

Table S1: Correlations Between Laboratory and MRI Versions of the EF Tasks in Individuals Who Completed Both Versions

<u>Measure</u>	<u>N</u>	<u>r</u>	<u>p</u>
Antisaccade	161	0.67	<.001
Stroop	167	0.69	<.001
Number Letter	172	0.69	<.001
Category Switch	164	0.76	<.001
Keep Track	166	0.52	<.001
Letter Memory	171	0.88	<.001

Note: Total N=175.

Table S2: Cross-Sibling Cross-Trait Correlations for Latent Variables

<u>Variable</u>	<u>MZ</u>	<u>DZ</u>	<u>Bio Sibs</u>	<u>Adop Sibs</u>
<i>Cross-Sibling Within-Trait Correlations</i>				
Common EF	0.82	0.37	0.32	0.18
Updating-Specific	1.00*	0.44	0.07	0.00
Shifting-Specific	0.79	0.36	0.40	0.23
WAIS	0.85	0.53	0.43	0.11
<i>Cross-Sibling Cross-Trait Correlations with WAIS</i>				
Common EF	0.20	0.10	0.12	0.09
Updating-Specific	0.74	0.37	0.49	0.12
Shifting-Specific	0.20	0.10	0.14	0.10

Note: * indicates that the correlation within MZ twins was constrained to be 1.0 because it was estimated slightly above 1.0. MZ = Monozygotic twins; DZ = Dizygotic twins; Bio Sibs = Biological siblings; Adop Sibs = Adoptive siblings (not genetically related); EF = Executive function, WAIS = Weschler Adult Intelligence Scale.

Table S3: Cross-Twin Cross-Trait Correlations for All Study Measures in the Longitudinal Twin Study (LTS) Subsample

Measure	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>MZ Twins</i>															
1. S1 Antisaccade	179	12.69													
2. S1 Stroop	181	.21	78.46												
3. S1 Number Letter	178	.29	.24	146.90											
4. S1 Category Switch	178	.38	.39	.58	159.47										
5. S1 Keep Track	181	.40	.22	.23	.38	9.22									
6. S1 Letter Memory	181	.37	.30	.10	.21	.53	13.39								
7. S1 WAIS	177	.42	.30	.14	.33	.65	.59	11.03							
8. S2 Antisaccade	177	.55	.31	.29	.38	.27	.31	.28	13.46						
9. S2 Stroop	182	.21	.44	.21	.35	.38	.30	.27	.30	80.03					
10. S2 Number Letter	175	.22	.05	.54	.39	.22	.09	.14	.22	.25	140.63				
11. S2 Category Switch	181	.29	.24	.40	.59	.33	.23	.30	.36	.30	.54	151.13			
12. S2 Keep Track	180	.20	.21	.19	.25	.46	.49	.41	.34	.35	.17	.23	8.53		
13. S2 Letter Memory	182	.35	.25	.13	.30	.53	.68	.52	.37	.35	.17	.26	.46	14.32	
14. S2 WAIS	178	.40	.28	.19	.38	.62	.58	.83	.34	.36	.23	.29	.41	.61	11.28
<i>DZ Twins</i>															
1. S1 Antisaccade	157	13.98													
2. S1 Stroop	165	.30	72.34												
3. S1 Number Letter	161	.33	.20	152.89											
4. S1 Category Switch	165	.44	.23	.66	148.72										
5. S1 Keep Track	166	.44	.08	.12	.24	8.16									
6. S1 Letter Memory	165	.50	.29	.14	.25	.44	14.57								
7. S1 WAIS	161	.29	.21	.00	.18	.49	.42	11.11							
8. S2 Antisaccade	163	.19	.12	.07	.07	.13	.20	.02	13.22						
9. S2 Stroop	168	.07	.23	.01	.14	.04	.12	.10	.27	80.68					
10. S2 Number Letter	168	.10	.21	.28	.32	.03	.18	.00	.38	.33	164.16				
11. S2 Category Switch	168	.13	.20	.07	.13	.07	.10	.05	.35	.30	.44	143.23			
12. S2 Keep Track	169	.09	.04	-.04	-.08	.16	.11	.23	.31	.21	.04	.06	8.30		
13. S2 Letter Memory	169	.22	.13	.02	.07	.30	.29	.27	.45	.29	.09	.16	.56	13.99	
14. S2 WAIS	168	.12	.08	-.06	-.02	.25	.15	.49	.23	.18	-.06	.08	.58	.54	11.38

