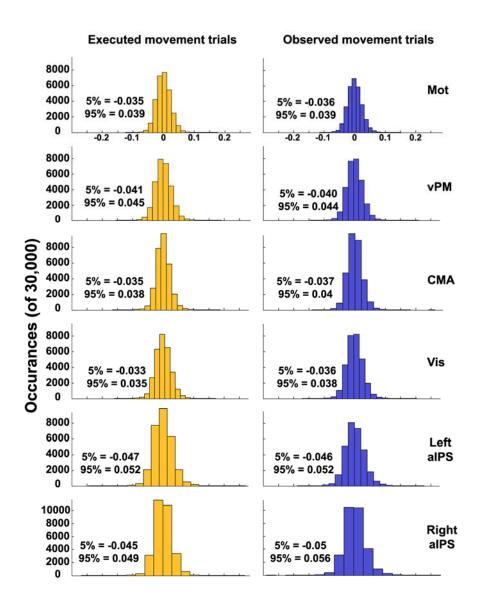
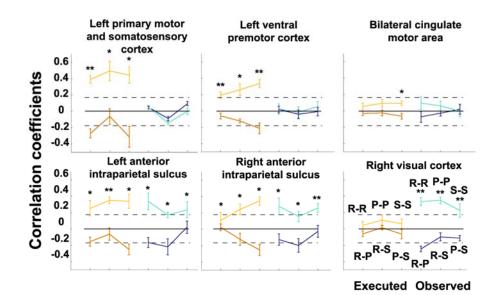


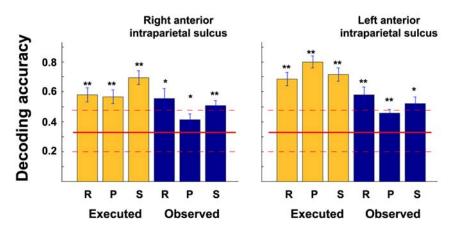
**Supplementary Figure 1:** Randomized classification analysis. We performed the classification analysis (see Methods) after shuffling trial identities (rock, paper, or scissors) randomly. The histograms characterize the distributions of decoding accuracies expected by chance in each ROI for executed movement trials (left, orange) and observed movement trials (right, blue). The 5<sup>th</sup> and 95<sup>th</sup> percentiles of the distributions are noted.



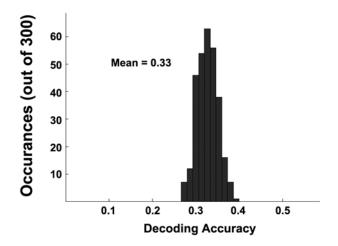
**Supplementary Figure 2:** Randomized correlation analysis. We performed the correlation analysis (see Methods) after shuffling trial identities (rock, paper, or scissors) randomly. The histograms characterize the distributions of correlation values expected by chance in each ROI for executed movement trials (left, orange) and observed movement trials (right, blue). The 5<sup>th</sup> and 95<sup>th</sup> percentiles of the distributions are noted.



**Supplementary Figure 3:** Correlation of response patterns, when dividing the data into two halves (same format as Figure 4). The 10 runs/games were randomly assigned to two groups, responses were averaged across games in each group, and then the correlations were computed between the two averages. This analysis was repeated 1000 times, randomly assigning the 10 games to each group.



**Supplementary Figure 4:** Classifier decoding accuracy using canonical HRFs instead of subject specific HRFs (same format as Figure 3).



**Supplementary Figure 5:** Random classification. To test the classification algorithm, we performed the classification analysis (see Methods) using random data generated by Matlab's *rand* function. The histogram characterizes the distribution of decoding accuracies expected by chance, which has a mean of 0.33 as expected. The width of this distribution is arbitrary and depends on the particulars of the distribution of random numbers.