

Supporting online material

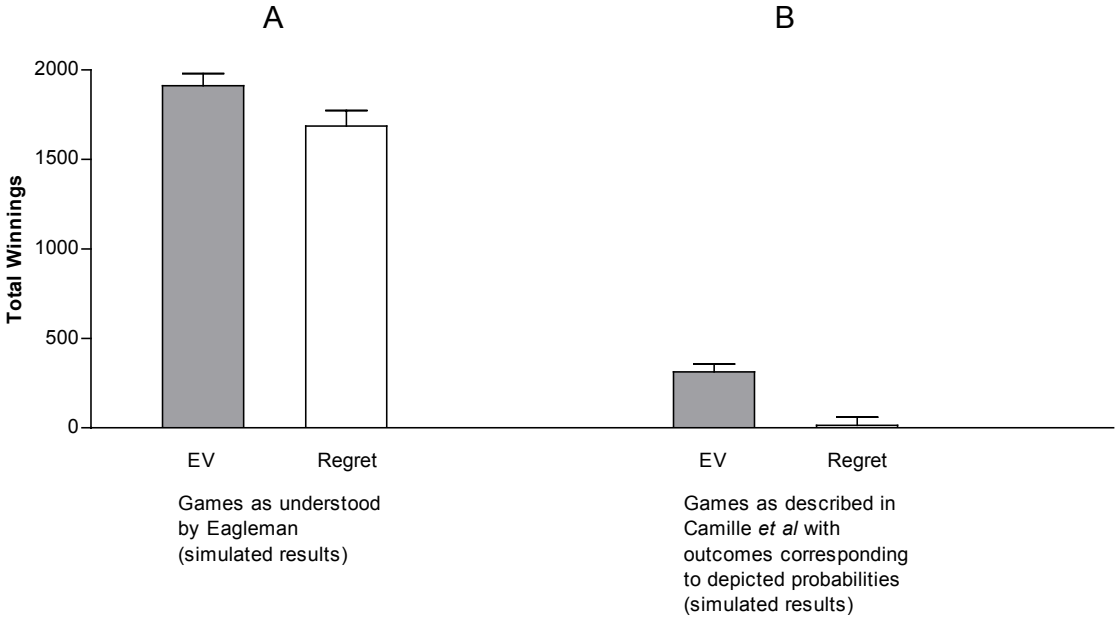
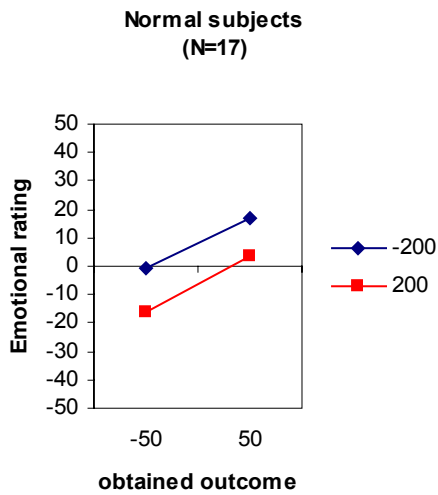


Figure S1. Simulation analysis with (A) random parameters structure as used by Eagleman, and (B) with parameters structure as used in Camille et al (4) with outcomes corresponding to actual probabilities.

Partial Feedback Condition: Disappointment Effect

A



B

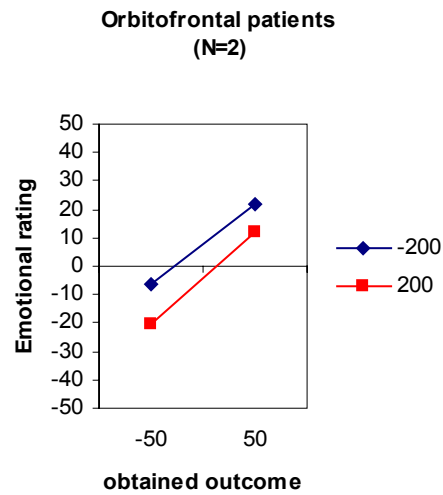


Figure S2 Emotional ratings in a replication of the task used by Camille et al. using actual outcomes matching depicted probabilities: **(A)** normal control subjects (N = 17) and **(B)** orbitofrontal patients (N = 2) for two obtained outcomes (-50 or 50) as a function of the unobtained outcome (-200 or +200) from the same gamble in the partial feedback condition (data from (6)).

