation and the spatial position of the target. Sequence of normal gaze following trials (I) with catch trials (II) where demonstrator portrait

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was shifted horizontally (here by 10°). Subject's responses in the catch trials were later classified into three categories (III): (1) The 'gaze following' category (red outline). (2) The 'learned spatial association' category (blue outline). (3) The 'other' category (gray outline). Dashed lines in the figures indicate the observer's eye gaze. (**B**) Testing for associations between head orientation and the ordinal position of targets. Sequence of normal gaze following trials (I) with catch trials (II) where the 10° eccentricity targets maintained their standard spatial position but changed their ordinal position (II). The responses in catch trials were later classified into three categories (III): (1) The 'gaze following' category (red outline). (2) The 'learned order association' category (blue outline). (3) The 'other' category (gray outline). (**C**) The results of control Experiment 1 (***Figure 2A***). Mean percentages of responses classified as the 'gaze following' category (red column), the 'learned spatial associations' category (blue column) and in the 'other' category (gray column). Both monkeys showed significantly more responses in the 'gaze following' category than in the two other ones (repeated measures 1-way ANOVA, significant effect of the factor 'response category' ($F_{2,54}$ = 51.23, p<0.001 [M1]; $F_{2,32}$ = 127.4, p<0.001 [M2]). (**D**) The results of the control Experiment 2 (***Figure 2B***). Mean percentages of responses classified as the 'gaze following' category (red column), the 'learned order associations' category (blue column) and in the 'other' category (gray column). Both monkeys showed significantly more responses in the 'gaze following' category than in the two other ones (repeated measures 1-way ANOVA, significant effect of the factor 'response category' [$F_{2,20}$ = 47.8, p=0.001 (M1); $F_{2,22}$ = 132.2, p<0.001 (M2)]); In [**C**] and [**D**] post hoc pairwise comparisons [with Bonferroni correction] are indicated with significance levels: ***p<0.001, **p<0.01, *p<0.05, not significant [ns]; n indicates the number of experimental repetitions. Error bars represent standard errors. M1 = monkey 1, M2 = monkey 2.

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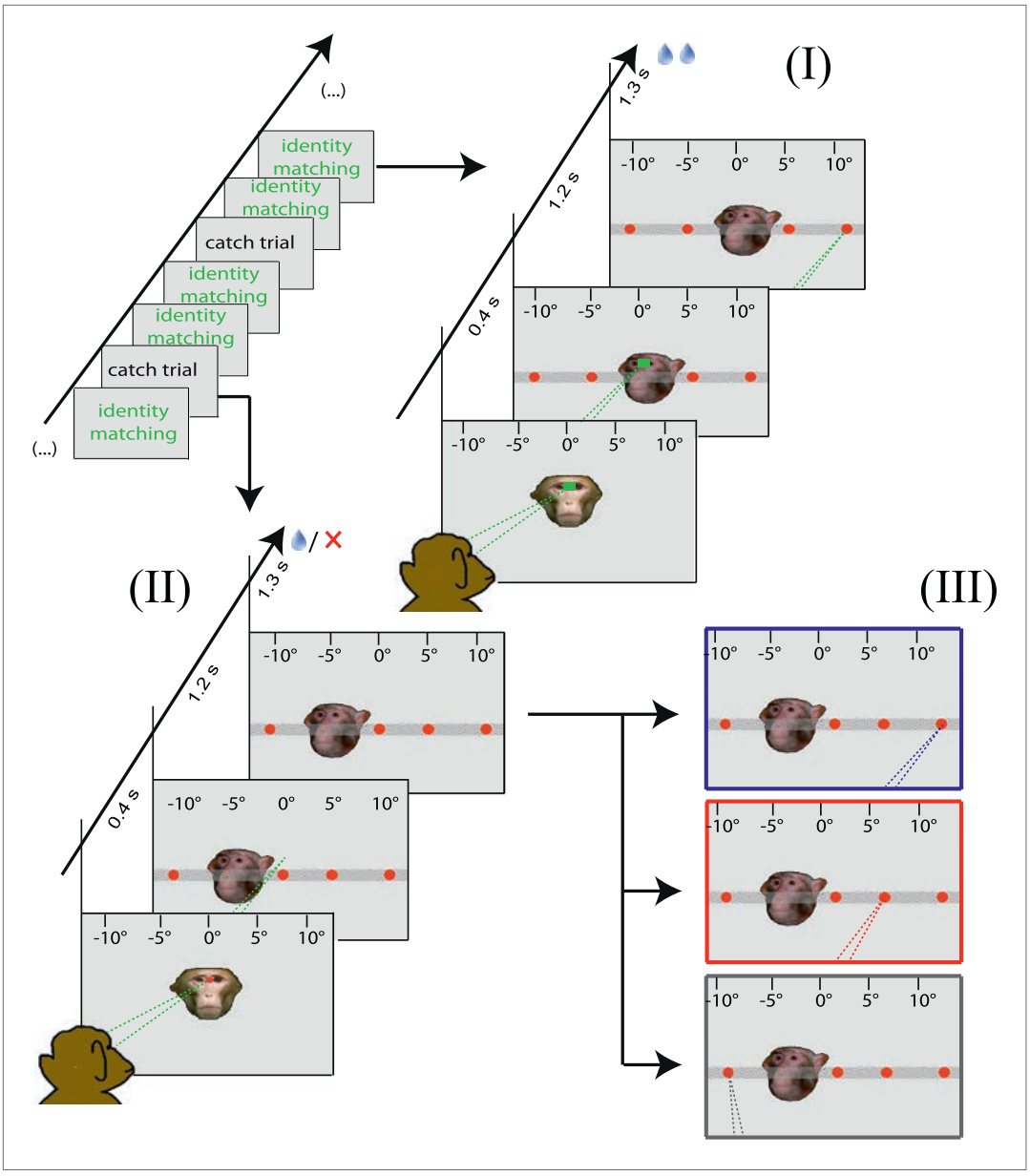

