Supplementary Table 1. Performance (mean ± 1 standard deviation) in the visual short-term memory (VSTM) and visual perceptual control (VPC) tasks as a function of set size (SS 1-4, 6, 8), drug (placebo, donepezil), and state (RW: rested wakefulness, SD: sleep deprivation). Accuracy and K were computed on the basis of all trials.

		Placebo		**Donepezil**	
		RW	**SD**	**RW**	**SD**
VSTM:	SS1	.87 ± .16	.59 ± .29	.87 ± .15	.65 ± .24
K	SS2	1.79 ± .27	1.24 ± .57	1.71 ± .27	1.33 ± .47
	SS3	2.32 ± .45	1.64 ± .85	2.48 ± .39	1.79 ± .79
	SS4	2.76 ± .71	1.95 ± 1.09	2.76 ± .96	1.95 ± .86
	SS6	2.92 ± 1.11	1.77 ± 1.90	3.24 ± 1.14	2.40 ± 1.71
	SS8	2.86 ± 1.67	1.59 ± 2.19	2.88 ± 1.65	1.95 ± 1.80
VSTM:	SS1	.94 ± .08	.80 ± .14	.93 ± .08	.82 ± .12
Accuracy	SS2	.95 ± .07	.81 ± .14	.93 ± .07	.83 ± .12
	SS3	.89 ± .08	.77 ± .14	.91 ± .06	.80 ± .13
	SS4	.85 ± .09	.74 ± .14	.84 ± .12	.74 ± .11
	SS6	.74 ± .09	.65 ± .16	.77 ± .09	.70 ± .14
	SS8	.68 ± .10	.60 ± .14	.68 ± .10	.62 ± .11
VSTM:	SS1	671 ± 187	770 ± 152	720 ± 167	747 ± 148
RT (ms)	SS2	706 ± 159	801 ± 149	733 ± 163	818 ± 171
	SS3	748 ± 134	834 ± 138	788 ± 193	825 ± 126
	SS4	796 ± 172	887 ± 192	832 ± 183	851 ± 122
	SS6	836 ± 188	964 ± 204	900 ± 217	939 ± 176
	SS8	863 ± 192	960 ± 176	923 ± 190	970 ± 176
VPC:	SS1	.88 ± .10	.75 ± .16	.88 ± .11	.76 ± .15
Accuracy	SS2	.91 ± .08	.78 ± .15	.91 ± .09	.79 ± .13
	SS3	.88 ± .12	.80 ± .14	.91 ± .10	.78 ± .14
	SS4	.92 ± .10	.80 ± .15	.93 ± .07	.80 ± .15
	SS6	.91 ± .11	.81 ± .13	.91 ± .09	.80 ± .14
	SS8	.90 ± .10	.84 ± .11	.90 ± .10	.80 ± .15
VPC	SS1	733 ± 179	811 ± 137	722 ± 140	794 ± 156
RT (ms)	SS2	725 ± 164	788 ± 131	724 ± 151	772 ± 146
	SS3	707 ± 156	782 ± 129	710 ± 144	767 ± 155

SS4	700 ± 166	769 ± 126	710 ± 144	762 ± 148
SS6	693 ± 164	772 ± 139	715 ± 149	752 ± 130
SS8	692 ± 154	751 ± 113	693 ± 135	741 ± 159

Supplementary Table 2. Performance accuracy (mean ± 1 standard deviation) in the visual short-term memory (VSTM) and visual perceptual control (VPC) tasks as a function of set size (SS 1-4, 6, 8), drug (placebo, donepezil), and state (RW: rested wakefulness, SD: sleep deprivation). Accuracy was computed on the basis of responded-to trials. For VSTM, there were significant effects of state, $F(1,27) = 14.54$, $p < .001$ and set size, $F(5,135) = 186.42$, $p < 0.001$. All other effects were not significant (smallest $p = 0.28$). For the VPC task, there was a significant effect of state, $F(1,27) = 12.36$, $p = 0.002$. The effects of drug ($p = 0.66$) and set size ($p = 0.10$) were not significant. There was an interaction of drug by state, $F(1,27) = 6.37$, $p = 0.02$, and an interaction of state by set size, $F(5,135) = 2.55$, $p = 0.03$.

