

Supplementary Material

Between-Groups Analysis of Subjective Ratings Data

We compared the subjective ratings in the 20 regular gamblers against the 14 healthy volunteers from Clark et al (2009, experiment 2) with modest gambling involvement (SOGS 0-2). This comparison is displayed in Supplementary Table 6; note values for the regular gamblers duplicate data in Supplementary Table 3. Analyses were conducted on raw ratings only as group differences in anchoring / distribution of ratings may confound effects on the z transformed ratings. For “How do you rate your chances of winning?”, a 2 (Personal Control) x 2 (Group) mixed-model ANOVA indicated a significant effect of Personal Control ($F(1,32)=32.5, p<.0001$), due to elevated ratings in the participant-chosen trials compared to computer-chosen trials. There was no significant main effect of Group ($F(1,32)=1.14, p=.294$) or Group x Personal Control interaction ($F(1,32)=2.85, p=.101$). For “How much do you want to continue to play the game?”, a 3 (Outcome) x 2 (Personal Control) x Group mixed-model ANOVA revealed a significant Outcome x Personal Control interaction term ($F(2,64)=8.70, p<.0001$) and significant main effect of Outcome ($F(2,64)=33.7, p<.0001$), with no further significant terms (all $p>.10$). Collapsing across Group, paired tests revealed a significant difference between the participant-chosen wins and the computer-chosen wins ($t(33)=3.32, p=.002$), and a marginally significant difference between participant-chosen near-misses and participant-chosen full-misses ($t(33)=1.87, p=.07$). Thus, in a larger sample ($n=34$) there was a subtle effect of near-miss outcomes to increase desire to play on participant-chosen trials.

Supplementary Table 1: Gambling preferences endorsed by the participants.

	Not at all	Less than once a week	Once a week or more
Played cards for money	4	8	8
Bets on horses, dogs, or other animals	4	6	10
Bet on sports	4	6	10
Played dice games for money	17	2	1
Went to a casino	7	8	5
Played the numbers or bet on lotteries	4	9	7
Played bingo	16	4	0
Played the stock and/or commodities markets	14	2	4
Played slot machines, poker machines, or other gambling machines	5	9	6
Bowled, played pool, golf or played some other game of skill for money	5	11	4

Supplementary Table 2: Questionnaire measures of clinical symptoms.

Measure	Mean (S.E.)
BDI Depression	12.93 (2.53)
BAI Anxiety	15.3 (2.47)
ASRS Total	34.5 (2.47)
BIS Total	72.08 (2.26)
Padua	58.36 (3.69)
AUQ Total	49.41 (7.89)

BDI: Beck Depression Inventory version II, BAI: Beck Anxiety Inventory, ASRS: Adult ADHD Self-Rating Scale, BIS: Barratt Impulsivity Scale; Padua: Padua Inventory for OCD symptoms, Washington State Revision; AUQ: Alcohol Use Questionnaire.

Supplementary Table 3: Subjective ratings data from the regular gamblers (n=20) on the near-miss task (mean (sd))

		Participant-Chosen	Computer-Chosen
<i>“How do you rate your chances of winning?” (0=very low, 100=very high)</i>			
	Raw	47.2 (17.5)	33.5 (13.9)
	Z	0.27 (0.23)	-0.28 (0.24)
<i>“How much do you want to continue to play?” (0=not at all, +100=a lot)</i>			
Wins	Raw	78.1 (18.1)	73.2 (23.9)
	Z	0.69 (0.48)	0.43 (0.41)
Near-misses	Raw	62.6 (21.9)	64.0 (17.4)
	Z	-0.10 (0.22)	-0.02 (0.23)
Full-misses	Raw	60.1 (21.8)	62.9 (20.4)
	Z	-0.19 (0.26)	-0.10 (0.26)

Supplementary Table 4: Whole-brain analyses of fMRI responses to gambling outcomes in the overall group of regular gamblers.

Region	Side	X	Y	Z	Voxel	Z statistic	P
<i>Contrast 1: Wins minus All Non-Wins</i>							
Thalamus ¹	R	2	-16	2	612	4.71	<0.001
Thalamus	R	14	-10	8		4.30	<0.001
	L	-20	-14	-2		3.56	<0.001
Ventral Striatum (Putamen) ¹	R	20	10	-6	212	3.66	<0.001
Insula / Posterior OFC (BA 47)	R	28	20	-6		3.46	<0.001
	R	36	16	-10		3.43	<0.001
Striatum - Globus Pallidus	L	-16	2	-6	56	3.39	<0.001
Striatum – Globus Pallidus	R	14	-6	-8	12	3.31	<0.001
Insula / Posterior OFC (BA 47)	L	-36	18	-6	60	3.47	<0.001
Midbrain	L	-8	-18	-14	26	3.42	<0.001
Posterior Cingulate (BA 30)	-	0	-50	18	50	3.32	<0.001
Posterior Cingulate (BA 30)	R	6	-44	32	16	3.19	0.001
<i>Contrast 2: Near-misses minus Full Misses</i>							
Parahippocampal Gyrus (BA 28) ¹	L	-16	-2	-10	35	4.32	<0.001
Parahippocampal Gyrus (BA 19)	R	22	-50	-4	10	3.47	<0.001
Cerebellum	R	6	-34	-6	27	3.84	<0.001
	L	-14	-54	-40	16	3.96	<0.001
Ventral Striatum (Putamen) ¹	R	18	6	-2	60	3.67	<0.001
	R	18	4	-10		3.66	<0.001
Middle Temporal Gyrus	R	62	-48	2	25	3.53	<0.001

