Supplementary Materials. Holt et al. 2009. Schizophrenia Bulletin

Supplementary Table 1: Example stimuli.

Table S1. Example Stimuli.

First sentence	Second sentence (without the critical word)	Neutral critical word	Positive critical word	Negative critical word
Nancy’s son ended up just like his father.	He was already a ____ by age 25.	husband	millionaire	criminal
Stephen owned a lot of nineteenth century art.	Everyone knew that he ____ paintings of old masters.	bought	loved	forged
An unfamiliar man rang Lenora's doorbell one day.	He had come to _____ her.	register	congratulate	arrest
Mr. Jenners planned to move his family to New York.	The reason for this was _____ to the children.	obvious	reassuring	hidden
Cheryl's baby cried when she took him to bed.	She quieted him with a ____ that night.	pacifier	lullaby	drug

Two-sentence descriptions of social situations for each of three experimental conditions (neutral, positive and negative), were constructed. For each pair of sentences, the first sentence was neutral and ambiguous in content. The emotional meaning of the sentence-pair was conferred by a positively-valenced, negatively-valenced or neutral word (the critical word) in the second sentence. Thus, other than one valence-associated or neutral word in the second sentence, the three conditions were identical in word content. The critical words of each condition were matched with respect to mean number of letters, frequency, and abstractness, but differed according to their affective valence and arousal. Norming studies in participants who did not participate in the fMRI study confirmed that the three conditions systematically differed according to their emotional valence (ratings on a 1-7 Likert scale: positive sentence pairs: mean valence rating > 5; negative sentence pairs: mean valence rating < 3; neutral sentence pairs: mean valence rating >3 and < 5) [1].

Supplementary Table 2: Within-group results.

A. Negative vs. Neutral

Control:

Negative > Neutral:

Region	BA	Area*	Tal (x, y, z)	P-value	Z score
L medial frontal gyrus/ superior frontal gyrus	10/9	334	-12, 56, -6	8×10^{-5}	3.93
L posterior cingulate gyrus	23	405	-3, -57, 28	0.001	3.28
R posterior cingulate gyrus/ precuneus/parietal sulcus	31/7	1061	21, -37, 43	0.002	3.04
R middle cingulate gyrus	24	306	6, -17, 37	0.004	2.91
L inferior parietal gyrus	40	522	-61, -24, 23	0.002	3.08
R superior parietal gyrus	6	338	39,-49, 56	0.02	2.32
R amygdala		256	28, -9, -12	0.02	2.01

Neutral > Negative:

Region	BA	Area*	Tal (x, y, z)	P-value	Z score
R anterior cingulate gyrus/superior frontal gyrus	32/8	673	7, 21, 44	0.0001	-3.87
R middle frontal gyrus/ inferior frontal sulcus	9/46	697	31, 33, 22	0.002	-3.05
R anterior insula		304	28, 25, -2	4×10^{-6}	-4.63

Schizophrenia:

Negative > Neutral:

Region	BA	Area*	Tal (x, y, z)	P-value	Z Score
L superior frontal gyrus[a]	9	168	-7, 49, 24	0.03	2.17
L superior temporal cortex	22	341	-51, -46, 18	0.02	2.31
L amygdala		320	-20, -9, -10	0.01	2.30
R amygdala**		384	24, -9, -11	0.02	1.99

Neutral > Negative:

Region	BA	Area*	Tal (x, y, z)	P-value	Z Score
L posterior cingulate cortex	23	341	-51, -46, 18	0.02	-2.31
R posterior cingulate gyrus	23	551	2, -37, 23	0.0006	-3.44
R parieto-occipital sulcus	19	347	18, -75, 27	0.007	-2.70

B. Positive vs. Neutral

Control:

Positive > Neutral:

Region	BA	Area*	Tal (x, y, z)	P-Value	Z Score
R medial frontal gyrus/anterior cingulate gyrus[a]	10/32	285	10, 55,-11	0.024	1.97
L posterior cingulate gyrus[a]	23/31	166	-7, -24, 39	0.006	2.73
R posterior cingulate cortex/precuneus[a]	31/7	268	9, -43, 54	0.005	2.81
R inferior parietal gyrus	40	303	-59, -23, 27	0.003	2.96
L occipital pole/middle occipital gyrus	18	618	-25, -103, -2	0.003	3.01
R amygdala		704	25, -9, -11	0.023	2.00
R hippocampus		256	21, -14, -12	0.038	1.77

