PNAS
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Supplementary Information for
The cost of correcting for error during sensorimotor adaptation

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This PDF file includes:
Figures S1 to S5

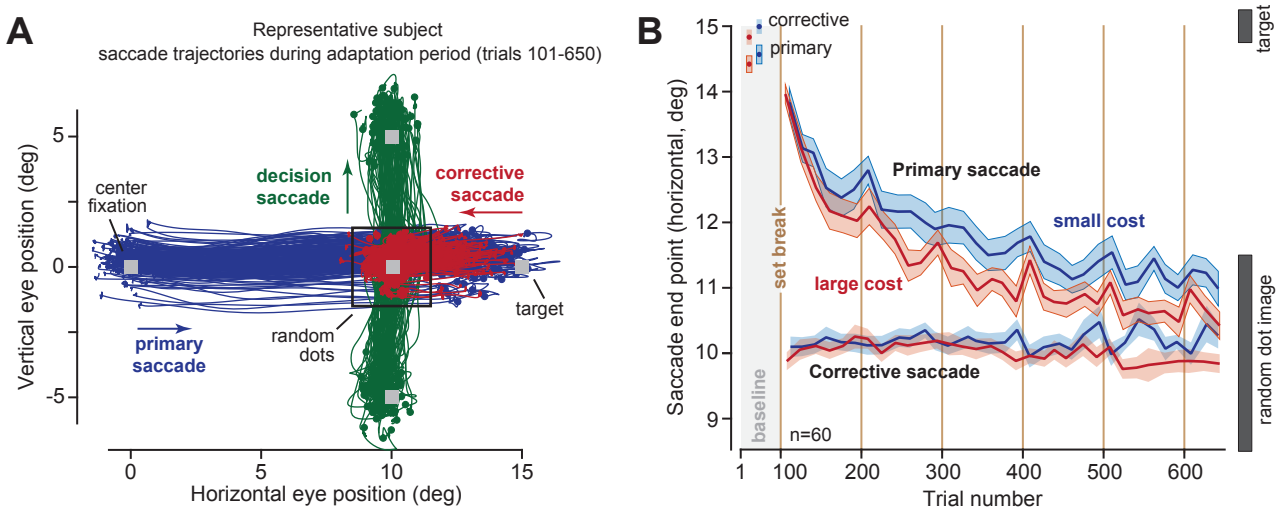

Fig. S1. Saccade trajectories and end positions for a representative subject and for the main groups. *(A)* Data for a representative subject during the adaptation trials for the target on the right. Primary saccade is followed by a corrective saccade, and then a decision saccade. *(B)* End position of the primary and corrective saccades for all subjects in the main experiments (n=60). In the baseline condition, the image was centered at the target, located at 15° along the horizontal axis. Primary saccades were slightly hypometric, which were then followed by a corrective saccade that brought gaze to center of the image. In the adaptation trials (101-650), the image was centered 5° away from the target. Following the primary saccade, a corrective saccade brought gaze to near the center of the image. This corrective movement carried a large cost for some images, and a small cost for other images. The rate of adaptation in the primary saccade was greater when the cost of error was large. Bin size in B is 8 trials. Error bars are SEM.

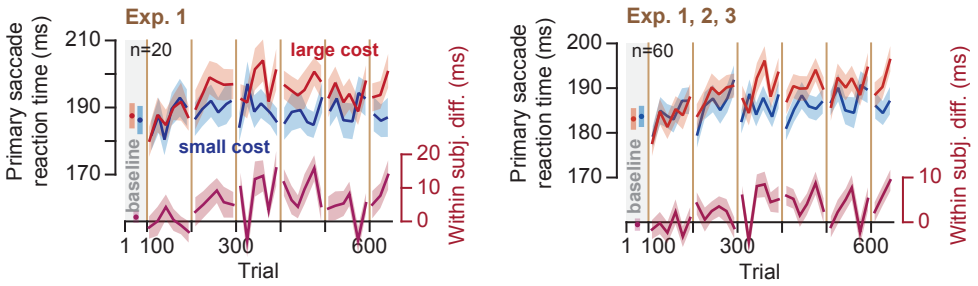

Fig. S2. Reaction times of primary saccades were faster toward the stimuli that promised greater reward, not the stimuli that carried a greater error cost. Note that the reaction times for the two stimuli start at approximately the same value but separate as the experiment continues. Bin size is 8 trials. Error bars are SEM.

