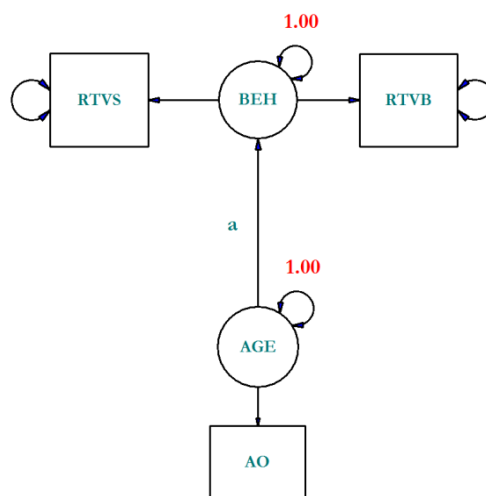


Supplementary material 1

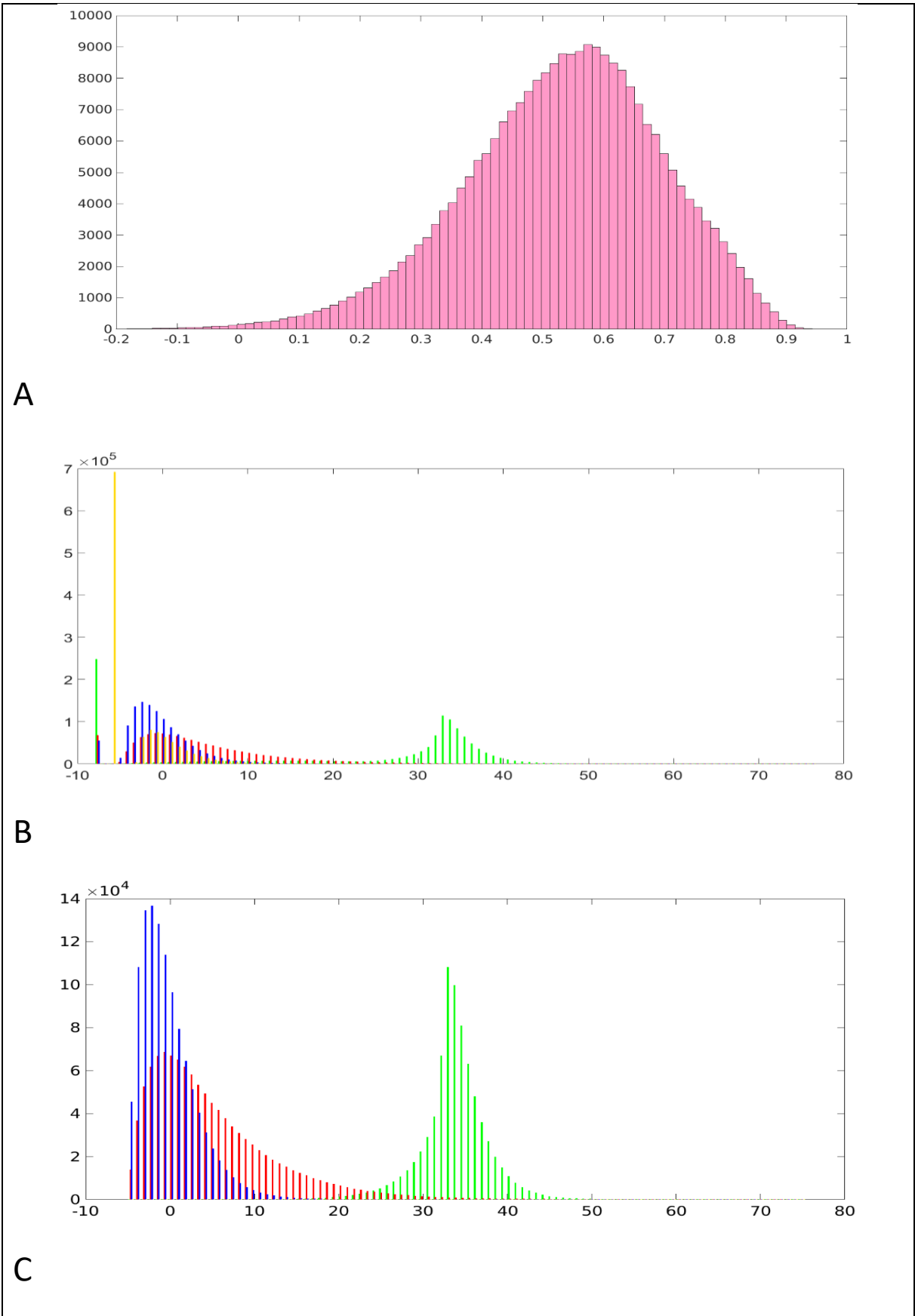
The two RT means of the test and retest phase of the experiment were used for a test-retest reliability analysis. Test-retest reliability of the tasks under study was good to excellent (ICC for spatial working memory task = 0.72; ICC for the verbal working memory = 0.76). Next, we averaged the data of the test-retest phase for further analysis including SEM. The paired t-test revealed substantial differences in response time between the verbal and the spatial working memory task ($p < 0.001$) confirming that these tasks are indeed distinct in nature. But the high correlation ($r = 0.79$) between the averaged response times of the spatial and verbal working memory tasks suggests that individual differences in response time of the tasks are driven by a common factor. One common factor might be age.



