

SUPPLEMENTARY TABLES

Supplementary Table S1. Candidate genes, SNPs, SNP functions and predicted direction of association

Gene	SNP	Function	SIFT Prediction Using Orthologues, Homologues	Predicted Negatively Associated Allele (Previous Studies)
Language and Speech (N = 9)				
ATP2C2	rs2303853	Gly411Ser	Tolerated, Tolerated	NA
DCDC2	rs2274305	Ser221Gly	Tolerated, Tolerated	A allele (Ser). (A allele associated with dyslexia (Schumacher et al., 2006); No significant association with dyslexia (Cope et al., 2005, Zuo et al., 2012))
DYX1C1	rs600753	Glu191Gly	Tolerated, Tolerated	G allele (Gly). (G allele associated with dyslexia in females (Dahdouh et al., 2009))
KIAA0319	rs807534	Tyr424/968/1004/1013Cys	Tolerated, Tolerated	NA
KIAA0319	rs807541	Ala309/853/889/898Ala	Synonymous	NA
KIAA0319	rs4576240	Thr97/133/142/Pro	Tolerated, Tolerated	No negatively associated allele reported. (Unassociated with dyslexia (Francks et al., 2004, Cope et al., 2005); unassociated with orthographic coding, phonological decoding ability, single-word reading ability, spelling ability and phonemic awareness (Dennis et al., 2009))
NAGPA	rs887854	Asn495Asn	Synonymous	NA
ZNF804A	rs1366842	Thr707Lys	Tolerated, Tolerated	NA
ZNF804A	rs12477430	His747Arg	Tolerated, Tolerated	NA
Episodic Memory (N = 14)				
ADCY8	rs12545028	Arg523Arg	Synonymous	NA
BDNF	rs6265	Val66/74/81/95/148Met	Damaging, Damaging*	A allele (Met). (Negatively associated with declarative memory in meta-analysis (Kambeitz et al., 2012). Not associated with general cognitive ability, memory, executive functioning, visual tasks or cognitive fluency in meta-analysis (Mandelman and Grigorenko, 2012). Negatively associated with visual memory and positively associated with visio-spatial memory (Yogeetha et al., 2013). No association with performance on the Wisconsin Card Sorting Test or Trail Making Test in schizophrenia patients or healthy controls (Zhai et al., 2013))
CAMK2G	rs2675671	Lys49Lys	Synonymous	NA

CLSTN2	rs17348572	Ile331Thr	Tolerated, Tolerated	No negatively associated allele reported. (Not associated with performance on the Wisconsin Card Sorting Test (Zhang et al., 2009))
CLSTN2	rs7632885	Val366Ile	Tolerated, Tolerated	NA
CLSTN2	rs10804675	Val847Val	Synonymous	NA
COMT	rs4680	Val158Met	Damaging, Tolerated	A allele (Met) by SIFT only . (Negative association of the Val allele with cognitive processing, working memory and encoding in meta-analysis (Mier, D et al., 2010). Negative association of the Val allele on phonological awareness and spelling (Landi et al., 2013). Negative association of the Val allele in males and positive association in females on verbal fluency (Soeiro-Desouza et al., 2013))
GRIN2B	rs3026160	Cys838Cys	Synonymous	NA
HTR2A	rs6314	His368/452Tyr	Tolerated, Tolerated	T allele (Tyr). (Associated with long-term verbal memory, verbal delayed recall and recognition; not associated with immediate recall, attention or executive function (de Quervain et al., 2003, Wagner et al., 2008). Associated with working memory, attention, and inefficient prefrontal blood oxygen level-dependent functional MRI response during these tasks (Blasi et al. 2013). Not associated with the Moray House Test, Raven's Progressive Matrices, verbal fluency or logical memory in children or with cognitive ageing (Harris et al., 2007))
HTR2A	rs6313	Ser34Ser	Synonymous	C allele (Ser). (Associated with spatial working memory in males (Gong et al., 2011). Not associated with the Moray House Test, Raven's Progressive Matrices, verbal fluency or logical memory in children or with cognitive ageing (Harris et al., 2007))
WWC1 (KIBRA)	rs17551608	Arg250Cys	Damaging, Damaging	T allele (Cys) from SIFT results. No negatively associated allele reported.
WWC1 (KIBRA)	rs3822659	Ser735Ala	Tolerated, Tolerated	T allele (Ser). (Associated with word fluency (Duning et al., 2013))
WWC1 (KIBRA)	rs3733980	Val801Val	Synonymous	NA
WWC1 (KIBRA)	rs3203960	Leu1005/1011/Leu	Synonymous	NA
Verbal Fluency (N = 5)				
CACNA1C	rs1544514	Ala174Ala	Synonymous	NA
DISC1	rs2492367	Ile119/469/501Ile	Synonymous	NA
DISC1	rs6675281	Leu485/607/639Phe, Thr572Thr	Damaging, Damaging	T allele (Phe) from SIFT results. No negatively associated allele reported.

