Supplemental material

The architecture of reward value coding in the human orbitofrontal cortex

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Supplemental Materials and Methods

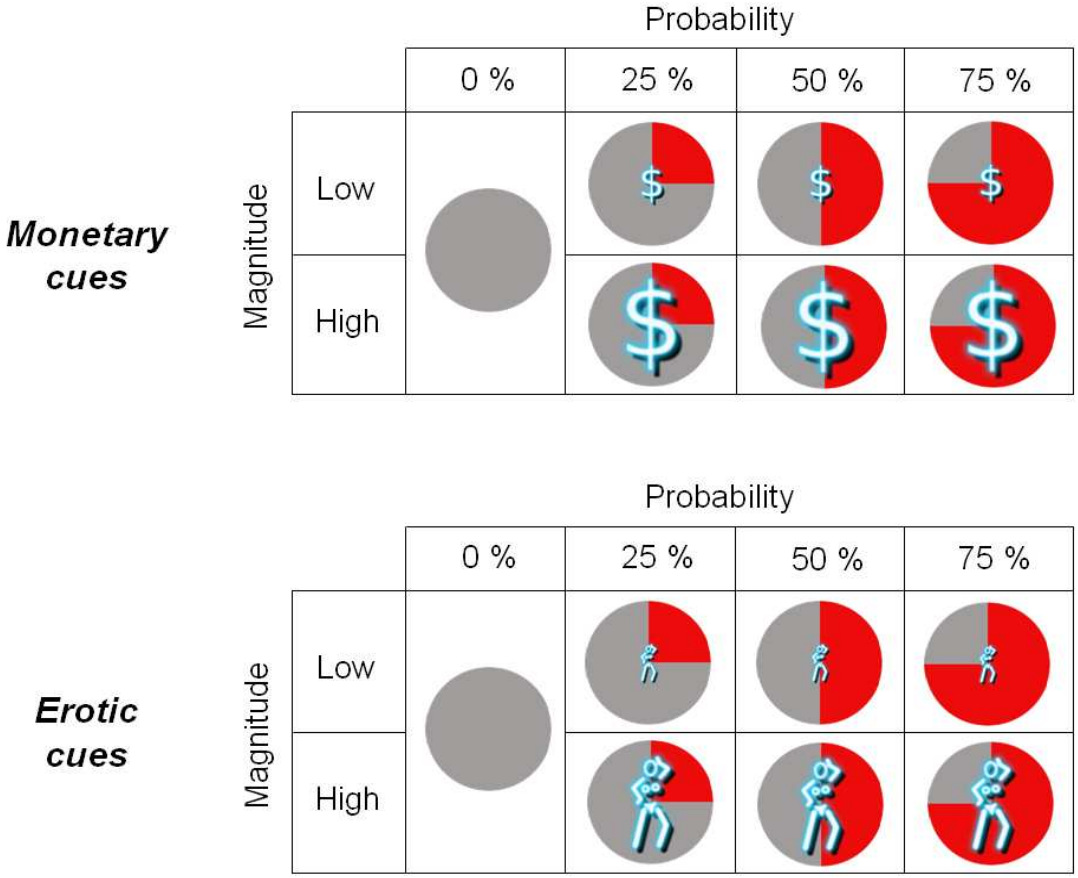

Figure S1. Visual cues predictive of reward outcomes. The red portion of the pie chart in the background circle indicated reward probability, the nature of the foreground pictogram (dollar or woman) indicated reward type, and the size of the pictogram indicated reward intensity (high or low). The control cue had a grey background symbolizing a reward probability of 0.