This figure: depicts the relation between age and working memory

The latter was investigated by means of an SEM as depicted in SOM figure 1 that describes the relation between age and the two reported measures of verbal and spatial working memory. This model fitted extremely well ($p = 1.0$) and the path “a” between the latent factor age and the latent factor behavior was highly significant $p < 0.001$. This suggests that a strong relation between age and measures of working memory exist.

Supplementary Material 2



This figure reports key statistics that were used to judge whether the requirements of voxelwise structural equation modeling were fulfilled.

Panel A: Histograms of the voxel wise correlation between FA and MD. Note that FA numbers were multiplied with -1 to ensure that both FA and MD correlate positive with the latent construct DTI. Three permille of the voxels showed anti correlated behavior which resulted inherently in poor model fit.

Panel B: Histograms of the voxel wise AIC statistics related to the Brain mediation model (green) cognitive mediation model (red) independent factor model (blue) common factor model (yellow). This histogram includes voxels that might exhibit ill conditioning.

Panel C: Histogram of the voxel wise AIC statistics related to the Brain meditation model (green) cognitive mediation model (red) independent factor model (blue) common factor model (yellow). This figure reports AIC voxels after filtering. We removed data from the SEM maps when the correlations between the latent factors were > 1 or < -1 and when the mx output reported ill conditioning of the model.

The outlying behavior of the AIC distributions at the left side of the histograms as depicted in figure 2B suggest ill conditioning of the SEM. This is in particularly the case for the common factor model. The comfortable fit statistics of the independent factor model (blue) suggest that a common factor is not very likely. The latter is indeed reflected in the poor behavior of the common factor AIC distribution depicted in yellow. Mark that the distributions of distinct models exhibit normal behavior when suspect voxels are omitted from the maps (figure 2C). the sanctioning procedure led to a total collapse of the common factor model.

Supplementary Material 3

name	code	Percentage filled	number of voxels	mean model fit
Right-Hippocampus_ctx-rh-insula	4783	20	1704	0.221
Right-Putamen_Right-Hippocampus	4547	17	1823	0.208
Right-Hippocampus_ctx-rh-lateralorbitofrontal	4760	17	1048	0.214
ctx-lh-caudalanteriorcingulate_Left-Hippocampus	240	16	938	0.212
Left-Pallidum_Left-Hippocampus	3940	16	1145	0.233

This table describes the anatomic properties of the cognitive mediation map. Here we report the number of voxels that were within the confines of the IIT reference white matter atlas. Name and tract code are according to the nomenclature of the mentioned atlas as described in: (<https://www5.iit.edu/~mri/Home.html>). The number of voxels refers to the absolute number of voxels that were commonly present in the SEM and atlas maps, while percent filled describes the extent to which white matter atlas maps were filled with SEM voxels. Finally, we report the mean model fit of the voxels found within the confines of the atlas maps.