Statistical Analysis

Normal Subjects. (1) Disappointment effect: In the partial feedback condition, disappointment is expressed in the perception of losses (-50) as more unpleasant and gains (+50) as less pleasant if the unobtained outcome from the same gamble wins 200 instead of losing 200. Wilcoxon sign-rank test: For -50 obtained: $P = .0075$; and for +50 obtained: $P < .001$.

(2) Regret effect: In the complete feedback condition, regret is expressed in the perception of losses (-50) as more unpleasant and gains (+50) as less pleasant if the outcome of the unselected gamble wins 200 instead of losing 200. For both -50 and +50 obtained: Wilcoxon sign-rank test: $P < .001$.

Regret vs. disappointment: For a given obtained outcome the emotional evaluation in the face of a more favorable outcome of 200 for the unchosen gamble (complete condition, Fig. 1 A) is more negative than in the face of an unobtained outcome of 200 for the chosen gamble (partial condition, Fig. S2 A). Wilcoxon sign-rank test: For -50 obtained: $P = 0.0179$; and for +50 obtained: $P = 0.0005$.

Normal control subjects' earnings in complete condition:

Average total earnings in complete feedback condition = 620.58 (St-dev = 89.22)

The earnings are smaller than the prediction from the maximization of expected value (i.e. 700). This is because of the parameter structure used, anticipating regret (as shown by normal subjects' choice behavior, Table 1) has a detrimental effect on subjects' earnings.

OFC patients' earnings in complete condition:

Average total earnings in complete feedback condition = 975 (St-dev = 176.77). OFC patients' earnings are higher than normal subjects' earnings, thus patients perform better than normal subjects. This is due to the absence of anticipating regret as shown in Table 1.

Table S1 Parameters used in Coricelli et al (6)

Trials	Gamble 1					Gamble 2				
	x1	p	y1	1-p	Outcome	x2	q	y2	1-q	Outcome
1	-50	0.2	-200	0.8	2	50	0.2	-50	0.8	2
2	200	0.5	-50	0.5	2	200	0.5	-200	0.5	1
3	200	0.8	-200	0.2	1	200	0.5	50	0.5	2
4	200	0.2	50	0.8	2	50	0.5	-200	0.5	2
5	50	0.8	-200	0.2	1	50	0.2	-50	0.8	2
6	200	0.5	50	0.5	2	200	0.5	-200	0.5	1
7	200	0.5	-200	0.5	2	200	0.8	-50	0.2	1
8	200	0.2	-200	0.8	1	200	0.5	-50	0.5	2
9	50	0.2	-200	0.8	2	50	0.8	-50	0.2	1
10	50	0.2	-50	0.8	2	50	0.2	-200	0.8	2
11	200	0.2	-50	0.8	1	200	0.2	50	0.8	2
12	200	0.8	-50	0.2	2	200	0.5	-200	0.5	1
13	50	0.8	-50	0.2	1	200	0.5	-200	0.5	2
14	-50	0.2	-200	0.8	2	-50	0.8	-200	0.2	1
15	200	0.5	-50	0.5	2	200	0.2	50	0.8	2
16	200	0.8	-200	0.2	1	200	0.2	-50	0.8	2
17	50	0.8	-200	0.2	1	200	0.2	-200	0.8	1
18	-50	0.8	-200	0.2	1	50	0.8	-200	0.2	1
19	-50	0.5	-200	0.5	1	200	0.2	-200	0.8	2
20	200	0.2	-200	0.8	2	50	0.8	-200	0.2	1
21	200	0.2	-200	0.8	2	50	0.8	-200	0.2	1
22	200	0.8	-50	0.2	1	200	0.8	-200	0.2	2
23	200	0.5	-50	0.5	2	200	0.2	-200	0.8	1
24	200	0.5	-200	0.5	1	50	0.8	-50	0.2	1
25	50	0.5	-200	0.5	1	-50	0.5	-200	0.5	1
26	200	0.5	50	0.5	1	200	0.8	-50	0.2	2
27	-50	0.8	-200	0.2	1	50	0.2	-200	0.8	2
28	200	0.8	50	0.2	2	200	0.8	-200	0.2	1
29	-50	0.2	-200	0.8	2	-50	0.5	-200	0.5	1
30	50	0.5	-200	0.5	1	-50	0.5	-200	0.5	2

Note: Outcome is equal to 1 if x and 2 if y.