Supplemental Results

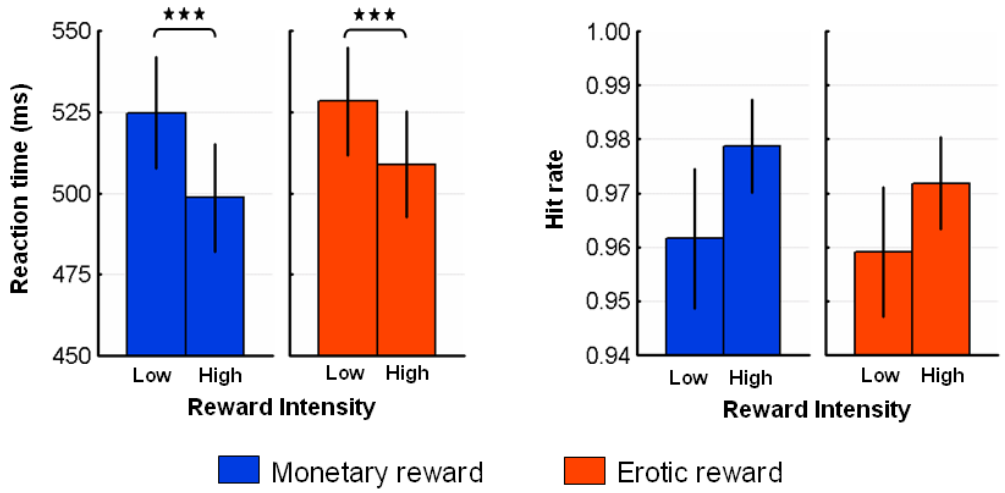

Figure S2. Behavioral results on the discrimination task. Mean reaction times and hit rates according to reward intensity, showing an identical behavior for monetary and erotic rewards (i.e. no significant reward type * intensity interaction: p=0.20 for reaction times and p=0.67 for hit rate). Error bars indicate standard error to the mean (SEM). Asterisks denote significance of Tukey's HSD tests (***p<0.001).

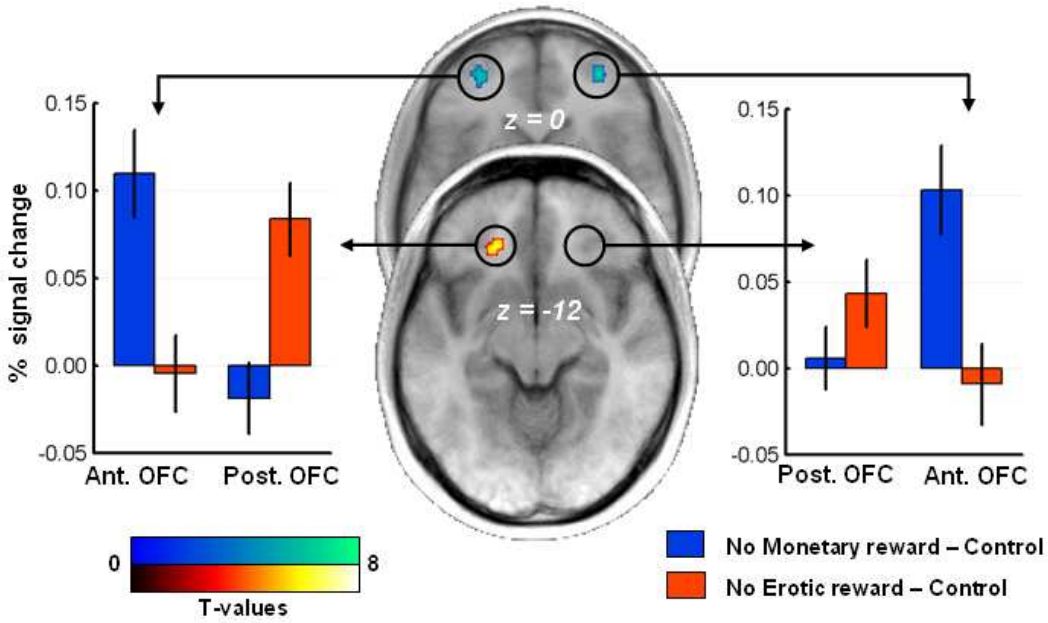

Figure S3. Postero-anterior dissociation in the orbitofrontal cortex depending on reward type for no-reward outcomes. Brain regions responding specifically to no-monetary reward outcomes are displayed in blue-green, and those responding specifically to erotic reward outcomes are displayed in red-yellow. Plots of mean percent signal change, which are not independent of the whole-brain analysis, are shown only to illustrate the double dissociation between monetary/erotic rewards and anterior/posterior OFC. Activations are overlaid on an average anatomical scan of all subjects ($p<0.05$ FWE whole-brain corrected). Error bars indicate standard error to the mean (SEM).

