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1. Results in healthy controls (n=13) and all subjects at ultra high-risk for psychosis

(n=23).

Supplementary Table 1. Group effect across both visits during adaptive reward prediction.

Healthy controls > Ultra high-risk subjects								
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value			
Ventral striatum*	0.029ª	/†	12/4/-10	R	3.48			
Ventral striatum*	0.038ª	/†	-14/8/-8	L	3.38			
Calcarine sulcus			12/-74/14	L	4.11			
Cuneus	0.049 ^b	322†	-2/-84/20	L	3.40			
Calcarine sulcus		$ \begin{array}{c} 322 \\ \hline 22 \\ \hline 22 \\ \hline 22 \\ \hline 311 \\ \hline 6 \\ 328 \\ \hline -4 \\ 53 \\ -4 \\ -1 \\ \hline -1 \\ \end{array} $	22/-70/6	R	3.38			
Midbrain	0.048b	211÷	-6/-24/-10	L	4.10			
Midbrain	0.048	511	6/-22/-10	R	3.61			
Middle temporal gyrus	0.047 ^b	328†	-48/-54/-4	L	3.77			
Superior temporal gyrus	0.7226 ^b	53	-46/12/-16	L	3.95			
Cuneus	0 1202	222	-14/-74/24	L	3.92			
Occipital gyrus	0.1292	223	-26/-76/20	L	3.58			
Calcarine sulcus	0.2111 ^b	175	-8/-78/6	L	3.77			
Superior patietal gyrus	0.4378 ^b	105	-14/-70/44	L	3.77			
Inferior frontal gyrus	0.2600b	155	52/10/2	R	3.68			
Insula	0.2000	155	44/8/6	R	3.65			
Cuneus	0.2546b	157	18/-96/8	R	3.65			
Calcarine sulcus	0.2340	137	24/-86/6	R	3.56			
Supramarginal gyrus	0.7971 ^b	41	54/-36/34	R	3.60			

Middle cingulate cortex	0.5099 ^b	90	6/6/44	R	3.54
Inferior parietal gyrus	0.5334 ^b	35	-30/-44/36	L	3.52
Precentral gyrus	0.6493 ^b	65	-50/2/36	L	3.51
Ventral striatum	0.5412b	84	12/0/8	R	3.43
Thalamus	0.3412	04	12/-14/8	R	3.37
Insula	0.8032 ^b	40	-36/-4/12	L	3.41
Postcentral gyrus	0 7102b	55	-20/-34/54	L	3.40
Paracentral gyrus	0.7105	55	-14/-26/54	L	3.31
Ventral striatum	0.8513 ^b	32	-14/8/-8	L	3.38
Thalamus	0.8798 ^b	27	-4/-20/12	L	3.34

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected, bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level.

No significant effects were found for ultra high-risk subjects > healthy controls.

Follow-up activity > baseline activity									
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value				
Ventral part of head of caudate nucleus*	0.0043ª	/†	-6/10/-2	L	4.09				
Ventral part of head of caudate nucleus	0.0911 ^b	251	-6/10/-2	L	4.09				
Cerebellum	0.8115 ^b	39	-4/-36/-46	L	3.84				
Thalamus	0.026b	2024	22/-18/12	R	3.79				
Ventral striatum	0.020	3031	14/0/8	R	3.49				
Inferior temporal gyrus	0.8833 ^b	27	-40/-16/-22	L	3.60				
Occipital gyrus	0.7544 ^b	48	26/-68/-4	R	3.58				
Anterior cingulate cortex	0.6655 ^b	62	-18/34/14	L	3.57				
Ventral striatum	0.8543 ^b	32	-14/-2/6	L	3.56				
Inferior frontal gyrus	0.3252 ^b	131	46/6/14	R	3.55				
Cerebellum	0.8239 ^b	37	2/-60/-6	R	3.53				
Superior temporal gyrus	0.9104 ^b	37	40/-40/16	R	3.52				
Lingual gyrus	0.8661 ^b	30	-20/-50/2	L	3.44				
Insula	0.8115 ^b	39	28/34/8	R	3.31				

Supplementary Table 2. Time effect across both groups during adaptive reward prediction.