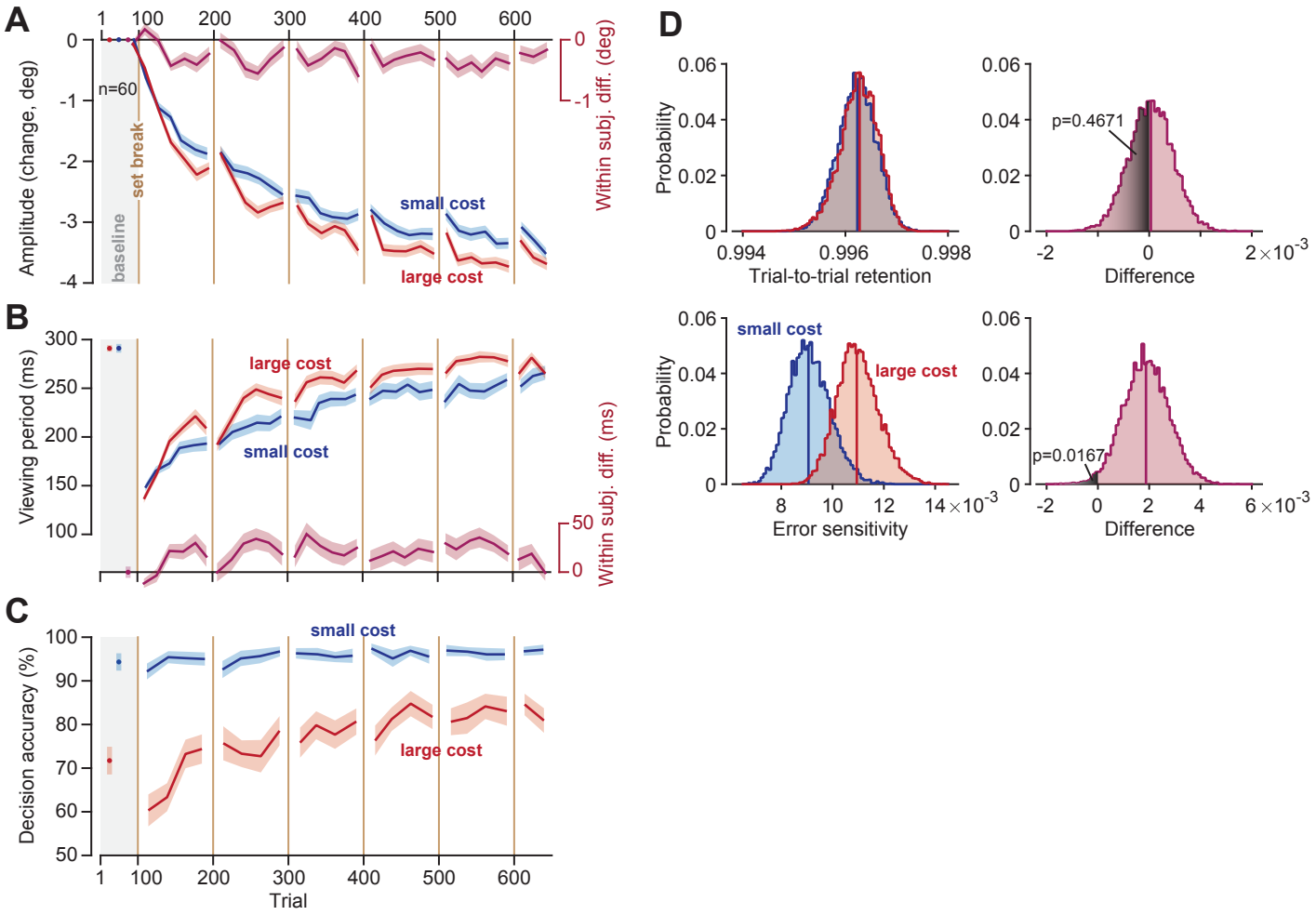

Fig. S3. The faster adaptation of the primary saccade provided more viewing time to perform motion discrimination. *(A)* Change in primary saccade amplitude from baseline. *(B)* Image viewing period over the course of adaptation. Faster adaptation provided more viewing time to perform motion discrimination. *(C)* Decision accuracy over the course of the adaptation. The impact of the increased viewing period on decision accuracy was much greater for large cost stimulus as compared to the small cost stimulus. *(D)* A single-state model was fit to the data and error sensitivity and retention were estimated using a permutation procedure (see Methods). The plots show the resulting distribution of parameter values and the within-population differences in parameter values due to change in cost.
Data from Exp. 1-3. Bin size in A & B is 8 trials and in C is 12 trials. Error bars are SEM.