		Placebo		**Donepezil**	
		RW	**SD**	**RW**	**SD**
VSTM:	SS1	.96 ± .05	.94 ± .07	.96 ± .05	.92 ± .07
	SS2	.97 ± .04	.92 ± .07	.95 ± .05	.91 ± .07
	SS3	.91 ± .06	.89 ± .07	.93 ± .05	.88 ± .09
	SS4	.87 ± .08	.84 ± .07	.87 ± .10	.85 ± .09
	SS6	.76 ± .08	.74 ± .12	.79 ± .09	.76 ± .12
	SS8	.70 ± .11	.69 ± .09	.69 ± .09	.68 ± .10
VPC:	SS1	.93 ± .07	.90 ± .08	.94 ± .07	.92 ± .09
	SS2	.96 ± .05	.92 ± .09	.96 ± .05	.92 ± .08
	SS3	.93 ± .08	.95 ± .06	.95 ± .05	.92 ± .07
	SS4	.96 ± .07	.94 ± .08	.97 ± .07	.92 ± .12
	SS6	.95 ± .06	.94 ± .08	.95 ± .06	.91 ± .10
	SS8	.94 ± .07	.95 ± .05	.95 ± .06	.91 ± .11

Supplementary Table 3. Mean number (± 1 standard deviation) of non-responses in both in-scanner tasks as a function of state, drug, and group (LV: Low Vulnerability; MV: Moderate Vulnerability; HV: High Vulnerability). There were a total of 384 trials within each scanning session. A state by drug by group ANOVA revealed a significant effect of state, $F(1,27) = 129.65$, $p < 0.001$, and interactions of state by group, $F(2,25) = 23.93$, $p < 0.001$, drug by group, $F(2,25) = 5.77$, $p = 0.009$, and state by drug by group, $F(2,25) = 7.29$, $p = 0.003$. A state by drug ANOVA was conducted for each group. There was a significant effect of state for all groups (largest $p = 0.01$ for LV). There was no effect of drug or a state by drug interaction for the LV and MV groups (smallest $p = 0.12$). For the HV group, there was a significant effect of drug, $F(1,8) = 7.97$, $p = 0.02$ and a state by drug interaction, $F(1,8) = 8.78$, $p = 0.02$. For this group, there was no effect of the drug at RW, $F(1,8) = .22$, $p = 0.65$ while the effect at SD was significant, $F(1,8) = 10.34$, $p = 0.01$.

	Placebo		**Donepezil**	
	RW	**SD**	**RW**	**SD**
All subjects	13.75 (17.16)	54.21 (42.48)	13.82 (18.18)	44.78 (33.96)
LV	11.22 (19.43)	19.56 (16.82)	9.67 (13.38)	34.67 (39.05)
MV	15.40 (14.34)	42.40 (13.76)	14.60 (18.95)	36.60 (26.57)
HV	14.44 (19.33)	102.00 (38.72)	17.11 (22.37)	64.00 (30.97)

Supplementary Table 4. Correlations between sleep-deprivation related changes (SDP-RWP) in performance accuracy in the visual short-term memory (VSTM), visual perceptual control (VPC), combined non-responses across both tasks, and number of lapses (RT > 500 ms) in the psychomotor vigilance task (PVT). All correlations were significant at $p < 0.01$.

	VSTM Accuracy	VPC Accuracy	VSTM + VPC Non-responses
VPC Accuracy	0.68	--	
VSTM + VPC Non-responses	-0.94	-0.82	--
PVT Lapses	-0.56	-0.55	0.65

Supplementary Table 5. Mean (± 1 standard deviation) Karolinska Sleepiness Scale ratings during the visual short-term memory (VSTM) and visual perceptual control (VPC) tasks as a function of state, drug and group (LV: Low Vulnerability; MV: Moderate Vulnerability; HV: High Vulnerability). For both tasks, there were significant effects of state ($p < 0.001$) but no significant effect of drug (smaller $p = 0.39$). There were no drug by state (smaller $p = 0.83$) or drug by state by group interactions (smaller $p = 0.15$).