Note: Measures based on reaction times (Stroop, Number Letter, and Category Switch) were reverse scored so that higher numbers indicate better performance on all measures. Standard deviations of each measure are provided on the diagonal. S1 = Sibling #1; S2 = Sibling #2; MZ = Monozygotic (i.e., identical) twin pairs; DZ = Dizygotic twin (i.e., fraternal) pairs; WAIS= Weschler Adult Intelligence Scale.

Table S4: Cross-Sibling Cross-Trait Correlations for All Study Measures in the Colorado Adoption Project (CAP) Subsample

Measure	<i>N</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Biological Siblings</i>															
1. S1 Antisaccade	161	16.90													
2. S1 Stroop	161	.36	86.06												
3. S1 Number Letter	161	.25	.26	188.22											
4. S1 Category Switch	161	.30	.35	.52	185.69										
5. S1 Keep Track	159	.40	.30	.20	.14	13.13									
6. S1 Letter Memory	157	.51	.35	.12	.05	.44	14.32								
7. S1 WAIS	159	.36	.38	.15	.23	.60	.46	10.65							
8. S2 Antisaccade	121	.27	.28	-.13	-.06	.20	.07	.16	16.06						
9. S2 Stroop	122	.20	.13	.01	.10	.16	.16	.09	.39	80.00					
10. S2 Number Letter	121	.11	.29	.03	.14	.22	.00	.27	.39	.36	200.62				
11. S2 Category Switch	122	.00	.10	.12	.22	-.01	-.15	.12	.45	.34	.40	184.33			
12. S2 Keep Track	122	.28	.24	-.06	.01	.21	.01	.29	.30	.31	.11	.24	14.14		
13. S2 Letter Memory	122	.26	.30	-.05	.04	.22	.23	.16	.40	.57	.08	.10	.52	15.20	
14. S2 WAIS	121	.07	.17	.02	.01	.41	.11	.41	.31	.42	.10	.26	.63	.53	12.04
<i>Adopted Siblings</i>															
1. S1 Antisaccade	138	17.48													
2. S1 Stroop	140	.29	82.14												
3. S1 Number Letter	140	.12	.19	173.78											
4. S1 Category Switch	140	.31	.26	.34	187.12										
5. S1 Keep Track	139	.29	.22	.12	.23	13.01									
6. S1 Letter Memory	139	.35	.20	.07	.21	.55	15.17								
7. S1 WAIS	141	.35	.13	.01	.21	.61	.45	12.09							
8. S2 Antisaccade	103	.02	.08	.05	-.08	-.01	.22	-.06	15.73						
9. S2 Stroop	104	-.05	.06	.15	.20	.14	.01	.14	.28	79.85					
10. S2 Number Letter	102	.17	.28	.15	.05	-.04	-.04	.19	.21	.14	211.63				
11. S2 Category Switch	104	.05	.00	.03	.05	.03	-.10	.15	.29	.28	.45	199.05			
12. S2 Keep Track	104	.11	.00	.17	.20	.09	.16	.11	.32	.19	.06	.18	14.83		
13. S2 Letter Memory	99	.16	.24	.16	-.05	.00	.07	-.01	.25	.08	.23	.22	.53	15.10	
14. S2 WAIS	103	.05	.06	.02	-.04	.13	.22	.10	.38	.35	.05	.18	.64	.43	13.36

Note: Switch cost reaction times (RTs) were reverse scored prior to analyses so that higher numbers relate to better performance on all measures. Standard deviations of each measure are provided on the diagonal. S1 = Sibling #1; S2 = Sibling #2; WAIS= Weschler Adult Intelligence Scale.