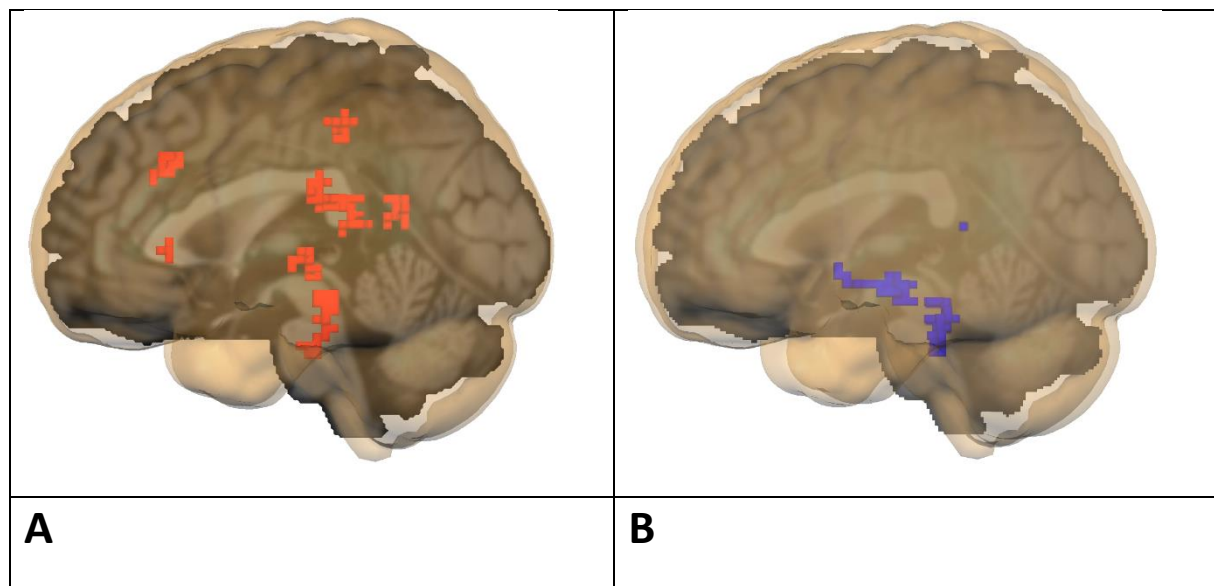
name	code	Percentage filled	number of voxels	mean model fit
ctx-lh-isthmuscingulate_ctx-lh-medialorbitofrontalroi	913	59	1653	0.226
ctx-lh-isthmuscingulate_Left-optic-tract	987	56	1288	0.226
ctx-lh-posteriorcingulate_Left-Cerebellum-Cortex	2235	48	1436	0.210
ctx-lh-posteriorcingulate_Axial-section-through-medulla	2285	47	3951	0.215
ctx-lh-parahippocampal_Left-Putamen	1538	47	1167	0.224
ctx-lh-caudalanteriorcingulate_ctx-rh-medialorbitofrontal	262	46	2869	0.224
Left-Caudate_ctx-rh-frontalpole	3780	46	2943	0.228
ctx-lh-caudalanteriorcingulate_Left-Hippocampus	240	45	2603	0.223
ctx-lh-parahippocampal_ctx-lh-paracentral	1516	45	2928	0.220
Left-Hippocampus_Left-optic-tract	4087	45	892	0.239
ctx-lh-caudalanteriorcingulate_ctx-lh-medialorbitofrontal	213	44	2899	0.220
Left-Putamen_Left-Hippocampus	3840	44	4799	0.225
ctx-lh-insula_Left-Hippocampus	3440	43	4920	0.221
Left-Caudate_Right-Thalamus-Proper	3743	43	2757	0.206

