Supplemental Tables and Figures

Table S1. Subject measures correlating with brain-wide signal variance (DVAR)

Subject Measures	Pearson r
DSM ADHD	0.16
ASR Attn. Problems	0.16
ASR Thought/Attention/Other	0.16
DSM Antisocial (pct)	0.17
ASR Somatic complaints (pct)	0.17
DSM Somatic problems (raw)	0.17
ASR Intrusive thoughts	0.17
Height	0.18
ASR Rule Breaking	0.18
ASR Total problems (raw)	0.18
ASR Critical items (raw)	0.18
ASR Total problems (AgeAdj)	0.19
ASR Externalizing (raw)	0.2
DSM Somatic problems (pct)	0.2
ASR Externalizing	0.2
DSM Antisocial (pct)	0.2
Anger/Aggression (Unadj)	0.2
Brain Volume	0.23
Hematocrit	0.27
Gender (M>F)	0.31
BMI	0.33
Weight	0.38

FD:DV r=.417

Supplemental Figure Captions

Figure S1. Cortical Parcellation and group average correlation values. (**a**) 324 region of interest parcellation from Gordon & Laumann et al., 2014. Regions are color coded by RSN membership. The average Fisher z-transformed correlation matrices are shown for all 457 subjects following Type A processing (**b**) and for 435 retained subjects following Type B processing (**c**).

Figure S2: Pervasive high frequency noise in unfiltered FD traces. (**a**) The top panel shows 1200 frames of raw FD values (red trace) for subject 519950. The black line indicates a 0.2 FD cutoff for frame censoring, as implemented previously (Power et al. 2012, 2014). The panel second from the top shows FD values after low pass filtering with a 0.3Hz Butterworth filter (red trace) for the same run, with the black line indicating a 0.025 FD cutoff. The third and fourth panels show the corresponding DVARS values (blue trace), mean global signal (black trace), and gray plot. The frames that would be censored by use of the filtered FD values are well-aligned with peaks in the DVARS trace and perturbations in the gray plot characteristic of head motion (Power et al. 2012, 2014), whereas many more frames would be censored if the unfiltered FD values were used. (**b**) In some HCP R-fMRI runs, FD and DVARS do not correspond as well. Observe that for subject 510326 there are several peaks in the DVARS trace between frames 100 and 400 that are well-aligned with perturbations in the gray plot characteristic of head motion (Power et al. 2012, 2014); however, these peaks are not reflected in either FD trace (see black arrows). Thus, a DVAR threshold of 105% of median was used for scrubbing. (**c**) Spectrogram of FD traces before averaged across all runs from all subjects before (top) and after (bottom) low-pass filtering to remove the respiration peak. Prior to filtering, a peak is present above 0.3 hz (black arrow), consistent with respiration.

Figure S3: FC:FD and FD:Behavior relationships used in Figure 3 shown as matrices. Arrows between matrices provide Pearson correlation coefficients between matrices. RSN abbreviations: VIS = Visual network (38 ROIs), PO = parieto-occipital (7 ROIs), SMD = dorsal somato-motor (37 ROIs); SMV = ventral somato-motor (8 ROIs); AUD = auditory (23 ROIs); CON = cingulo-opercular (39 ROIs); VAN = ventral attention (23 ROIs); SAL = Salience (4 ROIs), CP = Cingulo-parietal (5 ROIs), DAN = dorsal attention network (32 ROIs); FPN = frontoparietal control network (24 ROIs); DMN = default mode network (40 ROIs), NON = no assigned network (44 ROIs).

Figure S4. Motion influence on FC: across all 457 subject. Results presented here are calculated in a manner identical to Figure 3, except all 457 subjects (including those with reconstruction software version 1) were included.

Figure S5. Average in scanner head movement versus Body Mass Index.