Table S5: Estimates and 95% Confidence Intervals (95% CIs) from the Final Genetic Model (Figure 2)

Path or Variance Component	95% CI			Path or Variance Component	95% CI		
	Estimate	Lower	Upper		Estimate	Lower	Upper
<i>Factor Loadings - LTS</i>				<i>Correlations with WAIS</i>			
Antisaccade (Common EF)	0.73	0.67	0.78	A - Common EF	0.29	-0.75	0.81
Stroop (Common EF)	0.52	0.46	0.58	A - Updating-Specific	0.95	0.56	1.00
Keep Track (Common EF)	0.53	0.47	0.60	A - Shifting-Specific	-0.13	-0.76	0.67
Letter Memory (Common EF)	0.56	0.50	0.62	D - Common EF	0.98	-1.00	1.00
Category Switch (Common EF)	0.54	0.47	0.60	D - Updating-Specific	0.17	-1.00	1.00
Number Letter (Common EF)	0.41	0.33	0.48	D - Shifting-Specific	-0.13	-1.00	1.00
Keep Track (Updating-Specific)	0.55	0.48	0.61	H - Common EF	0.44	0.28	0.59
Letter Memory (Updating-Specific)	0.46	0.40	0.51	H - Updating-Specific	0.69	0.59	0.80
Category Switch (Shifting-Specific)	0.58	0.52	0.63	H - Shifting-Specific	-0.11	-0.33	0.12
Number Letter (Shifting-Specific)	0.59	0.53	0.64	C - Common EF	0.73	-1.00	1.00
<i>Factor Loadings - CAP</i>				C - Shifting-Specific	0.68	-0.78	1.00
Antisaccade (Common EF)	0.63	0.57	0.69	E - Common EF	0.60	0.33	0.94
Stroop (Common EF)	0.51	0.45	0.58	E - Shifting-Specific	-0.47	-0.19	0.05
Keep Track (Common EF)	0.40	0.35	0.46	<i>Residual Variances (% variance) - LTS</i>			
Letter Memory (Common EF)	0.53	0.47	0.59	A - Antisaccade	0.12	0.02	0.21
Category Switch (Common EF)	0.45	0.39	0.51	A - Stroop	0.19	0.09	0.29
Number Letter (Common EF)	0.33	0.27	0.40	A - Keep Track	0.00	0.00	0.04
Keep Track (Updating-Specific)	0.42	0.36	0.47	A - Letter Memory	0.19	0.12	0.26
Letter Memory (Updating-Specific)	0.43	0.38	0.49	A - Category Switch	0.07	0.00	0.16
Category Switch (Shifting-Specific)	0.49	0.44	0.54	A - Number Letter	0.18	0.09	0.27
Number Letter (Shifting-Specific)	0.48	0.43	0.53	E - Antisaccade	0.35	0.28	0.44
<i>Latent Variable ADCE (% variance)</i>				E - Stroop	0.54	0.45	0.64
A - Common EF	0.07	0.00	0.92	E - Keep Track	0.41	0.36	0.46
A - Updating-Specific	0.55	0.08	1.00	E - Letter Memory	0.28	0.22	0.35
A - Shifting-Specific	0.17	0.00	0.81	E - Category Switch	0.30	0.23	0.39
A - WAIS	0.64	0.35	0.84	E - Number Letter	0.31	0.23	0.40