ctx-lh-caudalanteriorcingulate_Left-Accumbens-area	242	43	1102	0.239
ctx-lh-superiorparietal_Left-optic-tract	2887	42	2085	0.216
Left-Hippocampus_Left-Amygdala	4041	42	2936	0.229
Right-Pallidum_ctx-rh-parahippocampal	4664	42	1060	0.201
ctx-lh-frontalpole_ctx-rh-lateralorbitofrontal	3160	42	2934	0.217
Right-Pallidum_Right-Hippocampus	4647	42	3001	0.213
ctx-lh-isthmuscingulate_Axial-section-through-medulla	985	42	5396	0.219
ctx-lh-rostralanteriorcingulate_ctx-rh-medialorbitofrontal	2562	42	4155	0.222
Left-Pallidum_Left-Hippocampus	3940	42	3049	0.214
ctx-lh-medialorbitofrontal_ctx-rh-rostralmiddlefrontal	1375	41	5976	0.209
ctx-lh-rostralanteriorcingulate_ctx-rh-lateralorbitofrontal	2560	41	2516	0.218
ctx-lh-parsorbitalis_ctx-rh-lateralorbitofrontal	1860	41	1457	0.226
Left-Pallidum_Right-Pallidum	3946	41	5754	0.219
ctx-lh-superiorfrontal_ctx-rh-frontalpole	2780	41	5687	0.218
ctx-lh-frontalpole_ctx-rh-medialorbitofrontal	3162	41	4602	0.219
ctx-lh-rostralanteriorcingulate_ctx-lh-frontalpole	2531	41	2097	0.203
Right-Pallidum_Right-optic-tract	4688	41	1845	0.213
ctx-lh-superiorfrontal_ctx-rh-lateralorbitofrontal	2760	41	6739	0.214
Left-Thalamus-Proper_Left-Accumbens-area	3642	41	1345	0.232
ctx-lh-rostralanteriorcingulate_ctx-lh-insula	2534	41	2606	0.231
ctx-rh-parahippocampal_ctx-rh-precentral	6472	41	3410	0.235
ctx-lh-insula_Left-Amygdala	3441	41	859	0.227
Left-Pallidum_Left-optic-tract	3987	41	2390	0.217
Left-Pallidum_Left-Amygdala	3941	40	2085	0.220
ctx-lh-parahippocampal_Left-Thalamus-Proper	1536	40	3114	0.210
ctx-lh-isthmuscingulate_Left-Hippocampus	940	40	6355	0.209
Right-Pallidum_Right-Amygdala	4648	40	2503	0.213
Left-Putamen_ctx-rh-superiortemporal	3878	40	1778	0.211
Left-Pallidum_Right-Thalamus-Proper	3943	40	6929	0.219
Left-Caudate_Left-Pallidum	3739	40	7450	0.207
ctx-lh-paracentral_Left-Cerebellum-Cortex	1635	40	5509	0.217

ctx-lh-parahippocampal_Left-Pallidum	1539	40	1800	0.213
ctx-lh-superiorfrontal_ctx-rh-middletemporal	2763	40	6674	0.208
ctx-lh-superiorfrontal_Left-Cerebellum-Cortex	2735	40	5912	0.216
ctx-lh-lateralorbitofrontal_ctx-rh-frontalpole	1180	40	3503	0.222
ctx-rh-paracentral_Axial-section-through-medulla	6585	40	9250	0.231

This table describes the anatomic properties of the independent component map. Here we report the number of voxels that were within the confines of the IIT reference white matter atlas. Name and tract code are according to the nomenclature of the mentioned atlas as described in: (<https://www5.iit.edu/~mri/Home.html>). The number of voxels refers to the absolute number of voxels that were commonly present in the SEM and atlas maps, while percent filled describes the extent to which white matter atlas maps were filled with SEM voxels. Finally, we report the mean model fit of the voxels found within the confines of the atlas maps.

Supplementary Material 4



This figure depicts voxels detected with sufficient fit related to the cognitive mediation model (red) and independent factor model (blue).

Panel A: Depicts the lateral view of voxels related to the cognitive mediation model thresholded at a volume of 300 mm². This image depicts voxels that exhibited a positive correlation between the latent factor and age.

Panel B: Depicts the lateral view of voxels related to the independent factor model thresholded at a volume of 300 mm². This image depicts voxels that exhibited a negative correlation between the latent factor and age

Supplementary Material 5 MX scripts

Brain mediation model

NGroups=1

Data Ninput=6 Nobservations=88

CMatrix

% voxelwise CMatrix

Label RTVS RTVB A FA MD DIS

Select RTVS RTVB A FA MD;

#define NumManifest 5

Begin Matrices;

S Symm 8 8

A Full 8 8

F Full 5 8

I Iden 8 8

End Matrices;