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected, bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant effects were found for baseline > follow-up.

Healthy controls > Ultra high-risk subjects								
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value			
Ventral striatum*	0.025 ^a	/†	-16/6/-8	L	3.54			
Parahippocampal gyrus			-14/-36/-8	L	4.14			
Cerebellum	<0.0001 ^b	831†	2/-58/-10	L	3.89			
Midbrain			-8/-30/-8	L	3.88			
Middle temporal gyrus	0.042 ^b	325†	-46/-64/0	L	4.03			
Superior temporal gyrus	0.8311 ^b	36	-46/14/-14	L	3.90			
Precentral gyrus	0.3664 ^b	119	-48/-6/40	L	3.76			
Insula	0.0735 ^b	269	44/6/-2	R	3.64			
Ventral striatum	0.7222 ^b	53	-16/6/-8	L	3.54			
Middle cingulate cortex	0.6773 ^b	60	-6/-12/40	L	3.52			
Precentral gyrus	0.8556 ^b	32	46/-8/44	R	3.50			
Supplementary Motor Cortex	0.2877h	1.4.1	4/6/46	R	3.49			
Middle cingulate cortex	0.2877	141	10/10/40	R	3.44			
Precentral gyrus	0.7868 ^b	43	54/-2/36	R	3.48			
Ventral striatum	0.8904 ^b	26	26/-10/8	R	3.46			
Insula	0.5791 ^b	76	-40/0/10	L	3.45			
Calcarine sulcus	0.9122b	20	-12/-80/6	L	3.41			
Lingual gyrus	0.8123	59	-6/-74/4	L	3.16			
Ventral striatum	0.7416 ^b	50	-30/-10/-8	L	3.31			

Supplementary Table 3. Group effect during adaptive reward prediction at baseline.

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected, bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant effects were found for ultra high-risk subjects > healthy controls.

Healthy controls > Ultra high-risk subjects									
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value				
Ventral striatum*	0.021ª	/†	10/18/-2	R	3.60				
Ventral striatum*	0.044ª	/†	-4/14/0	L	3.33				
Anterior cingulate cortex	0.0617b	202	-16/32/16	L	3.93				
Inferior frontal gyrus	0.0017*	293	-32/20/18	L	3.76				
Cerebellum	0.2488 ^b	157	-47/-52/-40	L	3.89				
Ventral striatum	0.7477 ^b	49	10/18/-2	R	3.60				
Middle cingulate cortex	0.8531 ^b	32	-18/-40/34	L	3.43				
Thalamus	0.3540 ^b	124	-4/-12/12	L	3.40				
Ventral striatum	0.7856 ^b	43	-4/14/0	L	3.33				
Insula	0.9141 ^b	21	-26/-26/30	L	3.30				
Cerebellum	0.8351 ^b	35	38/-48/-38	R	3.29				
Occipital gyrus	0.9141 ^b	21	20/-94/10	R	3.26				
Occipital gyrus	0.8763 ^b	28	-20/-86/14	L	3.24				
Insula	0.9192 ^b	20	30/-24/28	R	3.21				

Supplementary Table 4. Group effect during adaptive reward prediction at follow-up.

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected. bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the voxel level. No significant effects were found for ultra high-risk subjects > healthy controls.

Supplementary Table 5. Negative correlation between longitudinal changes in activation during adaptive reward prediction and change in the severity of abnormal beliefs in ultra high-risk subjects.

Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value
Ventral striatum*	0.0171 ^a	/†	18/6/-6	R	3.73
Precentral gyrus	0.6126 ^b	69	20/-20/64	R	3.79
Ventral striatum	0.2033 ^b	160	18/6/-6	R	3.73
Supplementary Motor Cortex			0/-16/58	R/L	3.65
Supplementary Motor Cortex	0.026 ^b	340†	-10/-4/70	L	3.52
Supplementary Motor Cortex			4/-6/64	R	3.52

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. ^apeak-level FWE-corrected. ^bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant positive correlations were found.