Superior Temporal Gyrus (BA 21)	L	-48	-24	-4	11	3.65	<0.001
Superior Temporal Gyrus (BA 38)	R	50	12	-20	15	3.64	<0.001
Inferior Frontal Gyrus (BA 47)	R	26	18	-12	12	3.30	<0.001
<i>Contrast 3: Near-miss by personal control interaction</i>							
Precuneus (BA 31)	L	-22	-74	16	29	3.78	<0.001
<i>Contrast 4: Participant-chosen wins minus computer-chosen wins</i>							
Cuneus (BA 18)	L	-2	-88	20	24	3.73	<0.001

Threshold = 10 voxels, $p < .001$ uncorrected. ¹ significant at $p < .05$ (FWE-corrected) within the win-contrast mask from Clark et al (2009).

Supplementary Table 5: Between-groups comparison of the 20 regular gamblers against 14 subjects from Clark et al (2009) who displayed modest gambling involvement ($\text{SOGS} \leq 2$). One further subject from Clark et al (2009) with a SOGS score of 3 was excluded, as a cut-off of 3 is taken to indicate mild problem or ‘at-risk’ gambling. Age was included as a covariate given that the regular gamblers were moderately older (mean 33.7, sd 8.0) than the healthy non-gamblers (mean 26.0, sd 7.5). Voxels significant in a whole-brain analysis, thresholded at $p < .001$ uncorrected with a cluster threshold of 10.

Region	Side	X	Y	Z	Voxel	Z statistic	P
<i>Wins minus All Non-Wins</i>							
Cuneus (BA 30, 18)	L	-16	-68	12	1760	5.01	<0.001
	L	-12	-76	14		4.60	<0.001
	R	12	-72	20		4.58	<0.001
Caudate	R	8	6	-4	313	4.08	<0.001
Lateral Globus Pallidus	L	-10	6	-4		3.99	<0.001
Thalamus	R	8	-4	4		3.95	<0.001
Midbrain	R	6	-12	-10	58	4.15	<0.001
Insula / Inferior Frontal Gyrus (BA 13)	L	-30	12	-14	44	4.16	<0.001
Medial Frontal Gyrus (BA 9)	L	-10	40	16	56	4.18	<0.001
Superior Temporal Gyrus (BA 22)	L	-44	-32	-2	109	4.13	<0.001
Middle Temporal Gyrus (BA 22)	L	-48	-40	-2		3.81	<0.001
Inferior Temporal Gyrus (BA 20)	L	-46	-26	-8		3.26	0.001
Parietal Lobe (BA 40)	R	24	-42	50	78	4.31	<0.001
Inferior Frontal Gyrus (BA 9)	L	-58	18	22	23	3.85	<0.001

Middle Frontal Gyrus (BA 11)	L	-40	34	-12	22	3.87	<0.001
Rostral Anterior Cingulate (BA 32)	R	8	34	-6	69	3.80	<0.001
Temporal Lobe	R	32	-14	-10	54	3.80	<0.001
Medial Frontal Gyrus (BA 10)	R	12	58	2	12	3.80	<0.001
Cerebellum	L	-4	-34	-2	17	3.73	<0.001

Supplementary Table 6: Subjective ratings data comparing the regular gamblers (n=20) and healthy volunteers with modest gambling involvement (n=14) from Clark et al (2009 experiment 2), on the near-miss task (mean (sd))

		Regular Gamblers (n=20)	Healthy Volunteers (n=14)	Pooled Group (n=34)
<i>“How do you rate your chances of winning?” (0=very low, 100=very high)</i>				
	Participant Chosen	47.2 (17.5)	49.3 (15.5)	48.1 (16.5)
	Computer Chosen	33.5 (13.9)	41.9 (12.9)	37.0 (13.9)
<i>“How much do you want to continue to play?” (0=not at all, +100=a lot)</i>				
Wins	Participant Chosen	78.1 (18.1)	79.7 (13.5)	78.7* (16.1)
	Computer Chosen	73.2 (23.9)	74.7 (12.6)	73.8* (19.8)
Near-misses	Participant Chosen	62.6 (21.9)	68.9 (14.6)	65.2 [†] (19.2)
	Computer Chosen	64.0 (17.4)	67.9 (13.3)	65.6 (15.7)
Full-misses	Participant Chosen	60.1 (21.8)	67.4 (14.7)	63.1 [†] (19.3)
	Computer Chosen	62.9 (20.4)	71.6 (12.3)	66.5 (17.8)

* differ $p < .005$, [†] differ $p = .07$

Supplementary Figure 1: Distributions of scores on the South Oaks Gambling Screen (SOGS).