Behavioral Measures

To generate a list of 120 measures of potential neurobiological interest, the following exclusion criteria (adapted from Smith et al.., 2015) were applied:

1. 70 measures, which were quantitatively poor measures according to one more of the following criteria:

   a. A measured contained very extreme outlier values, as measured by most extreme value from the median. Specifically, if *xs* is an SM value for subject s, and *ys*= (*xs* – *median*(*xs*))2, we consider an SM to have extreme outliers if *max*(*ys*) *>100* × *mean*(*ys*) .

   b. Fewer than 250 subjects had valid measures (too much missing data).

   c. Discreteness with severe imbalance, defined as >95% of all sub- jects having the same SM value.

2. 190 measures from the T1-weighted structural brain analysis using FreeSurfer (including volumes of subcortical structures, and average thickness and surface area of many cortical regions) were excluded. The only structural brain measure included was the cube-root of whole brain volume (including ventricles).

3. 57 variables considered undesirable, in some cases because they are not sufficiently likely to be measures relating to brain function, and in some cases where “minor” measures are highly correlated with more major related measures. Thus we removed: “Is the subject in college?”; “Is the subject in a live-in relationship?”; “Is the subject born in Missouri?”; BMI

self-report; thyroid/hypothyroid/endocrine measures; menstruation- related measures; fluid intelligence secondary measures of skipped tests and reaction time (as we included the highly correlated major measure □of correct responses); all minor Delayed Discounting measures (that is, all except for the two major ones of area-under-the-curve for $200 and $40,000); all minor Sustained Attention (Short Penn Continuous Performance Test) measures (keeping the major measures of sensitivity and specificity); the minor Verbal Episodic Memory (Penn Word Memory Test) measure of reaction time; the minor Emotion Recognition (Penn Emotion Recognition Test) measure of Correct Responses Median Response Time; the minor visual Contrast Sensitivity (Mars Contrast Sensitivity) measure of error count; Age (as age range was limited to 26-30); Handedness; Employment status; "Whether blood was drawn for testing and measured hematocrit levels?"; Walking Endurance and Gait Speed; Physical Grip Strength; four measures relating to family history; color vision and eyeglass correction..

4. 41 measures of substance use that were highly similar to included measures or of no interest. This included 24 measures relating to alcohol consumption, and 9 measures relating to tobacco use, 3 measures relating to marijuana use, and 5 measures relating to past use of other drugs.

The full list of the 120 subject measures that were retained:

ASR_Anxd_Raw ASR_Anxd_Pct ASR_Witd_Raw ASR_Witd_Pct ASR_Soma_Raw ASR_Soma_Pct ASR_Thot_Raw ASR_Thot_Pct ASR_Attn_Raw ASR_Attn_Pct ASR_Aggr_Raw ASR_Aggr_Pct ASR_Rule_Raw ASR_Rule_Pct ASR_Intr_Raw ASR_Intr_Pct ASR_Oth_Raw ASR_Crit_Raw ASR_Intn_Raw ASR_Intn_T ASR_Extn_Raw ASR_Extn_T ASR_TAO_Sum ASR_Totp_Raw ASR_Totp_T DSM_Depr_Raw DSM_Depr_Pct DSM_Anxi_Raw DSM_Anxi_Pct DSM_Somp_Raw DSM_Somp_Pct DSM_Avoid_Raw DSM_Avoid_Pct DSM_Adh_Raw DSM_Adh_Pct DSM_Inat_Raw DSM_Hype_Raw DSM_Antis_Raw DSM_Antis_Pct SSAGA_ChildhoodConduct SSAGA_PanicDisorder SSAGA_Agoraphobia SSAGA_Depressive_Ep SSAGA_Depressive_Sx Num_Days_Drank_7days SSAGA_Alc_D4_Ab_Dx Times_Used_Any_Tobacco_Today Total_Cigarettes_7days SSAGA_Mj_Ab_Dep

