## **Supporting Information**

## Xue et al. 10.1073/pnas.1111927109

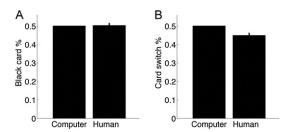


Fig. S1. Behavioral data in the functional MRI study. (A) The percentage of choosing black card by the computer and human subjects. (B) The percentage of switching from one card to another by the computer and human subjects. Error bars represent SE.

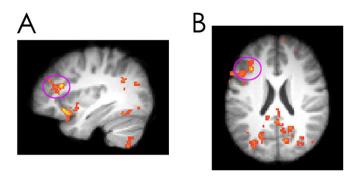


Fig. S2. Left lateral prefrontal cortex shows three-way interaction, which is overlaid on the (A) sagittal and axial slices of the group mean structural image. All activations were thresholded by using cluster detection statistics, with a height threshold of z > 2.3 and a cluster probability of P < 0.05, corrected for whole-brain multiple comparisons.

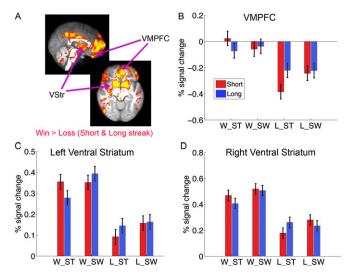


Fig. S3. Regions that showed stronger activations to gains than to losses. (A) Stronger activation to gains than to losses was found in a wide neural network, including the ventromedial prefrontal cortex (VMPFC) and bilateral ventral striatum (vStr). The activations, threshold at z > 2.3 (whole-brain corrected) are rendered onto the sagittal and axial slices of the group-average anatomical map. Plots of percent signal changes in the VMPFC (B), left vStr (C), and right vStr (C) regions show significant effects of current outcome. Error bars represent within-subject SE. For VMPFC, the reward effect (i.e., gains > losses) was stronger under short streaks than under long streaks [F(1,17) = 7.08, P = .017]. In the left and right vStr, there were (marginally) stronger activations when subjects subsequently switched their choice in the next trial than when they did not [left, F(1,17) = 3.76, P = 0.069; right, F(1,17) = 10.42, P = 0.005]. No other main effect or interaction was significant (P > 0.14).

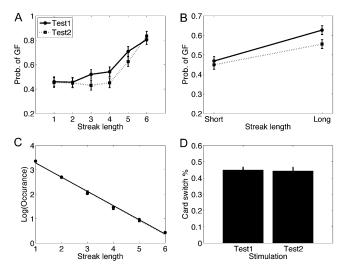


Fig. 54. Practice effects on the use of the GF strategy. (A) Percentage of the GF strategy as a function of streak length and test session. (B) The same result was plotted again by dividing the streaks into short streaks (≤3) and long streaks (≥4). (C) The number of short and long streaks subjects made in their choice as a function of practice. Log occurrence against streak length was fit with a linear function. (D) The percentage of switching from one card to another. Error bars represent withinsubject SE. There was a small trend of practice effects [F(1,17) = 1.79, P = 0.2]. After grouping the streaks into short and long streaks, the practice effect was still not significant [F(1,17) = 2.38, P = 0.14]. Practice did not change the stickiness of the decision, nor did it change the percentage of card switch [f(1,17) = 0.41, P = 0.69].

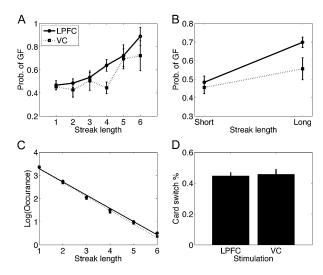


Fig. S5. Effect of transcranial direct current stimulation (tDCS) stimulation on the use of the gambler's fallacy (GF) strategy, based on the data from the first session. (A) Percentage of the GF strategy as a function of streak length and stimulation site. (B) The same result is plotted again by dividing the streaks into short streaks ( $\leq$ 3) and long streaks ( $\geq$ 4). (C) The number of short and long streaks subjects made in their choice as a function of stimulation. Log occurrence against streak length was fit with a linear function. (D) Percentage of switching from one card to another. Error bars represent SEM. With nine subjects in each group, anodal tDCS to lateral prefrontal cortex (LPFC), compared with visual cortex, significantly increased the use of the GF strategy [F(1,96) = 4.45, P = 0.038]. After grouping the streaks into short and long streaks, the tDCS effect was still significant [F(1,32) = 5.1, P = 0.031]; there is a trend of stimulation site—by–streak length interaction [F(1,32) = 2.29, P = 0.14]. A further post-hoc t test indicated that there was strong tDCS effect under long streak [t(16) = 2.33, t = 0.03], but no effect under short streak [t(16) = 0.64, t = 0.53].

Table S1. Brain regions that showed stronger activations to outcomes followed by GF choices than those followed by WSLS choices under long streaks

Regions	X	У	Z	Z
Left lateral prefrontal cortex	-36	26	18	3.76
Left precentral gyrus	-48	0	18	4.07
Right thalamus	6	-10	6	3.40
Right putamen	16	14	-10	3.28
Cerebellum	4	-48	-24	4.40
Left cerebellum	-32	-40	-32	4.67
Left middle/inferior temporal gyrus	-50	<b>–50</b>	-4	3.52

GF, gambler's fallacy; WSLS, win-stay, lose-shift.