Supplementary Figure 1. Significant correlations in ultra high-risk subjects between explicit adaptive salience responses (visual analogue scale, VAS) and (**A**) unusual thought content (r=-0.674, p<0.001), (**B**) CAARMS positive symptoms (r=-0.653, p<0.001) and (**C**) global functioning (GAF) (r=0.497, p=0.014) at follow-up.

A)

B)



Explicit adaptive salience at follow-up



C)

2. Results in healthy controls (n=13) and subjects at ultra high-risk for psychosis who did not transit to psychosis (n=22).

A. Behavioural data

Aberrant attribution of salience

Across both visits, UHR subjects showed significantly higher implicit aberrant salience than HCs subjects (F(1,33)=6.443, p=0.016), and there was a trend for a group x time interaction (F(1,33)=3.076, p=0.089). There was also a trend for a group x time interaction for explicit aberrant salience (F(1,33)=3.437, p=0.073). Based on our *a priori* hypotheses we constructed linear contrasts at each time point to test for the predicted group differences in aberrant salience.

At baseline, UHR subjects were more likely than HCs to attribute salience to irrelevant cue features (explicit aberrant salience) (F(1,33)=5.117, p=0.030), but did not exhibit greater implicit aberrant salience than HCs (F(1,33)=0.879, p=0.335). At follow-up the group difference in explicit aberrant salience was no longer significant (F(1,33)=0.073, p=0.789), but HCs had significantly lower implicit aberrant scores than the UHR group (F(1,33)=11.972, p=0.002) due to a reduction in this measure over time.

Adaptive attribution of salience

Across both visits, the UHR group had lower implicit adaptive salience scores than HCs (F(1,33)=11.603, p=0.002), as well as lower explicit adaptive salience scores (F(1,33)=5.763, p=0.02). There was also a strong trend for a group x time interaction for explicit adaptive salience (F(1,33)=4.086, p=0.051).

At baseline, UHR subjects had significantly lower implicit adaptive salience than HCs (F(1,33)=14.562, p=0.001) and also exhibited significantly lower explicit adaptive salience (F(1,33)=9.391, p=0.004). Both of these group differences were no longer significant at follow-up

(implicit adaptive salience: F(1,33)=3.642, p=0.065; explicit adaptive salience: F(1,33)=1.446, p=0.238), due to improved scores in the UHR group together with relatively stable performance in HCs.

B. Activation during salience processing

Supplementary Table 6. Group effect across both visits during adaptive reward prediction.

Healthy controls > Ultra high-risk subjects without transition (n=22)								
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value			
Ventral striatum*	0.025 ^a	/†	12/2/8	R	3.54			
Ventral striatum*	0.008 ^a	/†	-8/8/4	L	3.90			
Midbrain	0.024 ^b	401†	-6/-24/-10	L	4.25			
Midbrain	-		10/-24/-12	R	3.81			
Calcarine sulcus	0.118 ^b	231	12/-74/14	R	4.05			
Calcarine sulcus	-		22/-70/6	R	3.31			
Superior temporal gyrus	0.619 ^b	70	-46/12/-16	L	4.02			
Insula	0.514 ^b	89	-38/-4/12	L	3.97			
Ventral striatum	0.393 ^b	115	-8/8/4	L	3.90			
Cuneus	0.175 ^b	192	-14/-74/24	L	3.87			
Occipital gyrus	-		-26/-76/20	L	3.55			
Precentral gyrus	0.253 ^b	157	-50/2/36	L	3.80			
			-44/-4/36	L	3.59			
			-46/-6/50	L	3.25			
Insula	0.253 ^b	157	44/8/8	R	3.80			
Inferior frontal gyrus	-		52/10/2	R	3.60			
Superior patietal gyrus	0.440 ^b	104	-14/-70/44	L	3.79			
Postcentral gyrus	0.354 ^b	125	-20/-34/54	L	3.79			
Middle temporal gyrus	0.070 ^b	284	-52/-58/-2	L	3.70			
Calcarine sulcus	0.272 ^b	150	-8/-78/6	L	3.69			