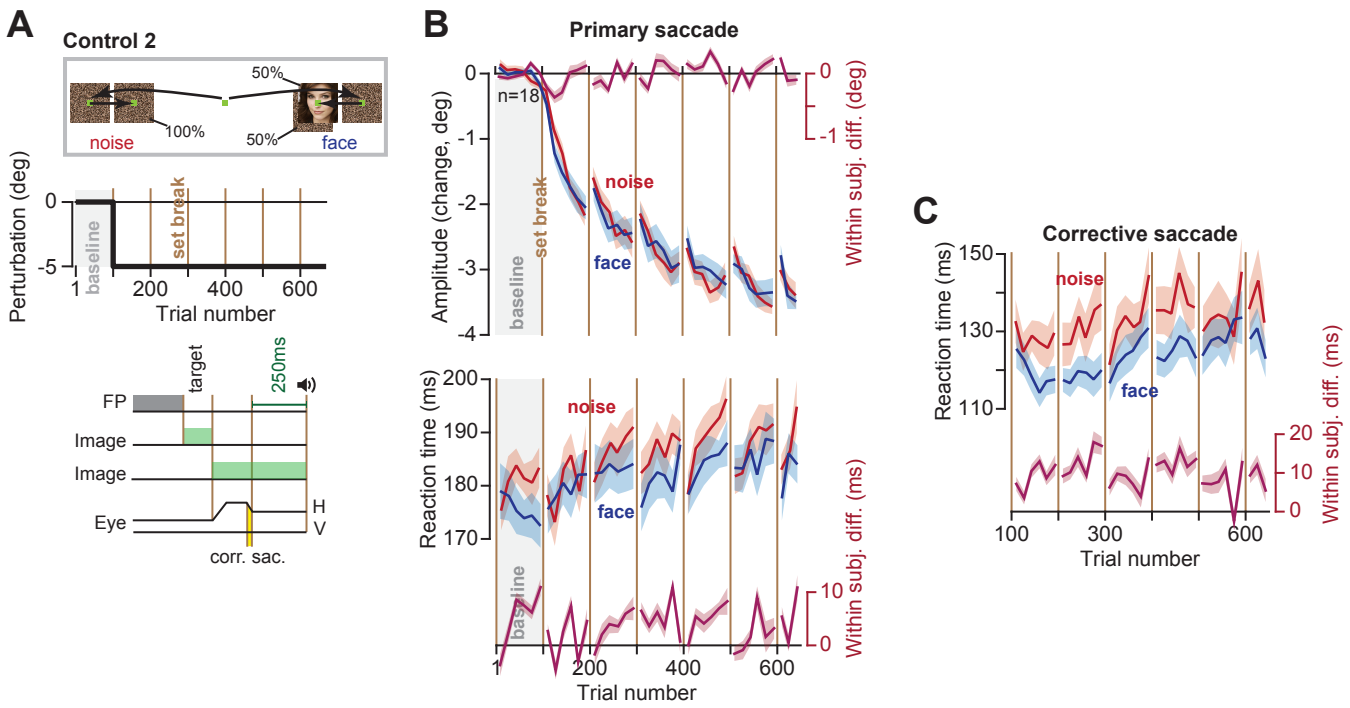

Fig. S4. Control 2: learning rates were unaffected by increased reward rate. We modulated the reward rate via presentation of noise and face images, eliminating both the cost of error and task difficulty. *(A)* Experiment design. The primary target was always a noisy image. On 50% of the trials to one side, this image was replaced by image of a face. *(B)* Primary saccades had a shorter reaction time toward the side that had a higher probability of a face image, but the rate of adaptation was not affected. *(C)* Corrective saccades had a lower reaction time toward the face image. Bin size is 8 trials. Error bars are SEM.

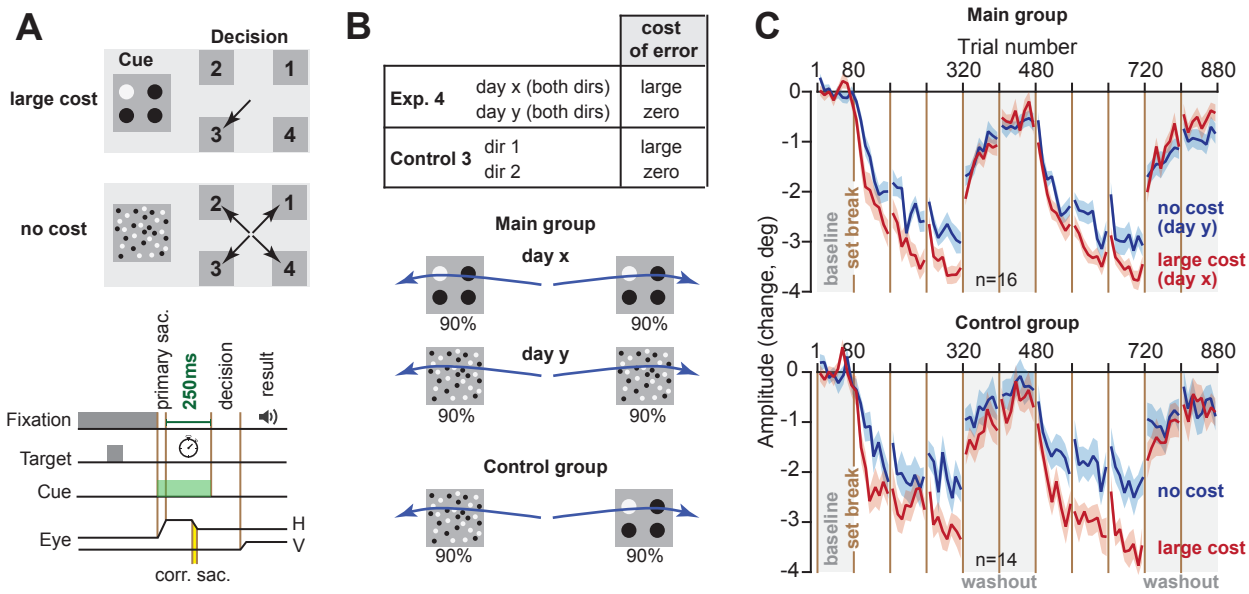

Fig. S5. Increasing the error cost for all movement directions increased the learning rates. *(A)* Experiment design. Subjects had a limited time to view the cue image. If the cue image contained large circles, then the correct decision was determined by the number of large black circles. If the cue image contained noise, then any decision was correct. *(B)* In the main group, during one session (day x, high cost day) there was 90% probability that the cue on both directions would have a large cost. During another session (day y, low cost day, a week apart) there was only 10% probability that the cues would have a large cost. In the control group, cues in one direction had a 90% probability of having a high cost, while in the other direction this probability was 10%. *(C)* Primary saccade amplitude with respect to baseline. Large cost consistently increased the learning rates. Bin size in C is 10 trials for main group and 5 trials for Control group. Error bars are SEM.