Figure 2—figure supplement 1. Design of the control experiments testing for learned associations between facial identity and the spatial position of the target.

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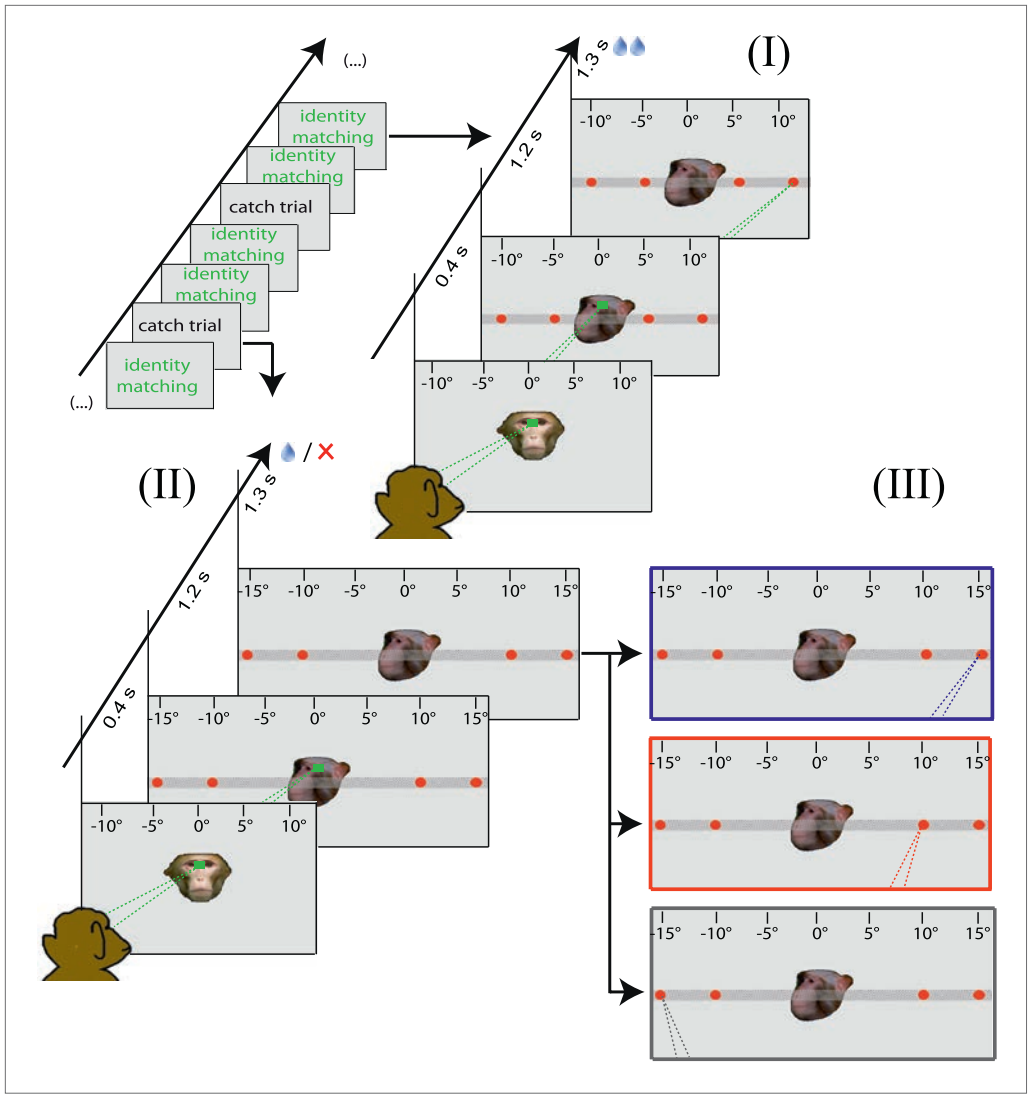