Middle cingulate cortex	0.205 ^b	177	6/6/44	R	3.68
Cuneus	0.350 ^b	126	18/-96/8	R	3.60
Occipital gyrus			26/-86/6	R	3.50
Calcarine sulcus	-		16/-100/0	R	3.47
Supramarginal gyrus	0.846 ^b	33	54/-36/34	R	3.55
Ventral striatum	0.573 ^b	78	12/2/8	R	3.54
Inferior parietal gyrus	0.908 ^b	22	-30/-44/36	L	3.47
Thalamus	0.840 ^b	34	12/-14/8	R	3.46
Supplementary Motor Cortex	0.785 ^b	43	2/-16/52	R	3.45
Middle cingulate cortex	0.760 ^b	47	-6/-10/40	L	3.41
Middle cingulate cortex			-10/-20/40	L	3.25
Ventral striatum	0.846 ^b	33	12/4/-10	R	3.41
Insula	0.816 ^b	38	-30/-22/10	L	3.41
Supplementary Motor Cortex	0.918 ^b	20	18/-22/52	R	3.37
Ventral striatum	0.840 ^b	34	-14/8/-8	L	3.34
Thalamus	0.912 ^b	21	-4/-20/12	L	3.34
Precentral gyrus	0.816 ^b	38	50/-4/44	R	3.33
Inferior frontal gyrus			56/8/26	R	3.31
Cuneus	0.869 ^b	29	-2/-86/20	L	3.32

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected, bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant effects were found for ultra high-risk subjects > healthy controls. **Supplementary Table 7.** Time effect across both groups (healthy controls + ultra high-risk subjects without transition) during adaptive reward prediction.

Follow-up activity > baseline activity								
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value			
Ventral part of head of caudate nucleus*	0.006 ^a	/†	-4/16/-6	L	3.99			
Ventral part of head of caudate nucleus	0.037 ^a	/†	19/12/-2	R	3.41			
Ventral striatum			-4/-16/-6	L	3.99			
Ventral striatum	0.125 ^b	209	-18/24/-8	L	3.55			
Ventral striatum			-8/12/-12	L	3.43			
Inferior frontal gyrus	0.132 ^b	211	46/6/14	R	3.85			
Insula			38/-16/28	R	3.75			
Thalamus		513†	22/-18/12	R	3.85			
Thalamus	0.0074 ^b		18/-8/10	R	3.69			
Ventral striatum			14/0/8	R	3.62			
Insula	0.411h	100	28/34/8	R	3.72			
Inferior frontal gyrus	0.411	108	38/18/10	R	3.19			
Lingual gyrus	0.626 ^b	68	2/-62/-6	R	3.71			
Occipital gyrus	0.683 ^b	59	26/-68/-4	R	3.65			
Cerebellum	0.868 ^b	30	-4/-36/-46	L	3.64			
Middle frontal gyrus	0.578	76	-24/34/12	L	3.59			
Inferior temporal gyrus	0.902	24	-40/-14/-24	L	3.59			
Superior temporal gyrus	0.908 ^b	23	40/-40/16	R	3.59			
Amygdala	0.923 ^b	20	-16/-6/-10	L	3.53			
Lingual gyrus	0.923 ^b	20	-20/-50/2	L	3.45			

Occipital gyrus			-34/-66/2	L	3.27
Ventral striatum	0.908 ^b	23	-14/-2/6	L	3.42
Ventral striatum	0 880p	28	30/12/6	R	3.24
	0.000*		24/18/6	R	3.15

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected, bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant effects were found for baseline > follow-up.