Matrix S

1

0 1

0 0 0

0 0 0 1

0 0 0 0 1

0 0 0 0 0 1

0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

Specify S

1

0 2

0 0 0

0 0 0 3

0 0 0 0 4

0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0 0

Label Row S

RTVS RTVB A FA MD AGE BEH DTI

Label Col S

RTVS RTVB A FA MD AGE BEH DTI

Boundary -100 100 S 1 1 1

Boundary -100 100 S 1 2 2

Boundary -100 100 S 1 4 4

Boundary -100 100 S 1 5 5

Matrix A

0 0 0 0 0 0 1 0

0 0 0 0 0 0 1 0

0 0 0 0 0 1 0 0

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0.5

0 0 0 0 0 0.5 0 0

Specify A

0 0 0 0 0 0 5 0

0 0 0 0 0 0 6 0

0 0 0 0 0 7 0 0

0 0 0 0 0 0 8

0 0 0 0 0 0 0 11

0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 10

0 0 0 0 0 9 0 0

Label Row A

RTVS RTVB A FA MD AGE BEH DTI

Label Col A

RTVS RTVB A FA MD AGE BEH DTI

Boundary -100 100 A 1 1 7

Boundary -100 100 A 1 2 7

Boundary -100 100 A 1 3 6

Boundary -100 100 A 1 4 8

Boundary -100 100 A 1 5 8

Boundary -100 100 A 1 7 8

Boundary -100 100 A 1 8 6

Matrix F

1 0 0 0 0 0 0 0

0 1 0 0 0 0 0 0

0 0 1 0 0 0 0 0

0 0 0 1 0 0 0 0

0 0 0 0 1 0 0 0

Label Row F

RTVS RTVB A FA MD

Label Col F

RTVS RTVB A FA MD AGE BEH DTI

Covariance F & ((I - A)~ & S);

Option Multiple issat

End

drop 9

End

drop 10

End

End Group;

Cognitive mediation model

NGroups=1

Data Ninput=6 Nobservations=88

CMatrix

% voxelwise CMatrix

Label RTVS RTVB A FA MD DIS

Select RTVS RTVB A FA MD;

#define NumManifest 5

Begin Matrices;

S Symm 8 8

A Full 8 8

F Full 5 8

I Iden 8 8

End Matrices;

Matrix S

1

0 1

0 0 0

0 0 0 1

0 0 0 0 1

0 0 0 0 0 1

0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

Specify S

1

0 2

0 0 0

0 0 0 3

0 0 0 0 4

0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0 0

Label Row S

RTVS RTVB A FA MD AGE BEH DTI

Label Col S

RTVS RTVB A FA MD AGE BEH DTI

Boundary -100 100 S 1 1 1

Boundary -100 100 S 1 2 2

Boundary -100 100 S 1 4 4

Boundary -100 100 S 1 5 5

Matrix A

0 0 0 0 0 0 1 0

0 0 0 0 0 0 1 0

0 0 0 0 0 1 0 0

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 0

0 0 0 0 0 0.5 0 0

0 0 0 0 0 0 0.5 0

Specify A

0 0 0 0 0 0 5 0

0 0 0 0 0 0 6 0

0 0 0 0 0 7 0 0

0 0 0 0 0 0 8

0 0 0 0 0 0 0 11

0 0 0 0 0 0 0 0

0 0 0 0 0 9 0 0

0 0 0 0 0 0 10 0

Label Row A

RTVS RTVB A FA MD AGE BEH DTI

Label Col A

RTVS RTVB A FA MD AGE BEH DTI

Boundary -100 100 A 1 1 7

Boundary -100 100 A 1 2 7

Boundary -100 100 A 1 3 6

Boundary -100 100 A 1 4 8

Boundary -100 100 A 1 5 8

Boundary -100 100 A 1 7 6

Boundary -100 100 A 1 8 7

Matrix F

1 0 0 0 0 0 0

0 1 0 0 0 0 0

0 0 1 0 0 0 0

0 0 0 1 0 0 0

0 0 0 0 1 0 0

Label Row F

RTVS RTVB A FA MD

Label Col F

RTVS RTVB A FA MD AGE BEH DTI

Covariance F & ((I - A)~ & S);

Option Multiple issat

End

drop 10

End

drop 9

End

End Group;

Independent factor model

NGroups=1

Data Ninput=6 Nobservations=88

CMatrix

% voxelwise CMatrix

Label RTVS RTVB A FA MD DIS

Select RTVS RTVB A FA MD ;

#define NumManifest 5

Begin Matrices;

S Symm 8 8

A Full 8 8

F Full 5 8

I Iden 8 8

End Matrices;