		Placebo		Donepezil	
		RW	**SD**	**RW**	**SD**
VSTM	LV	5.07 ± 1.35	7.93 ± 1.39	4.62 ± 1.67	8.02 ± 0.98
	MV	4.68 ± 1.90	7.88 ± 0.95	5.00 ± 1.50	7.90 ± 1.37
	HV	4.60 ± 1.80	7.78 ± 0.82	4.66 ± 1.85	7.50 ± 1.63
	Total	4.78 ± 1.63	7.86 ± 1.04	4.77 ± 1.61	7.80 ± 1.33
VPC	LV	5.22 ± 1.49	7.80 ± 1.18	4.69 ± 1.74	7.96 ± 1.35
	MV	4.84 ± 2.06	7.88 ± 1.05	5.06 ± 1.34	7.70 ± 0.88
	HV	5.40 ± 2.13	7.87 ± 1.22	4.58 ± 1.68	7.76 ± 0.84
	Total	5.14 ± 1.86	7.85 ± 1.11	4.79 ± 1.54	7.80 ± 1.01

Supplementary Table 6. Regions whose activity showed significant effects of set size and state in the visual short-term memory task. No regions showed significant main effects of drug. All main effects were significant at $p < 0.05$ (corrected).

	Tal Coordinates			BA	
	x	y	z		
Effect of Set Size					**F(5,135)**
L Frontal Eye Fields	-30	-10	46	6	22.61
R Frontal Eye Fields	30	-10	49	6	14.76
L Inferior Frontal Gyrus	-39	5	31	44	19.20
R Pre-Supplementary Motor Area	3	11	46	6	39.20
L Insula	-30	17	7	13	22.61
R Insula	30	17	7	13	22.44
L Temporal Parietal Junction	-51	-61	13	39	10.61
R Temporal Parietal Junction	57	-52	13	39	18.95
L Post Intraparietal Sulcus (Superior Parietal)	-27	-64	43	7	37.96
R Post Intraparietal Sulcus (Superior Parietal)	24	-64	40	7	40.31
L Ant Intraparietal Sulcus (Inferior Parietal)	-60	40	40	40	15.18
R Ant Intraparietal Sulcus (Inferior Parietal)	51	-52	31	40	20.49
L Middle Occipital Gyrus	-30	-79	13	18	19.30
R Middle Occipital Gyrus	27	-79	13	18	18.06
L Inferior Occipital Gyrus	-21	-82	-14	19	12.83
R Inferior Occipital Gyrus	24	-76	-11	19	15.98
L Lingual Gyrus	-18	-97	1	17	13.08
R Lingual Gyrus	18	-88	1	17	18.32
Effect of State					**F(1,27)**
L Insula	-48	11	10	13	70.23
R Insula	39	5	7	13	68.10
R Middle Temporal Gyrus	36	-61	10	39	52.59
L Middle Temporal Gyrus	-45	-70	7	39	62.98
L Intraparietal Sulcus (Superior Parietal)	-24	-67	55	7	67.74
R Intraparietal Sulcus (Superior Parietal)	-18	-70	52	7	80.41
L Precuneus	-18	-79	37	19	58.44
R Precuneus	18	-76	37	19	54.22
L Fusiform Gyrus	-30	-55	-8	19	66.41
R Fusiform Gyrus	33	33	-46	-14	76.38
L Middle Occipital Gyrus	-30	-76	16	18	90.98

L Middle/Inferior Occipital Gyrus	-36	-82	-2	19	69.44
R Middle Occipital Gyrus	30	-82	4	19	78.26
R Middle Occipital Gyrus	27	-76	19	18	61.27
L Ventral Occipital Cortex	-42	-70	-8	19	75.57
R Ventral Occipital Cortex	30	-67	-14	19	65.15

Supplementary Table 7. Regions whose activity showed significant effects of set size and state in the visual perceptual control task. No region showed significant main effects of drug. All main effects were significant at $p < 0.05$ (corrected).

	Tal Coordinates			BA	
	x	y	z		
Effect of Set Size					**F(5,135)**
L Inferior Occipital Gyrus	-24	-79	-14	19	10.63
R Inferior Occipital Gyrus	24	-76	-8	19	14.39
L Middle Occipital Gyrus/Cuneus	-24	-91	7	18	15.56
R Middle Occipital Gyrus/Cuneus	27	-82	7	18	11.11
Effect of State					**F(1,27)**
L Cuneus	-21	-82	34	19	57.38
R Cuneus	21	-82	33	19	52.04
L Temporal Occipital Junction	-45	-70	-2	37	91.17
R Temporal Occipital Junction	39	-61	1	37	87.59
L Middle Occipital Gyrus	-24	-85	16	18	73.71
R Middle Occipital Gyrus	33	-82	10	18	90.43
L Ventral Occipital Cortex	-24	-61	-5	19	67.84
R Ventral Occipital Cortex	27	-73	-14	19	65.27
R Fusiform Gyrus	30	-43	-14	37	80.69