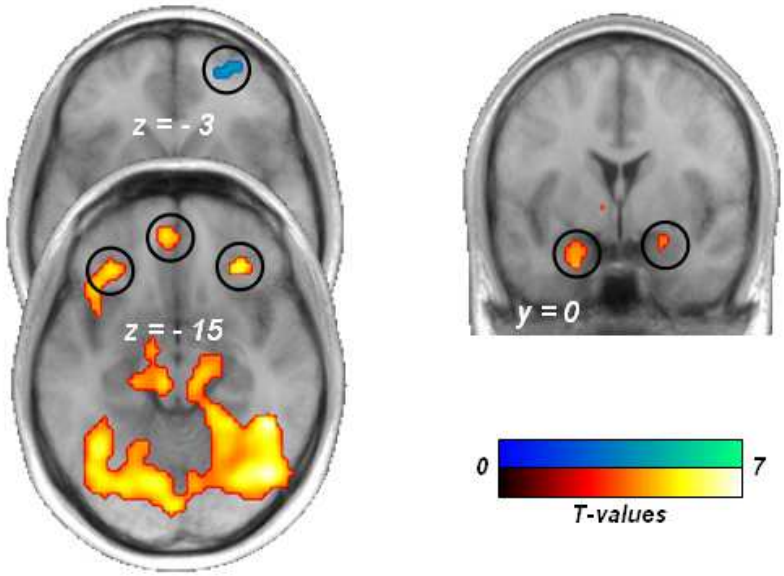

Figure S4. Brain regions in which the correlation with hedonic value was greater for one type of reward compared to the other (comparison of parametric regressors modelling hedonic ratings across reward and no-reward outcomes). Brain regions showing a greater correlation with monetary hedonic value are displayed in blue-green (anterior lateral OFC: x,y,z=30, 54, -6, T=4.31) and those showing a greater correlation with erotic hedonic value are displayed in red-yellow (posterior lateral OFC: x,y,z=-33, 30, -15, T=5.22; 30, 33, -15, T=5.86; medial OFC: x,y,z=-6, 48, -15, T=5.22; amygdala: x,y,z=-24, -3, -30, T=4.77; 15, -9, -18, T=5.35). Note that these results parallel the findings of the categorical analysis presented in Fig. 2 and Fig. 3, as the identified brain regions are identical in both cases. Activations are overlaid on an average anatomical scan of all subjects (for display purposes they are shown at $p<0.0005$ uncorrected, but all survive an FDR corrected threshold of $p<0.05$ with a cluster extent of 40). Note that the left anterior OFC also showed a greater correlation with monetary hedonic value at a more liberal threshold of $p<0.005$ uncorrected.

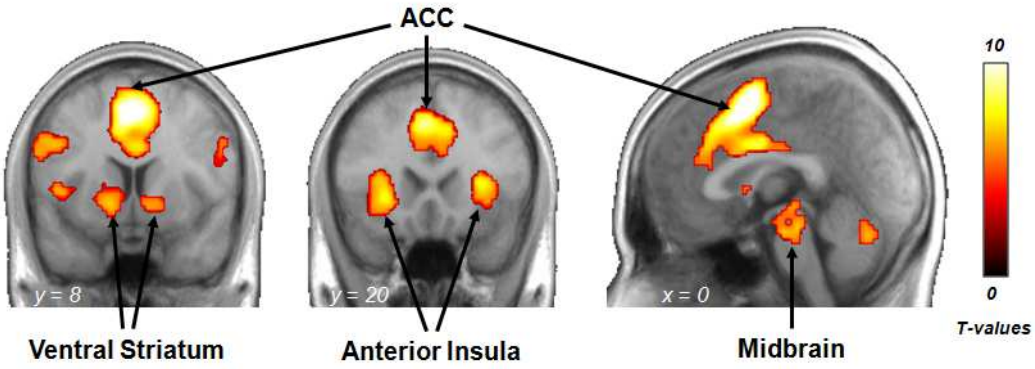

Figure S5. Brain regions responding to both monetary and erotic rewards in a simple contrast against the control condition (conjunction of the contrasts MR>C and ER>C). Activations are overlaid on an average anatomical scan of all subjects ($p<0.05$ FWE whole-brain corrected).

Supplemental Tables

Brain Region	Hemisphere	MNI peak coordinates			T-value
		x	y	z	
Brain regions specific of monetary reward outcomes					
Middle frontal / Anterior orbital gyrus †	Left	-30	51	0	5.92
	Right	30	54	-3	6.80
Middle frontal gyrus	Right	36	12	54	6.05
Inferior parietal lobule	Left	-51	-48	57	8.99
	Right	45	-48	45	6.99
Precuneus	Right	3	-66	48	5.38
Brain regions specific of no-monetary reward outcomes					
Middle frontal gyrus †	Left	-30	51	0	6.16
	Right	33	51	0	6.20
Superior frontal gyrus	Left	6	36	36	5.58

Table S1. Brain regions specific of monetary reward outcomes (contrast MR>ER, masked inclusively with MR>C and exclusively with ER>C) **and no-monetary reward outcomes** (contrast NoMR>NoER, masked inclusively with NoMR>C and exclusively with NoER>C). All reported foci survived a voxel-level threshold of $p<0.05$ FWE whole-brain corrected and a minimum cluster size of 5 voxels. Regions marked with a † were subsequently used in a region of interest analysis.