Healthy controls > Ultra high-risk subjects without conversion (n=22)								
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value			
Ventral striatum*	0.009ª	/†	-16/6/-10	L	3.87			
Ventral striatum*	0.042ª	/†	14/2/8	R	3.37			
Precentral gyrus			-50/0/38	L	4.37			
Precentral gyrus	0.069 ^b	268	-42/-10/44	L	3.41			
Postcentral gyrus			-44/-20/46	L	3.29			
Parahippocampal gyrus			-12/-36/-8	L	4.32			
Cerebellum	<0.0001 ^b	1117†	0/-40/-12	L	4.16			
Midbrain			8/-30/-10	R	3.83			
Superior temporal gyrus		428†	-46/14/-14	L	4.25			
Ventral striatum	0.014 ^b		-16/6/-10	L	3.87			
Ventral striatum			-24/-2/-10	L	3.81			
Insula	0.106	228	-38/-2/12	L	4.17			
Inferior frontal gyrus	0.100	220	-52/6/10	L	3.50			
Middle temporal gyrus			-46/-64/0	L	4.08			
Middle temporal gyrus	0.052 ^b	295	-44/-44/-2	L	3.37			
Middle temporal gyrus			-50/-50/-4	L	3.24			
Precentral gyrus			46/-8/44	R	4.00			
Precentral gyrus	0.243 ^b	153	54/2/36	R	3.62			
Precentral gyrus			56/8/30	R	3.51			

Supplementary Table 8. Group effect during adaptive reward prediction at baseline.

Middle cingulate cortex	0.036 ^b	332†	8/10/40	R	3.82
Ventral striatum			26/-10/8	R	3.82
Ventral striatum	0.473 ^b	94	22/-2/8	R	3.52
Ventral striatum			12/4/6	R	3.32
Middle cingulate cortex	0.270 ^b	144	-6/-12/40	L	3.74
Insula			44/6/-2	R	3.62
Insula	0.048 ^b	304†	42/8/6	R	3.61
Inferior frontal gyrus			56/6/8	R	3.55
Precentral gyrus	0.893 ^b	26	-22/-28/52	L	3.43
Calcarine sulcus	0.876 ^b	29	-12/-80/6	L	3.38
Insula	0.910 ^b	23	-32/-22/10	L	3.34

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected, bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant effects were found for ultra high-risk subjects > healthy controls.

Healthy controls > Ultra high-risk subjects without conversion (n=22)									
Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value				
Ventral striatum*	0.025 ^a	/†	10/18/-2	R	3.53				
Ventral striatum*	0.046ª	/†	-6/14/0	L	3.31				
Anterior cingulate cortex	0.089 ^b	255	-16/32/16	L	3.86				
Inferior frontal gyrus			-32/20/18	L	3.72				
Ventral striatum			-20/14/20	L	3.42				
Cerebellum	0.264 ^b	151	-46/-52/-40	L	3.82				
Ventral striatum	0.811 ^b	39	10/18/-2	R	3.53				
Middle cingulate cortex	0.914 ^b	21	-18/-40/34	L	3.38				
Thalamus	0.446 ^b	102	-4/-12/12	L	3.35				
Thalamus			-12/-4/10	L	3.32				
Ventral striatum	0.754 ^b	48	-6/14/0	L	3.31				
Insula	0.920 ^b	20	-26/-26/30	L	3.31				
Cerebellum	0.899 ^b	24	38/-48/-38	R	3.24				

Supplementary Table 9. Group effect during adaptive reward prediction at follow-up.

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. apeak-level FWE-corrected. bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the voxel level. No significant effects were found for ultra high-risk subjects > healthy controls.

Supplementary Table 10. Negative correlation between longitudinal changes in activation during adaptive reward prediction and change in the severity of abnormal beliefs in ultra high-risk subjects who did not convert (n=22).

Region	P value	Cluster size	MNI co-ordinates (X/Y/Z)	R/L	Z value
Ventral striatum*	0.021ª	/†	18/6/-6	R	3.67
Supplementary Motor Cortex	0.001 ^b	671†	4/-6/62	R	4.18
Supplementary Motor Cortex			-8/-6/70	L	4.13
Supplementary Motor Cortex			-2/-14/58	L	3.41
Ventral striatum	- 0.174 ^b	171	32/0/2	R	3.75
Ventral striatum			18/6/-6	R	3.67
Ventral striatum	- 0.745 ^b	50	-30/-20/0	L	3.30
Ventral striatum			-26/-8/-4	L	3.18

Results are reported using a cluster-forming threshold p<0.001 uncorrected, with an extent threshold of 20 voxels. *Small volume corrected. ^apeak-level FWE-corrected. ^bcluster-level FWE-corrected. † survives FWE correction for multiple comparisons at the cluster or voxel level. No significant positive correlations were found.