Matrix S

1

0 1

0 0 0

0 0 0 1

0 0 0 0 1

0 0 0 0 0 1

0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

Specify S

1

0 2

0 0 0

0 0 0 3

0 0 0 0 4

0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0 0

Label Row S

RTVS RTVB A FA MD AGE BEH DTI

Label Col S

RTVS RTVB A FA MD AGE BEH DTI

Boundary -100 100 S 1 1 1

Boundary -100 100 S 1 2 2

Boundary -100 100 S 1 4 4

Boundary -100 100 S 1 5 5

Matrix A

0 0 0 0 0 0 1 0

0 0 0 0 0 0 1 0

0 0 0 0 0 1 0 0

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 0

0 0 0 0 0 0.5 0 0

0 0 0 0 0 0.5 0 0

Specify A

0 0 0 0 0 0 5 0

0 0 0 0 0 0 6 0

0 0 0 0 0 7 0 0

0 0 0 0 0 0 8

0 0 0 0 0 0 0 11

0 0 0 0 0 0 0 0

0 0 0 0 0 9 0 0

0 0 0 0 0 10 0 0

Label Row A

RTVS RTVB A FA MD AGE BEH DTI

Label Col A

RTVS RTVB A FA MD AGE BEH DTI

Boundary -100 100 A 1 1 7

Boundary -100 100 A 1 2 7

Boundary -100 100 A 1 3 6

Boundary -100 100 A 1 4 8

Boundary -100 100 A 1 5 8

Boundary -100 100 A 1 7 6

Boundary -100 100 A 1 8 6

Matrix F

1 0 0 0 0 0 0

0 1 0 0 0 0 0

0 0 1 0 0 0 0

0 0 0 1 0 0 0

0 0 0 0 1 0 0

Label Row F

RTVS RTVB A FA MD

Label Col F

RTVS RTVB A FA MD AGE BEH DTI

Covariance F & ((I - A)~ & S);

Option Multiple issat

End

drop 10

End

drop 9

End

End Group;

Common factor model

NGroups=1

Data Ninput=6 Nobservations=88

CMatrix

% voxelwise CMatrix

Label RTVS RTVB A FA MD DIS

Select RTVS RTVB A FA MD;

#define NumManifest 5

Begin Matrices;

S Symm 9 9

A Full 9 9

F Full 5 9

I Iden 9 9

End Matrices;

Matrix S

1

0 1

0 0 0

0 0 0 1

0 0 0 0 1

0 0 0 0 0 1

0 0 0 0 0 0 1

0 0 0 0 0 0 0 1

0 0 0 0 0 0 0 0 1

Specify S

1

0 2

0 0 0

0 0 0 3

0 0 0 0 4

0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0

Label Row S

RTVS RTVB A FA MD AGE BEH DTI com

Label Col S

RTVS RTVB A FA MD AGE BEH DTI com

Boundary -100 100 S 1 1 1

Boundary -100 100 S 1 2 2

Boundary -100 100 S 1 4 4

Boundary -100 100 S 1 5 5

Matrix A

0 0 0 0 0 0 1 0 0

0 0 0 0 0 0 1 0 0

0 0 0 0 0 1 0 0 0

0 0 0 0 0 0 0 1 0

0 0 0 0 0 0 0 1 0

0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0.5

0 0 0 0 0 0 0 0 0.5

0 0 0 0 0 0.5 0 0 0

Specify A

0 0 0 0 0 0 5 0 0

0 0 0 0 0 0 6 0 0

0 0 0 0 0 7 0 0 0

0 0 0 0 0 0 8 0

0 0 0 0 0 0 0 1 1 0

0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 1 0

0 0 0 0 0 0 0 0 1 2

0 0 0 0 0 9 0 0 0

Label Row A

RTVS RTVB A FA MD AGE BEH DTI com

Label Col A

RTVS RTVB A FA MD AGE BEH DTI com

Boundary -100 100 A 1 1 7

Boundary -100 100 A 1 2 7

Boundary -100 100 A 1 3 6

Boundary -100 100 A 1 4 8

Boundary -100 100 A 1 5 8

Boundary -100 100 A 1 7 9

Boundary -100 100 A 1 8 9

Boundary -100 100 A 1 9 6

Matrix F

1 0 0 0 0 0 0 0 0

0 1 0 0 0 0 0 0 0

0 0 1 0 0 0 0 0 0

0 0 0 1 0 0 0 0 0

0 0 0 0 1 0 0 0 0

Label Row F

RTVS RTVB A FA MD

Label Col F

RTVS RTVB A FA MD AGE BEH DTI com

Covariance F & ((I - A)~ & S);

Option Multiple issat

End

drop 9

End

drop 12

End

drop 10

End

End Group;