Supporting Information

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SI Text

Comparison of Responses to Food Objects in Exp. 1 and Rewarded Nonfood Objects in Exp. 2. A total of 36 mirror neurons were responding in both Exp. 1 and Exp. 2. These neurons were usually activated very similarly by the food object in Exp. 1 (direct reward) and the rewarded nonfood object in Exp. 2 (indirect reward). This finding is suggested by a highly significant ($P < 0.05$, $r^2 = 0.5$) correlation between the discharge associated with direct and indirect rewards (Fig. S1A). In addition, for the nonrewarded objects in Exp. 1 and Exp. 2 the correlation was highly significant (Fig. S1B).

Additional Information on Exp. 3. A total of 104 mirror neurons (44% of 237 tested motor neurons) responded to a motor act performed on object A and 90 mirror neurons (55% of 164 neurons tested motor) responded to a motor act directed at object B (Table S1).

We compared the activity in the phase of the grip showing the maximum visual response relative to baseline (see analysis of visual responses in the main text). We found that 49 neurons tested for object A and 52 neurons tested for object B exhibited visual responses that differed significantly between the three conditions (no reward, less-relished reward, favorite reward) ($P < 0.05$, Kruskall–Wallis). For further analysis we considered only the subset of neurons that showed a significant ($P < 0.05$) post hoc effect between the favorite reward and nonreward conditions. This subset consisted of 35 neurons responding to motor acts performed on object A and 36 neurons responding to motor acts performed on object B.

Additional Information on the Oculomotor Behavior in Exp. 1 and Exp. 2. In Exp. 1 we analyzed the monkey's eye movements during action observation from 44 randomly chosen experimental sessions. Few single sessions in Exp. 1 ($n = 7$, 15%) showed a significant difference between food and nonfood conditions ($P < 0.05$, Wilcoxon U test) in the duration of fixation within a period from 2 s before to 2 s after the hand-object contact event. The average ± standard durations of fixations while observing motor acts performed in the two conditions were 354 ms ± 57 ms and 381 ms ± 85 ms, respectively.

In Exp. 2 we analyzed the eye movements in 37 randomly chosen experimental sessions. No single session showed a significant difference in the duration of fixations in the time period defined before ($P > 0.05$ Wilcoxon U test). The average ± standard durations of fixations while observing motor acts performed in the rewarded and nonrewarded conditions were 360 ms ± 71 ms and 342 ms ± 57 ms, respectively.

We tested if the 2D distributions of eye position showed a dependency on condition in the two experiments by resorting to bootstrapping. For each pair of conditions to be compared, we generated bootstrap distributions of 2D eye position by resampling at each iteration 1,000 samples of the total eye-position data drawn at random. The two resulting distributions were then cross-correlated and the spatial offset at the peak of the cross-correlation determined. Based on 1,000 repetitions of this procedure, a distribution of spatial offset measures was computed. If the peak of this distribution deviated from zero (mean ± 1.96 SD), we concluded that the two eye-position patterns to be compared differed significantly.

We found a few sessions (16 of 44 sessions for Exp. 1 and 7 of 37 sessions for Exp. 2) that showed significant changes between the conditions. Furthermore, less than 5% of the sessions ($n = 2$ in the 44 session of Exp. 1 and $n = 0$ in the 37 session of Exp. 2) showed at the same time a difference in fixation durations and distributions of eye position.
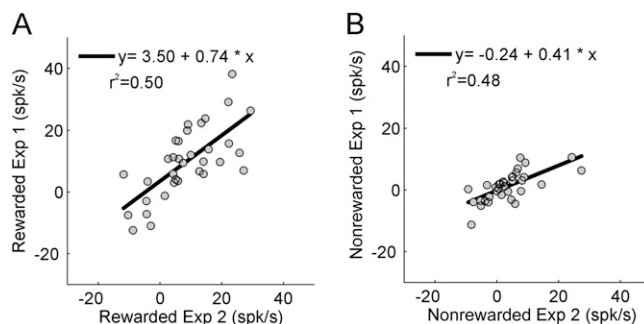

Fig. S1. Comparison of responses evoked in Exp. 1 and Exp. 2 for $n = 36$ neurons responding in both experiments. (*A*) Linear regression analysis comparing the discharge modulation elicited by the food object in Exp. 1 vs. the rewarded object in Exp. 2. (*B*) Linear regression analysis comparing the discharge modulation for the nonrewarded object in Exp. 1 vs. the nonrewarded object in the Exp. 2.

Table S1. Number of mirror neurons modulated in Exp. 3

Object	Motor	Mirror	Mirror modulated by reward
Object A	237	104 (44% of motor)	49 (21% of motor, 47% of mirror)
Object B	164	90 (55% of motor)	52 (32% of motor, 58% of mirror)

Table S2. Number of mirror neurons showing a post hoc (Bonferroni-corrected) selectivity for one of the rewarded conditions in Exp. 3

Object	Selective for the favorite reward	Selective for the less relished-reward	Selective for no reward	Response dependent on the reward but unselective	Total
Object A	14 (29%)	1 (2%)	7 (14%)	27 (55%)	49 (100%)
Object B	22 (42%)	2 (4%)	5 (10%)	23 (44%)	52 (100%)