Figure 2—figure supplement 2. Design of the control experiment testing for associations between the facial identity and the ordinal position of targets.

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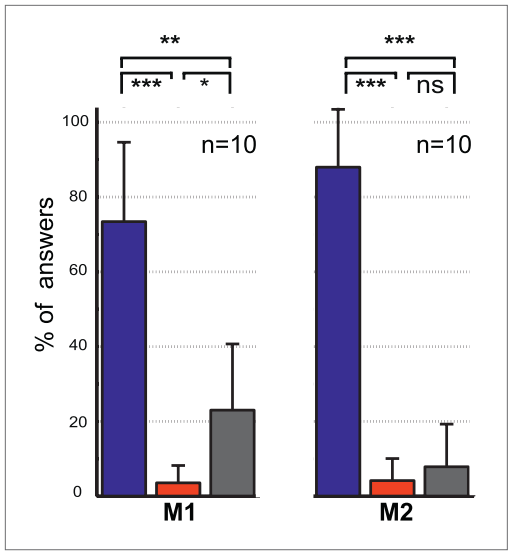

Figure 2—figure supplement 3. The results of the control experiment testing for associations between demonstrator's identity and target location (***Figure 2—figure supplement 1***).
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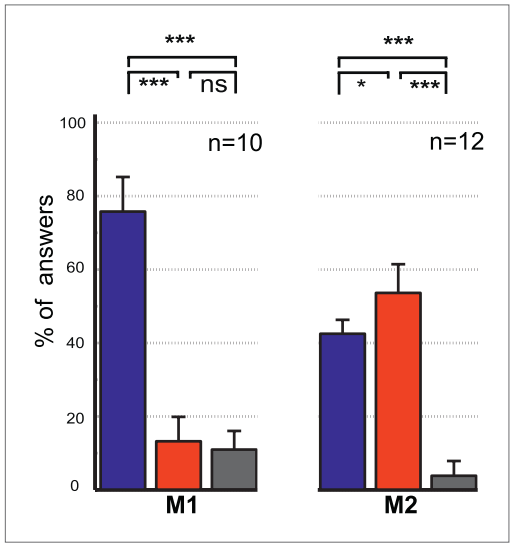