Parameters description of Table S1:

1. There are 30 trials for each condition (*partial* and *complete* feedback).
2. We maintain the same set of trials for each condition.
3. The parameters were selected from combinations of the following values: -200, -50, +50, +200 and outcome probabilities .2, .5, .8.
4. The two gambles always differ in their expected values, and in the values of their actual outcomes.
5. There are 6 possible pairs of outcomes (outcome obtained in the chosen gamble and outcome of the unselected gamble, or *vice versa*): (1) -50 / 200; (2) 50 / 200; (3) -50 / -200; (4) 50 / -200; (5) 50 / -50; (6) -200 / 200.
6. Predicted total earnings if the subjects maximize expected values are equal to 700 for each condition. Predicted earnings if subjects anticipate regret (exclusively) are equal to -300; thus deviation from maximization of expected values in terms of anticipating regret has a detrimental effect in subjects' earnings.
7. Actual outcomes correspond to depicted probabilities, e.g. in 10 gambles with $p=.8$ and $1-p=.2$, we have 8 times the outcome x_1 and 2 times the outcome y_1 .

Notation: We call g_1 and g_2 gamble 1 and gamble 2, respectively. x_1 and y_1 are the higher and the lower outcomes of g_1 ; and x_2 and y_2 are the higher and the lower outcomes of g_2 . p is the probability of x_1 and $1-p$ is the probability of y_1 ; and q is the probability of x_2 and $1-q$ is the probability of y_2 . Outcome is equal to 1 if x and 2 if y .

Table S2 Parameters used in Camille et al (4).

Trials	Gamble 1					Gamble 2				
	x1	p	y1	1-p	Outcome	x2	q	y2	1-q	Outcome
1	200	0.5	50	0.5	2	200	0.5	-50	0.5	2
2	200	0.5	50	0.5	1	200	0.8	-50	0.2	2
3	50	0.5	-200	0.5	2	-50	0.5	-200	0.5	1
4	-50	0.5	-200	0.5	1	50	0.2	-200	0.8	2
5	200	0.2	-50	0.8	1	50	0.5	-200	0.5	2
6	-50	0.8	-200	0.2	2	50	0.2	-200	0.8	1
7	50	0.5	-50	0.5	1	200	0.5	-50	0.5	1
8	200	0.5	-50	0.5	2	200	0.2	50	0.8	1
9	-50	0.5	-200	0.5	1	-50	0.8	-200	0.2	2
10	200	0.2	-50	0.8	2	50	0.8	-50	0.2	1
11	50	0.2	-200	0.8	1	-50	0.2	-200	0.8	2
12	200	0.5	50	0.5	2	50	0.8	-200	0.2	1
13	-50	0.2	-200	0.8	2	-50	0.5	-200	0.5	2
14	200	0.5	-50	0.5	2	50	0.8	-50	0.2	2
15	200	0.2	-50	0.8	1	200	0.2	50	0.8	2
16	-50	0.2	-200	0.8	2	-50	0.8	-200	0.2	1
17	50	0.5	-50	0.5	2	50	0.8	-200	0.2	2
18	50	0.5	-50	0.5	1	200	0.2	-50	0.8	1
19	50	0.2	-50	0.8	1	50	0.8	-50	0.2	2
20	200	0.2	-50	0.8	1	-50	0.5	-200	0.5	2
21	50	0.5	-200	0.5	2	50	0.2	-50	0.8	2
22	50	0.2	-200	0.8	2	50	0.8	-50	0.2	1
23	200	0.8	-50	0.2	1	200	0.8	50	0.2	1
24	50	0.5	-200	0.5	2	-50	0.8	-200	0.2	1
25	200	0.2	50	0.8	1	200	0.8	-50	0.2	2
26	200	0.5	-50	0.5	2	50	0.8	-200	0.2	2
27	50	0.2	-50	0.8	1	50	0.2	-200	0.8	2
28	200	0.2	-50	0.8	1	50	0.8	-200	0.2	1
29	50	0.2	-200	0.8	1	-50	0.8	-200	0.2	1
30	50	0.2	-50	0.8	1	50	0.8	-200	0.2	1

Note: Outcome is equal to 1 if x and 2 if y.

References

4. N. Camille *et al.*, *Science* **304**, 1167 (2004).
6. G. Coricelli *et al.*, in preparation.