Brain Region	Hemisphere	MNI peak coordinates			T-value
		x	y	z	
Brain regions specific of erotic reward outcomes					
Posterior orbital gyrus †	Left	-30	33	-15	7.56
	Right	30	33	-15	7.54
Medial orbital / Straight gyrus †	Left	-6	45	-15	8.90
Amygdala †	Left	-21	-6	-27	6.94
	Right	24	0	-27	5.45
Superior frontal gyrus	Left	-3	57	30	6.98
Inferior frontal gyrus	Right	54	36	9	6.97
Superior temporal gyrus	Left	-39	18	-24	6.45
Precentral gyrus	Right	48	-6	54	5.83
Parahippocampal gyrus	Left	-18	-51	-9	6.92
	Right	21	-54	-6	8.86
Middle Temporal / Middle occipital gyrus	Left	-48	-81	12	10.52
	Right	54	-66	6	11.18
Fusiform gyrus	Left	-42	-42	-24	6.91
	Right	42	-45	-21	11.20
Cuneus / Superior occipital gyrus	Left	-12	-84	33	6.11
	Right	12	-84	24	7.37
		0	-84	12	7.47
Lingual gyrus	Left	-21	-72	-3	6.27
	Right	24	-60	12	6.32
Brain regions specific of no-erotic reward outcomes					
Posterior orbital gyrus †	Left	-21	33	-12	6.39

Table S2. Brain regions specific of erotic reward outcomes (contrast ER>MR, masked inclusively with ER>C and exclusively with MR>C) **and no-erotic reward outcomes** (contrast NoER>NoMR, masked inclusively with NoER>C and exclusively with NoMR>C). All reported foci survived a voxel-level threshold of $p<0.05$ FWE whole-brain corrected and a minimum cluster size of 3 voxels. Regions marked with a † were subsequently used in a region of interest analysis.

Brain Region	Hemisphere	MNI peak coordinates			T-value
		x	y	z	
Ventral striatum †	Left	-12	9	-9	6.38
	Right	9	6	-9	6.2
Midbrain †	Left	-3	-24	-24	7.3
	Right	6	-24	-9	6.23
Anterior insula †	Left	-27	21	-6	7.48
	Right	33	24	3	8.14
Anterior cingulate †	Left	-6	27	39	8.15
	Right	9	18	39	8.42
	Right	3	6	27	7.37
Posterior cingulate	Left	-3	-18	27	6.1
	Right	3	-3	30	8.58
Middle frontal gyrus	Left	-27	-6	48	7.71
	Right	30	-6	54	7.00
Superior frontal gyrus	Left	-9	15	45	10.82
Superior frontal / precentral gyrus	Left	-27	-12	57	10.08
Thalamus	Left	-9	-18	9	6.76
Superior parietal lobule	Left	-15	-66	54	9.42
Middle occipital gyrus	Right	39	-81	12	8.14
Cerebellum	Left	-33	-54	-33	8.03
	Right	33	-69	-27	6.96

Table S3. Brain regions activated by both monetary and erotic reward outcomes (conjunction of MR>C and ER>C, masked inclusively by the brain regions responding parametrically to both monetary and erotic hedonic ratings). All reported foci survived a voxel-level threshold of $p<0.05$ FWE whole-brain corrected and a minimum cluster size of 10 voxels. Regions marked with a † were subsequently used in a region of interest analysis.

Brain Region	Hemisphere	MNI peak coordinates			*T-value*
		x	y	z	
Ventral striatum	Left	-9	9	-6	3,98
	Right	6	9	-9	4,57
Anterior insula	Left	-33	18	-18	4,8
	Right	39	21	-15	3,37
Anterior cingulate	Left	-3	42	15	5,57
	Left	-3	21	27	4,23
Middle frontal gyrus	Left	-42	9	57	4,16
	Right	54	9	45	3,76
Thalamus	Right	12	-30	-3	3,95
Superior temporal gyrus	Right	63	-42	12	4,17
	Right	45	-51	9	4,13
Inferior temporal gyrus	Left	-57	-12	-24	3,91
	Right	54	-12	-33	3,71
Posterior cingulate	Left	0	-9	33	4,35
	Left	0	-30	39	3,67
Superior parietal lobule	Left	-30	-51	72	4,07
Inferior parietal lobule	Left	-57	-51	30	4,05
	Left	-39	-60	45	3,8
Superior occipital gyrus	Left	-42	-75	21	4,41
	Right	51	-66	12	4,16
Inferior occipital gyrus	Right	39	-93	-9	3,86
Fusiform gyrus	Left	-27	-42	-24	4,1
	Right	30	-72	-24	4,65
Lingual gyrus	Left	-6	-72	9	4,55
	Right	9	-72	3	5,78
Cuneus	Left	-21	-96	30	3,65
	Right	15	-84	33	4,88
Precuneus	Left	-12	-69	27	4,9
Cerebellum	Left	-15	-66	-24	3,94
	Right	3	-69	-24	4,63

Table S4. Brain regions responding parametrically with positive prediction errors for both monetary and erotic rewards. All reported foci survived a voxel-level threshold of $p<0.001$ uncorrected for multiple comparisons.