Neutral > Positive:

Region	BA	Area*	Tal (x, y, z)	P-Value	Z score
R anterior cingulate gyrus/ superior frontal gyrus	32/8	364	9, 22, 39	0.021	-2.33
L inferior frontal gyrus	45	363	-30, 19, 0	0.0003	-3.64
L inferior frontal gyrus/ middle frontal gyrus	45/9	409	-53, 23, 2	0.013	-2.48
R inferior frontal gyrus	45	938	53, 30, 10	0.001	-3.20
R anterior insula		558	28, 23, -3	1×10^{-6}	-4.89

Schizophrenia:

Positive > Neutral:

Region	BA	Area*	Tal (x, y, z)	P-Value	Z score
L amygdala		576	-20, -8, -12	0.005	2.56

Neutral > Positive:

Region	BA	Area*	Tal (x, y, z)	P-value	Z Score
L anterior cingulate gyrus[a]	24/32	180	-12, 19, 31	0.004	-2.89
L anterior cingulate gyrus/superior frontal gyrus	32/6	329	-3, 12, 53	0.004	-2.91
R anterior cingulate gyrus/superior frontal gyrus	32/8	779	11, 35, 29	0.0005	-3.51
R anterior cingulate gyrus[a]	24	212	5, 6, 28	0.0005	-3.48
L anterior cingulate cortex/orbital cortex	32/10/11	313	-12, 44, -11	0.025	-2.24
R anterior cingulate cortex/orbital cortex	32/10/11	636	11, 39, -9	0.023	-2.28
R medial frontal gyrus/orbital cortex[a]	10/11	285	19, 48, -11	0.011	-2.52
R posterior cingulate gyrus	23	380	6, -26, 29	0.0002	-3.69
L inferior frontal gyrus	45	543	-49, 38, 8	0.0002	-3.74
L inferior frontal sulcus	45	1008	-45, 20, 10	0.016	-2.41
R inferior frontal gyrus	45	875	43, 29, 17	0.003	-2.95
R middle frontal cortex	46	908	28, 45, 10	0.003	-2.99
L inferior precentral sulcus	4	1051	-41, 2, 28	0.027	-2.22
R precentral cortex	6	662	40, 5, 18	0.0001	-3.81

C. Negative vs. Positive

Control:

Negative > Positive:

Region	BA	Area*	Tal (x, y, z)	P-value	Z Score
L posterior cingulate gyrus/precuneus/ subparietal sulcus	31/7	395	-13, -53 31	0.004	2.86
L middle temporal gyrus	21	348	-64, -37, 6	0.002	3.18
R middle temporal gyrus/ superior temporal sulcus	21	428	57, -33, 1	$8x\ 10^{-6}$	4.48
R hippocampus		192	21, -14, -12	0.038	1.77

Positive > Negative:

Region	BA	Area*	Tal (x, y, z)	P-value	Z Score
R anterior cingulate gyrus[a]	24/32	196	2, 31, -3	0.05	-1.93
R medial frontal gyrus[a]	10	162	9, 58, -6	0.001	-3.22

Schizophrenia:

Negative > Positive:

Region	BA	Area*	Tal (x, y, z)	P-value	Z Score
L anterior cingulate gyrus[a]	24/32	152	-4, 22, 28	0.017	2.40
R anterior cingulate gyrus[a]	24	181	7, 15, 23	0.035	2.11
L anterior cingulate cortex/ orbital cortex	32/24/1 1	609	-9, 27, -11	0.002	3.13
R anterior cingulate cortex/ orbital cortex	32/25/1 1	481	15, 26, -15	0.006	2.75
L posterior cingulate gyrus/ precuneus/subparietal sulcus[a]	31/7	182	-5, -55, 40	0.008	2.67
R posterior cingulate gyrus[a]	31	100	13, -28, 42	0.0008	3.34
L superior frontal gyrus	9	921	-5, 47, 22	0.001	3.20
L superior frontal gyrus	8	608	-7, 29, 52	0.004	2.92
R superior frontal gyrus/ middle frontal sulcus	9	390	23, 52, 21	0.006	2.73
L orbital cortex/ inferior frontal gyrus	47	720	-32, 19, -14	0.0009	3.33
R inferior frontal cortex	45	703	44, 30, 17	0.004	2.86
R middle temporal sulcus/ superior temporal sulcus	21	471	50, -24, -5	0.003	3.02
L inferior parietal gyrus/ superior temporal sulcus	22/40	313	-47, -47, 25	0.009	2.63

Table S2. Within-group results. Location and size of clusters which showed significant activation in th healthy controls (n=18) and schizophrenia patients (n=14) for the Negative vs. Neutral (A), Positive vs. Neutral (B) and Negative vs. Positive (C) contrasts, with Talairach (Tal) coordinates, p and z score for the local p minimum for each cluster. *mm^2 for clusters on the cortical surface, mm^3 for clusters within t amygdala and hippocampus. All clusters reported above met a significance threshold of $p<.05$ correcte except those labeled with an [a], which are smaller activations found with the *a priori* regions of interest (see Methods). BA = Brodmann area; L= left; R= right. Cortex = gyrus + sulcus. Anterior cingulate corte = anterior cingulate gyrus, pericallosal sulcus or subcallosal gyrus; orbital cortex = orbital gyrus, orbital sulcus, suborbital sulcus or rectus gyrus. **In an exploratory analysis, responses during the two TRs summed to calculate the peak response (10-12s and 12-14s following trial onset) were examined separately: the patients showed increased activation during the second TR to the negative vs. neutral contrast in the right dorsal amygdala (Tal coordinates of peak: 22, -9, -11; z = 3.08), and this cluster exhibited greater activation in the patients relative to the controls (21, -8, -10; z = 2.91).

Supplementary Behavioral Results.

When we evaluated the relationship between response times to each condition and magnitude of responses to that condition within the foci that showed significant main effects of condition in each group (see Supplementary Table 2), we found positive correlations between activation magnitudes and reaction times (RTs) in both groups. The control subjects showed correlations between RTs and response to the negative (Rhos= .58-.68; ps =.04-.002) and positive (Rhos =.48-.55; ps=.04-.018) sentence-pairs in the left and right posterior cingulate gyri, but no such correlations to responses to the neutral sentence-pairs. The patients showed correlations between RTs and response to the negative (Rho= .57; p =.03), positive (Rhos =.74-.79; ps= .002-.008) and neutral (Rho =.60; p=.02) sentence-pairs in the left posterior cingulate gyrus; to the positive (Rhos=.64-.66; ps=.01-.009) and neutral (Rho =.60; p=.02) sentence-pairs in the left anterior cingulate/orbitofrontal cortices; and to the positive sentence-pairs in the right anterior cingulate /orbitofrontal cortices (Rho=.60; p=.02) and right mid cingulate cortex (Rho=.58; p=.03). Thus, in sum, both groups showed longer RTs with more activation (less deactivation) of the posterior cingulate gyri (left and right for the controls, left only for the patients) in response to the positive and negative sentence-pairs. The patients also showed this effect to the neutral sentence-pairs in the left posterior cingulate gyrus, and to the positive and neutral sentence-pairs in anterior portions of the cingulate gyrus.

In contrast, there were no significant correlations between activation magnitudes and percentage of responses that corresponded to the *a priori* ratings in either group.

Therefore, within a particular condition, less deactivation of midline cortical regions was associated with longer RTs. This pattern could reflect greater engagement of default network regions in association with increasing emotional load, or could be similar to the reductions in task-induced deactivation in default network regions, and elevations in RTs, that have been associated with the commission of errors[2], lapses in attention[3], and mind-wandering[4] during cognitive tasks. Follow-up studies which parametrically vary emotional load and task difficulty will shed further light on the relative influences of these factors on default network function.

References

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