D - Common EF	0.65	0.00	0.90	<i>Residual Variances (% variance) - CAP</i>			
D - Updating-Specific	0.45	0.00	0.92	A - Antisaccade	0.09	0.02	0.17
D - Shifting-Specific	0.43	0.00	0.83	A - Stroop	0.18	0.08	0.28
D - WAIS	0.11	0.00	0.36	A - Keep Track	0.00	0.00	0.02
H - Common EF	0.72	0.51	0.94	A - Letter Memory	0.17	0.10	0.25
H - Updating-Specific	1.00	0.83	1.00	A - Category Switch	0.05	0.00	0.12
H - Shifting-Specific	0.60	0.23	0.85	A - Number Letter	0.12	0.06	0.19
H - WAIS	0.74	0.62	0.85	E - Antisaccade	0.51	0.42	0.60
C - Common EF	0.18	0.00	0.36	E - Stroop	0.56	0.45	0.66
C - Updating-Specific	0.00	0.00	0.13	E - Keep Track	0.66	0.61	0.72
C - Shifting-Specific	0.10	0.00	0.38	E - Letter Memory	0.36	0.27	0.45
C - WAIS	0.10	0.00	0.21	E - Category Switch	0.50	0.41	0.59
E - Common EF	0.11	0.04	0.19	E - Number Letter	0.54	0.45	0.62
E - Updating-Specific	0.00	0.00	0.15	<i>Residual Variances (% variance) - WAIS</i>			
E - Shifting-Specific	0.31	0.13	0.52	A - WAIS	0.00	0.00	0.30
E - WAIS	0.16	0.13	0.20	D - WAIS	0.00	0.00	0.16
				C - WAIS	0.00	0.00	0.12
				E - WAIS	0.10	0.01	0.15

Note: Results correspond to the model depicted in Figure 2 in the main text, though squared path coefficients are presented here (for latent ADCE and residual ACEs). Factor loadings and residual additive genetic influences were equated across LTS and CAP subsamples, but standardized estimates differ because residual nonshared environmental influences were allowed to differ across subsample. A = Additive genetic; D = Dominance genetic; H = Broad-sense genetic (i.e., additive + dominance); C = Shared environment; E = Nonshared environment; LTS = Longitudinal Twin Sample; CAP = Colorado Adoption Project; WAIS = Weschler Adult Intelligence Scale.

Table S6: Descriptive Statistics for All Study Measures Including Harmonized and Raw MRI Tasks

Measure	N	M	SD	Range	Skewness	Kurtosis	Reliability
