SUPPLEMENTARY ONLINE MATERIALS

NEURAL CORRELATES
OF ASSOCIATIVE FACE MEMORY
IN THE ANTERIOR INFERIOR TEMPORAL CORTEX
OF MONKEYS

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Neuronal Response to Abstract Patterns during Passive Viewing and during Erroneous Trials of the APA task.

To investigate whether the preference for the abstract pattern associated with an individual face would be seen only during the correct performance of the APA task, or whether it might also be seen during erroneous trials, we additionally investigated the activities of the associative pair-selective neurons during erroneous trials of the APA task. In the scatter plot of Supplementary Fig. 1A, we compared the neuronal responses to the best abstract-pattern cue during correct performance of the APA task, and the neuronal responses to the same abstract-pattern cue during erroneous trials of the APA task, for the 33 associative pair-selective neurons in which neuronal-activity data during erroneous trials were available for the best abstract-pattern cue during correct trials of the APA task. The results indicated that neuronal responses to the cue presentation of the best abstract pattern associated with an individual face were evident even for the erroneous trials. The results also revealed that the magnitudes of neuronal responses to the best abstract-pattern cue in the correct trials of the APA task and those to the same abstract-pattern cue in the erroneous trials were not significantly different (paired t-test, two-tailed, $p = 0.2549$) and showed a significant positive correlation ($r = 0.9158$, $p = 8.0645 \times 10^{-14}$).

Furthermore, to examine whether the preference for the abstract pattern associated with an individual face would be seen only during performance of the APA task, or whether it might also be seen during passive fixation, we additionally investigated the activities of the associative pair-selective neurons during the passive viewing of faces. For the passive viewing, neuronal activities in response to the presentation of an abstract pattern (496 ms duration) which was the same as used in the original experiment were recorded during the eye fixation. In the scatter plot of Supplementary Fig. 1B, we compared the averaged neuronal responses to the best abstract-pattern cue during the performance of the APA task and the averaged neuronal responses to the same abstract-pattern cue during the passive viewing of the 10 associative pair-selective neurons that were available. Neuronal activities during the period of 64-560 ms after stimulus onset were subtracted from the spontaneous activities during the -128-0 ms period. The results indicated that, even in the passive viewing, neuronal responses to the abstract pattern associated with an individual face were evident. The results also revealed that the magnitudes
of the neuronal responses in the active APA task and those during the passive viewing were not significantly different (paired t-test, two-tailed, $p = 0.7534$) and showed a significant positive correlation ($r = 0.8317$, $p = 0.0029$).

Supplementary Figure 1. Neuronal Response to Abstract Patterns during Passive Viewing and during Erroneous Trials of the APA task.

(A) Scatter plot between the averaged neuronal responses to the best abstract-pattern cue during correct trials of the APA task and those to the same abstract-pattern cue during erroneous trials ($N = 33$).

(B) Scatter plot between the averaged neuronal responses to the best abstract-pattern cue during the performance of the APA task and those to the same abstract-pattern cue during the passive viewing ($N = 10$).
Selectivity to facial view and facial identity of individual associative pair-responsive neurons: Selectivity Indexes Analyses

To estimate the stimulus selectivity of individual neurons, we also performed analysis using contrast index measures in addition to the analysis based on the ROC curves. We calculated the view-selectivity index (VSI) and the identity-selectivity index (ISI) of all of the associative pair-responsive neurons, as defined by the following equations:

\[
VSI = \frac{(R_{\text{best cue view}} - R_{\text{worst cue view}})}{(R_{\text{best cue view}} + R_{\text{worst cue view}})}
\]

\[
ISI = \frac{(R_{\text{best cue identity}} - R_{\text{worst cue identity}})}{(R_{\text{best cue identity}} + R_{\text{worst cue identity}})}
\]

In these equations, \(R_{\text{best cue view}}\), \(R_{\text{worst cue view}}\), \(R_{\text{best cue identity}}\), and \(R_{\text{worst cue identity}}\) indicate the mean cue face response of an individual neuron to the best view of the best identity, to the worst view of the best identity, to the best identity of the best view, and to the worst identity of the best view, respectively. Thus, a VSI or ISI value closer to 1 indicates higher tuning to the facial view or facial identity, whereas a VSI or ISI value closer to 0 indicates lower tuning to the facial view or facial identity.

We calculated VSI of cue-face responses for the best facial identity and ISI of cue-face responses for the best facial view, of all of the face responsive neurons. The frequency distribution of the VSIs and that of the ISIs for the associative pair-selective neurons, associative pair-responsive but not associative pair-selective neurons, and face-responsive but not associative pair-responsive neurons are depicted in the histograms in Supplementary Fig. 2A and B, respectively. The arrows in Supplementary Fig. 2A and B indicate the VSI and ISI values of the examples depicted in Fig. 2 (black) and Fig. 3 (white). The means of the VSIs and those of the ISIs were significantly different for all the associative pair-responsive neurons (paired \(t\)-test, two-tailed, \(p = 0.0355\)), implying that the associative-pair responsive neurons showed a higher selectivity for facial identities than for facial views. In Supplementary Fig. 2C that depicts the VSI distribution for all the associative pair-responsive neurons, the neurons that showed the significant main effect by facial views in the two-way ANOVA with repeated measures is indicated by gray color. The distributions of VSIs for face-responsive neurons recorded from the AITv in our previous study (Eifuku et al., 2004) are also shown in Supplementary Fig. 2D; there were no significant differences between the mean of VSIs for the associative...
pair-responsive neurons in the present study and the mean of VSIs for the face-responsive neurons in the previous study (Student’s $t$-test, two-tailed, $p = 0.3087$).

Supplementary Figure 2. Selectivity to facial view and facial identity of individual associative pair-responsive neurons: Selectivity Indexes Analyses

(A) Frequency distribution of the view-selectivity index (VSI) for responses to the best facial identity of the associative pair-selective neurons ($n=63$, upper, white); associative pair-responsive but not associative pair-selective neurons ($n=17$, upper, black); and face-responsive but not associative pair-responsive neurons ($n=40$, lower, gray). Arrows indicate the VSI values of the neurons depicted in Fig. 2 (black) and Fig. 3 (white), which were 0.4997 and 0.3030, respectively.

(B) Frequency distribution of the identity-selective index (ISI) for responses to the best facial identity of the associative pair-selective neurons (upper, white); associative pair-responsive but not
associative pair-selective neurons (upper, black); and face-responsive but not associative pair-responsive neurons (lower, gray). Arrows indicate the ISI values of the neurons depicted in Fig. 2 (black) and Fig. 3 (white), which were 0.5667 and 0.4201, respectively.

(C) Frequency distribution of the VSI for responses to the best facial identity of the associative pair-responsive neurons. In this graph, the neurons that showed a significant main effect of facial views in the two-way ANOVA with repeated measures (factors: facial identity and facial view; $p < 0.05$) are indicated by gray.

(D) Frequency distribution of the VSI for responses to the best facial identity of face-responsive neurons analyzed in the previous paper (Eifuku et al., 2004).