DISC1	rs12133766	Leu499/621/653/Leu, 3' UTR	Synonymous	NA
SLC6A3 (DAT)	rs6350	Asn38Asn	Synonymous	NA
Processing Speed (N = 11)				
ATRNL1	rs10885721	Thr1203Thr	Synonymous	NA
C20orf196	rs1699233	Gly107Gly	Synonymous	NA
CRTC3	rs8033595	Ser72Asn	Tolerated, Damaging	A allele (Asn) from SIFT results. No negatively associated allele reported.
DIP2C	rs3740304	Tyr1551Tyr	Synonymous	NA
DIP2C	rs2288681	Ala1274Ala	Synonymous	NA
NFKBIL1	rs2230365	Ser103/126/Ser	Synonymous	NA
PDE1C	rs3213709	Gly610/670/Gly	Synonymous	NA
PDE1C	rs2302450	Ala594/654Ala	Synonymous	NA
PDE1C	rs1860790	Asn591/651Asn	Synonymous	NA
PKNOX1	rs234781	Thr114Thr	Synonymous	NA
SPATA7	rs3179969	Val42/74Met	Tolerated, Tolerated	NA

Supplementary Table S2. Means and Standard Deviations for Number of Valid Words and LSA-Derived Phenotypes by Group and Sex

Phenotype	Control Males (N = 142)	Control Females (N = 165)	Proband Males (N = 159)	Proband Females (N = 35)	Sibling Males (N = 66)	Sibling Females (N = 98)
Number of Valid Words	22.28 (5.51)	21.72 (4.50)	15.82 (5.12)	17.51 (5.29)	22.11 (5.27)	20.47 (4.03)*
Average Vector Length	0.060 (0.014)	0.064 (0.011)**	0.067 (0.20)	0.067 (0.018)	0.060 (0.013)	0.065 (0.011)**
Overall Vector Length	0.50 (0.097)	0.52 (0.076)	0.43 (0.11)	0.47 (0.095)	0.50 (0.087)	0.50 (0.073)
Cosine to 'Animal'	0.14 (0.028)	0.14 (0.030)	0.14 (0.042)	0.15 (0.041)	0.14 (0.025)	0.15 (0.030)*
Average Cosine	0.094 (0.025)	0.098 (0.028)	0.10 (0.038)	0.11 (0.032)	0.097 (0.023)	0.10 (0.028)
Cohesion (Window-Size = 1)	0.19 (0.050)	0.18 (0.050)	0.18 (0.063)	0.18 (0.054)	0.19 (0.053)	0.19 (0.053)
Cohesion (Window-Size = 2)	0.12 (0.047)	0.12 (0.046)	0.12 (0.053)	0.12 (0.053)	0.13 (0.049)	0.12 (0.048)
Cohesion (Window-Size = 3)	0.10 (0.041)	0.10 (0.041)	0.10 (0.057)	0.10 (0.050)	0.11 (0.041)	0.10 (0.041)

**p*-value < 0.05

Supplementary Table S3. Correlations among LSA-derived variables and measures from the WMS and CVLT

	Number of valid words	Average cosine	Average vector length	Overall vector length	Cohesion (window size =1)	Cohesion (window size =2)	Cohesion (window size =3)	WMS Logical memory 1	WMS Logical memory 2	Difference in WMS Logical memory 1 and 2	CVLT 15 correct	CVLT long delay
Cosine to 'animal'	-0.12 (0.010)	0.70 (<2.2e-16)	-0.17 (0.00033)	-0.13 (0.00066)	0.17 (0.00049)	0.23 (8.06e-07)	0.39 (<2.2e-16)	-0.11 (0.020)	-0.12 (0.015)	0.030 (0.53)	0.0010 (0.98)	-0.015 (0.76)
Number of valid words		-0.20 (2.28e-05)	-0.33 (1.83e-12)	0.56 (<2.2e-16)	0.24 (4.47e-07)	0.13 (0.0063)	0.099 (0.038)	0.16 (0.00073)	0.19 (6.96e-05)	-0.10 (0.030)	0.069 (0.15)	-0.10 (0.031)
Average cosine			-0.043 (0.37)	0.0068 (0.89)	0.41 (<2.2e-16)	0.50 (<2.2e-16)	0.57 (<2.2e-16)	-0.089 (0.062)	-0.12 (0.014)	0.077 (0.11)	0.042 (0.38)	0.030 (0.53)
Average vector length				0.52 (<2.2e-16)	-0.090 (0.062)	-0.17 (0.00027)	-0.18 (0.00013)	-0.11 (0.018)	-0.10 (0.030)	-0.013 (0.78)	-0.059 (0.22)	0.061 (0.20)
Overall vector length					0.22 (2.46e-06)	0.079 (0.097)	0.067 (0.16)	0.038 (0.43)	0.062 (0.20)	-0.082 (0.086)	0.0066 (0.89)	-0.027 (0.58)
Cohesion (window size =1)						0.55 (<2.2e-16)	0.36 (5.77e-15)	0.011 (0.83)	-0.024 (0.61)	0.064 (0.18)	0.067 (0.16)	0.049 (0.31)
Cohesion (window size =2)							0.57 (<2.2e-16)	0.050 (0.30)	0.0092 (0.85)	0.087 (0.070)	0.094 (0.049)	0.0011 (0.98)
Cohesion (window size =3)								-0.034 (0.48)	-0.069 (0.15)	0.086 (0.070)	0.041 (0.39)	0.036 (0.45)

size =3)												
WMS Logical memory 1									0.91 (<2.2e-16)	0.10 (0.031)	0.21 (1.14e-05)	0.20 (1.73e-05)
WMS Logical memory 2										-0.30 (1.18e-10)	0.23 (6.66e-07)	0.20 (1.52e-05)
Differen ce between WMS Logical memory 1 and 2											-0.11 (0.027)	-0.042 (0.38)
CVLT 15 correct												0.25 (1.31e-07)

Values are r (*p*-value). Bolded values are significant after Bonferroni correction for the number of tests (N=66).

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