<i>Longitudinal Twin Study</i>							
Antisaccade (% correct) - All	676	73.05	13.57	16.67, 99.75	-0.53	0.25	-
Antisaccade (% correct) - Laboratory	228	72.68	17.38	16.67, 98.61	-0.62	-0.25	0.91 ^a
Antisaccade (% correct) - MRI raw	448	-0.02	0.99	-2.36, 2.33	-0.17	-0.73	0.94 ^a
Antisaccade (% correct) - MRI harmonized	448	73.24	11.16	46.78, 99.75	-0.17	-0.73	0.94 ^a
Stroop (RT Interference)	696	151.35	78.66	-90.29, 426.38	0.82	1.12	0.96 ^a
Number Letter (RT Switch Cost) - All	682	245.60	151.42	-81.90, 928.69	1.27	2.68	-
Number Letter (RT Switch Cost) - Laboratory	231	260.21	193.19	-81.90, 928.69	1.21	1.66	0.91 ^a
Number Letter (RT Switch Cost) - MRI raw	451	180.00	117.94	-29.58, 565.54	0.86	0.85	0.93 ^a
Number Letter (RT Switch Cost) - MRI harmonized	451	238.13	124.31	17.23, 644.49	0.86	0.85	0.93 ^a
Category Switch (RT Switch Cost)	692	184.03	151.63	-103.05, 800.11	1.14	1.46	0.91 ^a
Keep Track (% correct) - All	696	70.71	8.66	26.63, 97.22	-0.89	2.48	-
Keep Track (% correct) - Laboratory	234	70.19	11.93	26.63, 97.22	-0.71	0.88	0.64 ^b
Keep Track (% correct) - MRI raw	462	76.50	14.01	34.96, 100.00	-0.68	0.13	0.75 ^b
Keep Track (% correct) - MRI harmonized	462	70.97	6.39	52.01, 81.70	-0.68	0.13	0.75 ^b
Letter Memory (% correct)	697	72.77	14.18	25.73, 100.00	-0.09	-0.73	0.93 ^b
WAIS Full Scale IQ	684	108.87	11.31	74, 143	-0.14	-0.01	0.97 ^c
<i>Colorado Adoption Project</i>							
Antisaccade (% correct)	533	66.12	17.43	15.28, 98.61	-0.37	-0.55	0.90 ^a
Stroop (RT Interference)	537	176.20	82.12	1.93, 426.38	0.70	0.61	0.96 ^a
Number Letter (RT Switch Cost)	534	294.83	194.20	-157.13, 928.69	0.98	1.39	0.91 ^a
Category Switch (RT Switch Cost)	537	252.20	188.32	-163.94, 808.37	0.94	0.66	0.93 ^a
Keep Track (% correct)	534	65.75	13.61	26.63, 94.44	-0.48	0.01	0.60 ^b
Letter Memory (% correct)	527	69.88	15.06	25.73, 100.00	-0.14	-0.38	0.93 ^b
WAIS Full Scale IQ	534	112.42	12.17	69, 148	-0.07	0.18	0.97 ^c