Figure 2—figure supplement 4. The results of the control experiment testing for associations between demonstrator's identity and the ordinal position of targets (***Figure 2—figure supplement 2***).
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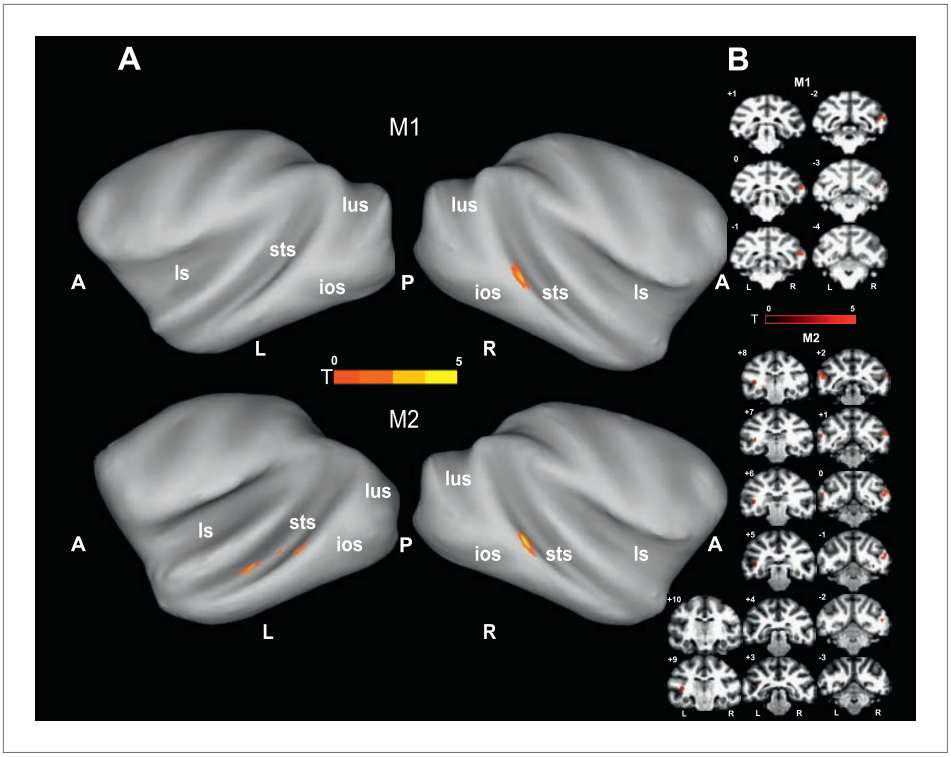

Figure 3. 'Gaze following vs identity matching' BOLD contrast. (**A**) Lateral views of the partially inflated hemispheres of monkeys M1 and M2 with significant ($p<0.005$, uncorrected, 5 contiguous voxels) BOLD 'gaze following vs identity matching' contrasts. A = anterior, P = posterior, L = left, R = right, sts = superior temporal sulcus, ios = inferior occipital sulcus, lus = lunate sulcus, ls = lateral sulcus. (**B**) Coronal sections through the brains of monkeys M1 and M2 with corresponding significant BOLD contrast from (**A**). The color scale bar gives the t-scores indicating the size of significant BOLD contrasts. The numbers in the left corners of each section indicate the distance from the vertical interaural plane of each monkey. L = left, R = right.

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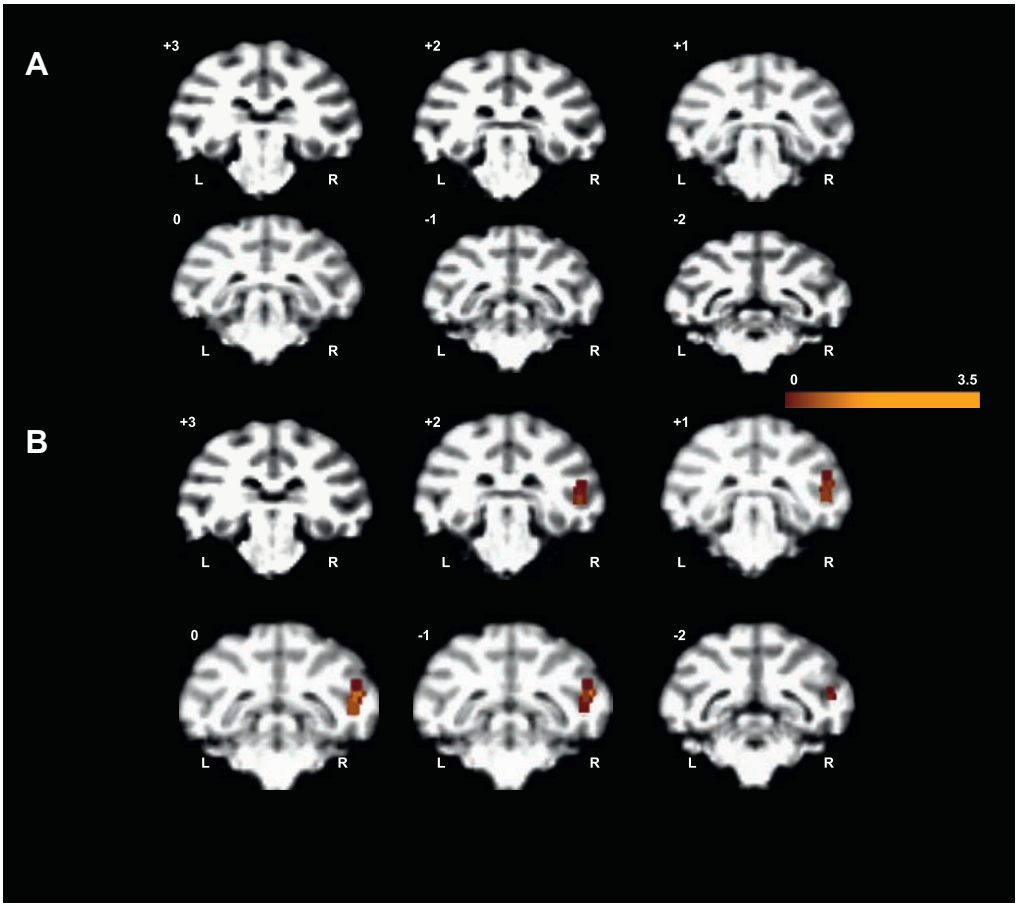