Note: Reliability was computed using the split-half Spearman-Brown coefficient (^a), Cronbach's alpha (^b), or based on internal reliability from Wechsler (1997) (^c). Reliability for MRI subjects was based on all subjects who completed that version, including the $n=153$ individuals whose primary data was analyzed based on their CATSLife assessment. RT = Reaction time; WAIS = Weschler Adult Intelligence Scale; IQ = Intelligence quotient.

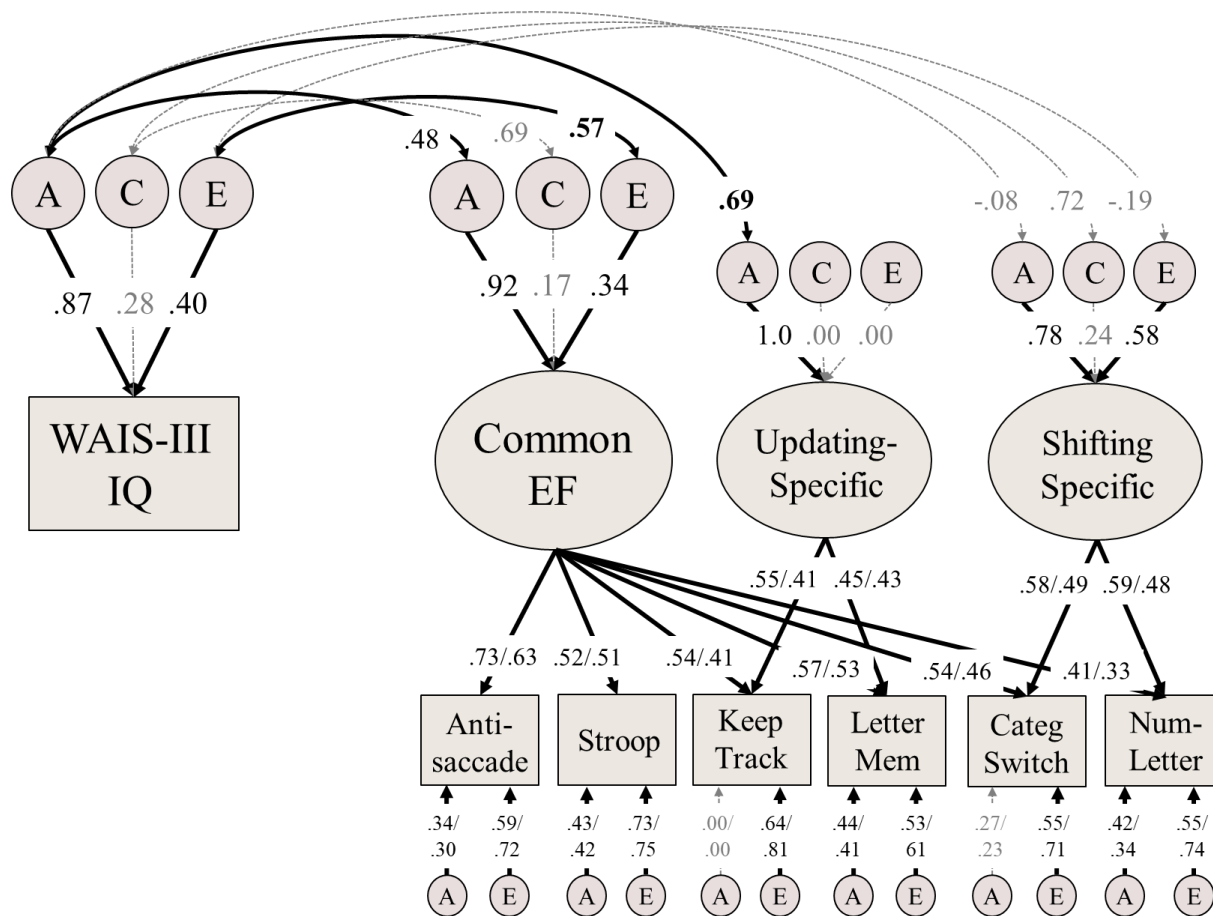


Figure S1: This figure displays a similar model as Figure 2 in the main text except all dominance genetic influences are not estimated, for comparison with prior studies. Results of this ACE model are similar, and this model did not fit significantly worse than the ADCE model, $\chi^2(7)=5.78$, $p=.567$. However, shared environmental estimates (C) are smaller in this model given that they can be cancelled out by the presence of (nonsignificant) dominance genetic influences (D). Therefore, we present the full ADCE model in the main text. Most paths were equated across subsample, but because residual nonshared environmental influences were allowed to differ, standardized estimates of factor loadings and residual A influences also differ across Longitudinal Twin Study subsample (LTS; left) and the Colorado Adoption Project subsample (CAP; right). Significant paths are displayed in black text, with solid black arrows ($p<.05$). Model Fit: $\chi^2(420)=644.78$, $p<.001$, RMSEA=.028, CFI=.907. A = Additive genetic influences; E = Nonshared environmental influences; WAIS-III IQ = Weschler Adult Intelligence Scale full-scale intelligence quotient.

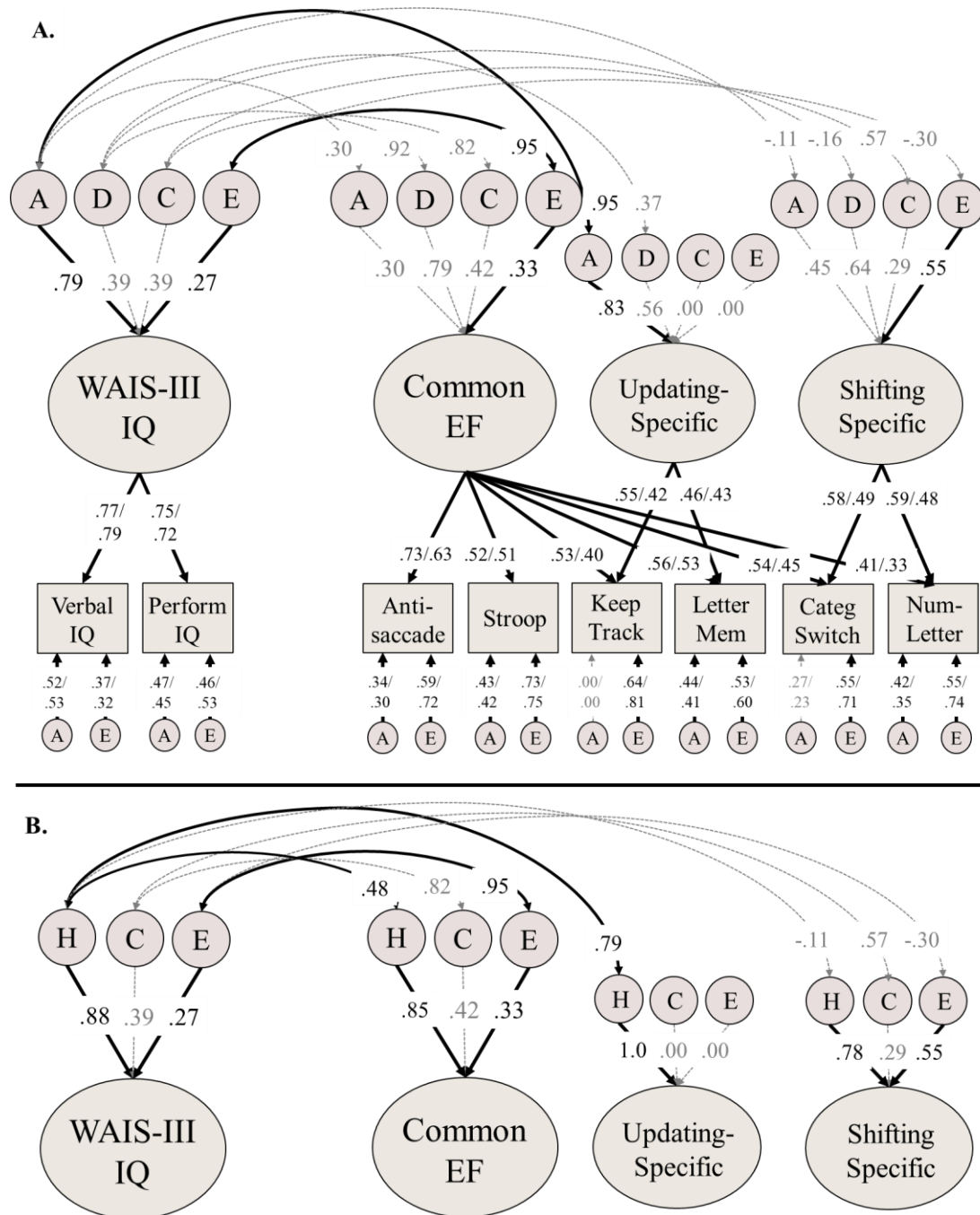


Figure S2: This figure displays a similar model to Figure 2 in the main text except full-scale IQ has been replaced with a latent variable based on verbal IQ and performance IQ subtests. Most paths were equated across subsample, but because residual nonshared environmental influences were allowed to differ, standardized estimates of factor loadings and residual A influences also differ across Longitudinal Twin Study subsample (LTS; left) and the Colorado Adoption Project subsample (CAP; right). Significant paths are displayed in bold, with solid black arrows ($p < .05$). Model Fit: $\chi^2(537) = 865.86$, $p < .001$, RMSEA = .029, CFI = .900. A = Additive genetic influences; C = Shared/common environmental influences; E = Nonshared environmental influences; WAIS-III IQ = Weschler Adult Intelligence Scale full-scale intelligence quotient.