Figure 3—figure supplement 1. 'Gaze following vs identity matching' BOLD contrast evoked in Experiment 1 using a unilateral small coil placed on the left hemisphere of M1.

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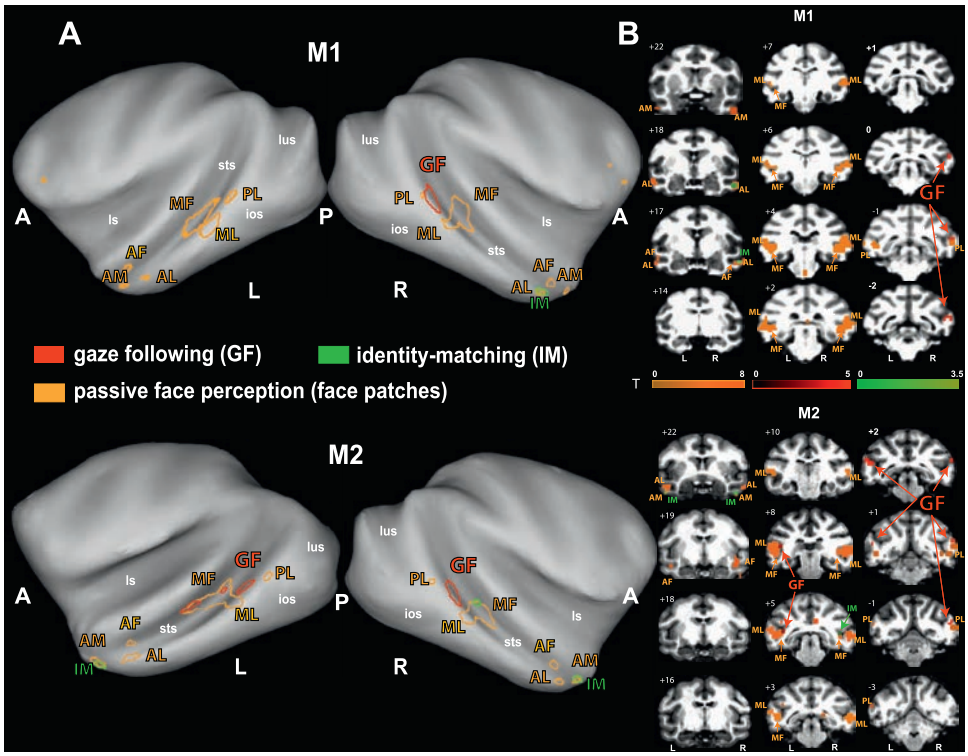

Figure 4. Comparison of the patterns of BOLD responses to 'gaze following' and 'identity matching' with the face patch BOLD pattern, delineated by the passive viewing of faces. (**A**) Lateral views of the partially inflated hemispheres of monkeys M1 and M2 with borders of significant BOLD responses. Face patches (orange) based on 'faces vs nonfaces' contrast ($p<0.05$, uncorrected, 5 contiguous voxels) masked with an 'all non-scrambled vs all scrambled' objects' contrast ($p<0.05$ uncorrected). The red contours: significant BOLD contrasts for the 'gaze following vs identity matching' comparison ($p<0.005$, uncorrected, 5 contiguous voxels). The green contours: significant BOLD contrasts for the opposite, 'identity matching vs gaze following' comparison ($p<0.05$, uncorrected, 5 contiguous voxels). A = anterior, P = posterior, L = left, R = right, sts = superior temporal sulcus, ios = inferior occipital sulcus, lus = lunate sulcus, ls = lateral sulcus. (**B**) Coronal sections through the brains of monkeys M1 and M2 with corresponding significant BOLD contrasts from (**A**). The numbers in the left corners indicate the distance from the vertical interaural plane of each monkey (positive values anterior, neg. posterior) (L = left, R = right).