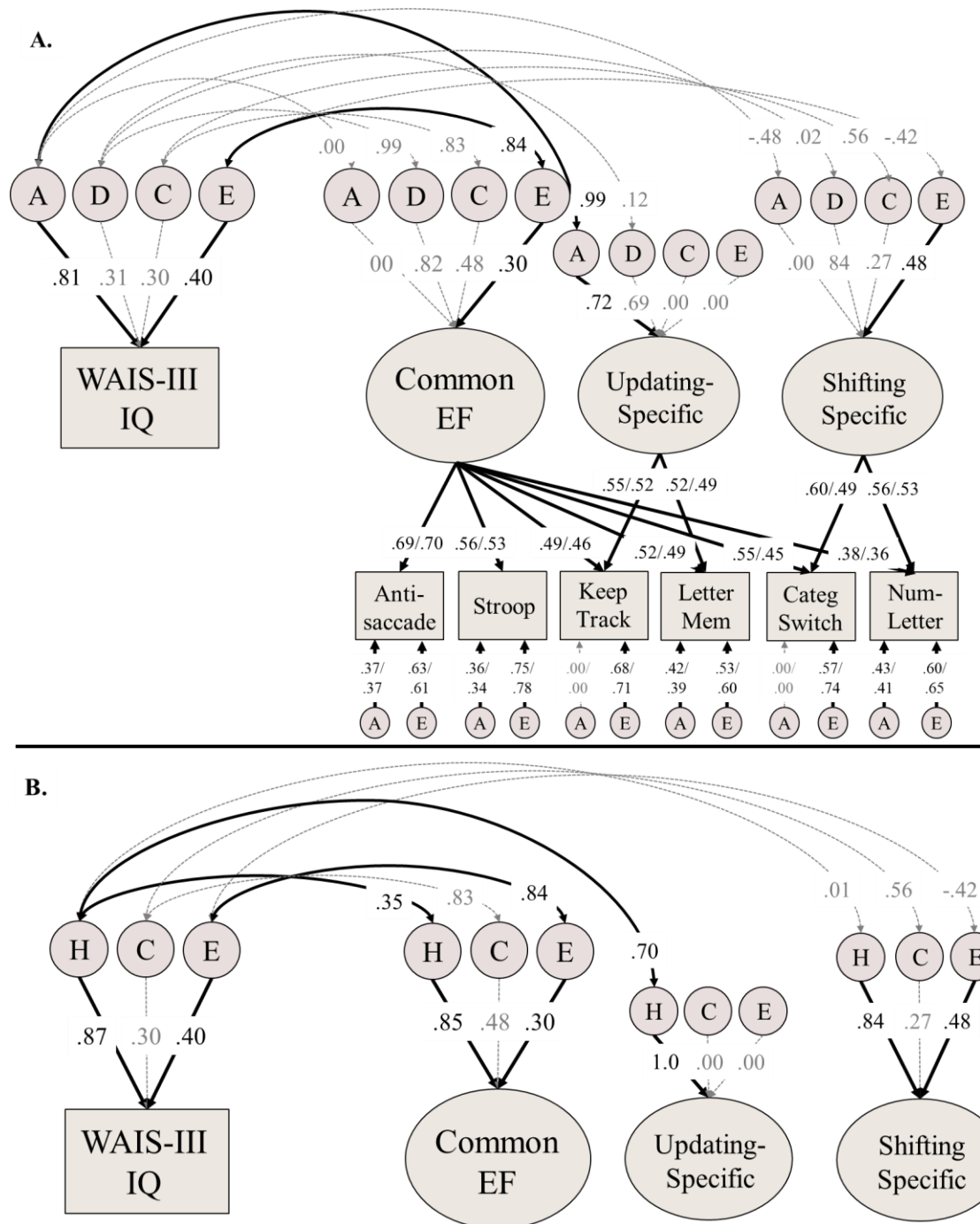


Figure S3: This figure displays a similar model to Figure 3 in the main text except all data from MRI tasks has been excluded (i.e., 3 of 6 EF tasks for $n=485$ subjects). Most paths were equated across subsample, but because residual nonshared environmental influences were allowed to differ, standardized estimates of factor loadings and residual A influences also differ across Longitudinal Twin Study subsample (LTS; left) and the Colorado Adoption Project subsample (CAP; right). Significant paths are displayed in black text, with solid black arrows ($p < .05$). Model Fit: $\chi^2(413)=579.38$, $p < .001$, RMSEA=.024, CFI=.919. A = Additive genetic influences; C = Shared/common environmental influences; E = Nonshared environmental influences; WAIS-III IQ = Weschler Adult Intelligence Scale full-scale intelligence quotient.