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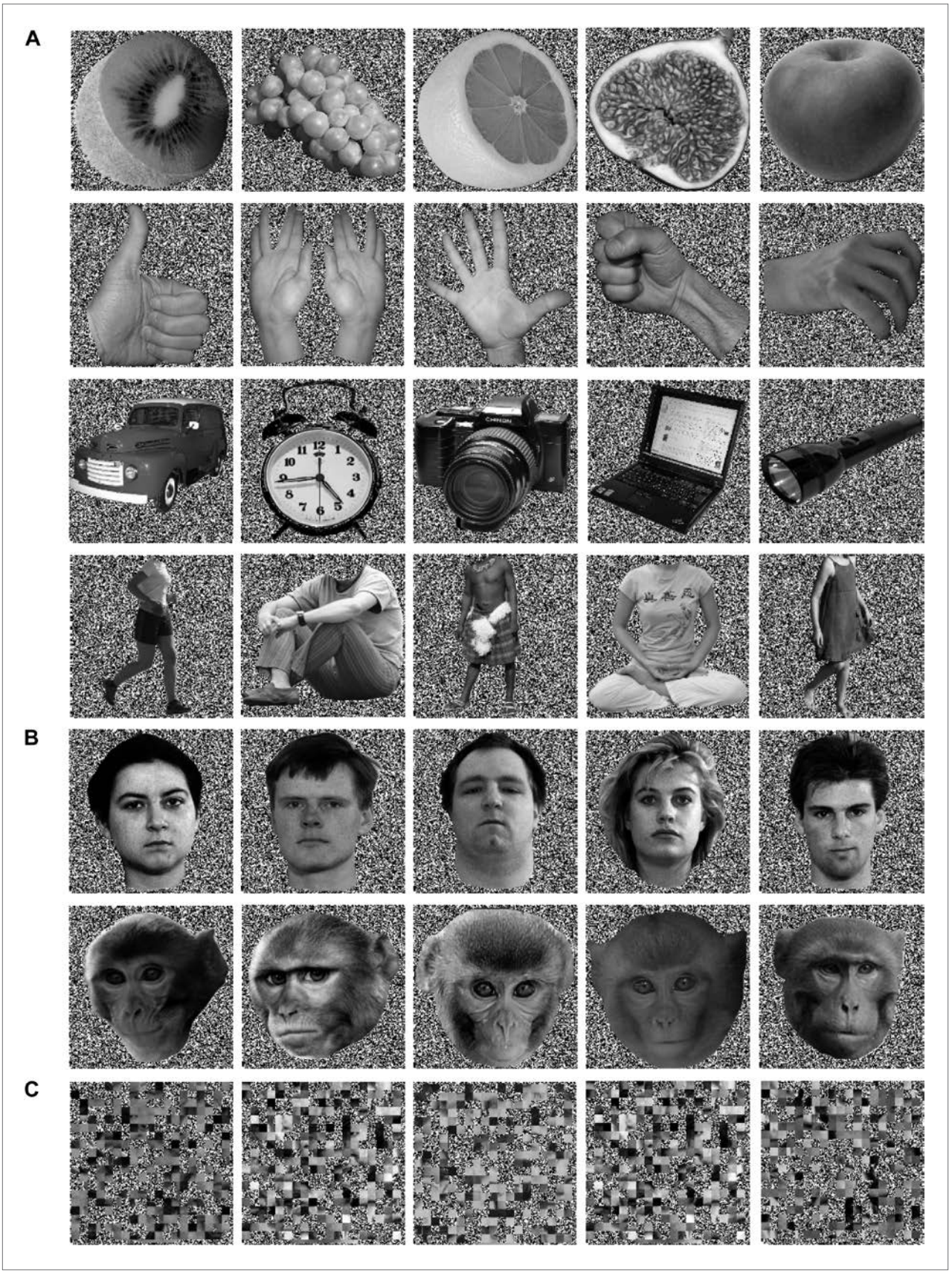

Figure 4—figure supplement 1. Examples of stimuli used in the 'passive face perception' experiment.
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