MMSE_Score PSQI_Score PicSeq_Unadj PicSeq_AgeAdj CardSort_Unadj CardSort_AgeAdj Flanker_Unadj Flanker_AgeAdj PMAT24_A_CR ReadEng_Unadj ReadEng_AgeAdj PicVocab_Unadj PicVocab_AgeAdj ProcSpeed_Unadj ProcSpeed_AgeAdj DDisc_AUC_200 DDisc_AUC_40K VSPLOT_TC VSPLOT_CRTE VSPLOT_OFF SCPT_SEN SCPT_SPEC IWRD_TOT ListSort_Unadj ListSort_AgeAdj ER40_CR ER40ANG ER40FEAR ER40NOE ER40SAD AngAffect_Unadj AngHostil_Unadj AngAggr_Unadj FearAffect_Unadj FearSomat_Unadj Sadness_Unadj LifeSatisf_Unadj MeanPurp_Unadj PosAffect_Unadj Friendship_Unadj Loneliness_Unadj PercHostil_Unadj PercReject_Unadj EmotSupp_Unadj InstruSupp_Unadj PercStress_Unadj SelfEff_Unadj Dexterity_Unadj Dexterity_AgeAdj NEOFAC_A NEOFAC_O NEOFAC_C NEOFAC_N NEOFAC_E Odor_Unadj Odor_AgeAdj PainInterf_Tscore Taste_Unadj Taste_AgeAdj Mars_Log_Score Mars_Final Gender SSAGA_Income SSAGA_Educ BMI Weight Height BPSystolic BPDiastolic HbA1C FS_BrainSeg_Vol

Descriptions of each subject measure can be found at wiki.humanconnectome.org/display/PublicData/HCP+Data+Dictionary+Public-+500+Subject+Release#HCPDataDictionaryPublic-500SubjectRelease

Additional Cleaning Approaches not included in Type B processing

Confound Regression

Seven measures used by Smith and colleagues (Smith 2015) were regressed across subjects from every edge (i.e. the relationship between a pair of ROIs). Here, we also included hematocrit. Regression of these 8 measures was applied at the population level to FC data obtained using both Type A and Type B processing. The 8 confounds are listed in Figure 1.

CompCor

Multiple regressors were generated by decomposition of white matter (5 regressors) and ventricle (5 regressors) timecourses using PCA (Behzadi et al., 2007). The mean gray matter regressor was excluded. In the CompCor processing regime, all other steps in Type B were unchanged.

Partial Correlation

Because partial correlation performs best using maximally temporally separated ROIs, the partial correlation processing stream was run using a 200-ROI ICA-

based parcellation rather than the 324-ROI Gordon-Laumann parcellation (Smith et al., 2013). Partial correlation was computed on Type A data using FSLNets (Smith et al., 2004) with L2 regularization at rho = 0.01.

Motion Influence P-values using correlation coefficient

Correlation coefficient based permutation cutoff: $R<0.274$ for $p_{perm} < 0.05$.

New Reconstruction (fig 3):

Type A FC:FD v FC:IQ – $r = -0.31$, $r^2 = 0.10$, $p_{perm} = 0.026$

Type A FC:FD v FC:Beh – $r = 0.50$, $r^2 = 0.25$, $p_{perm} < 0.0001$

Type B FC:FD v FC:IQ – $r = -0.14$, $r^2 = 0.02$, $p_{perm} = 0.20$

Type B FC:FD v FC:Beh – $r = 0.10$, $r^2 = 0.01$, $p_{perm} = 0.29$

All subjects (fig S4):

Type A FC:FD v FC:IQ – $r = -0.20$, $p_{perm} = 0.12$

Type A FC:FD v FC:Beh – $r = 0.49$, $p_{perm} < 0.0001$

Type B FC:FD v FC:IQ – $r = -0.07$, $p_{perm} = 0.37$

Type B FC:FD v FC:Beh – $r = 0.0$, $p_{perm} = 0.50$

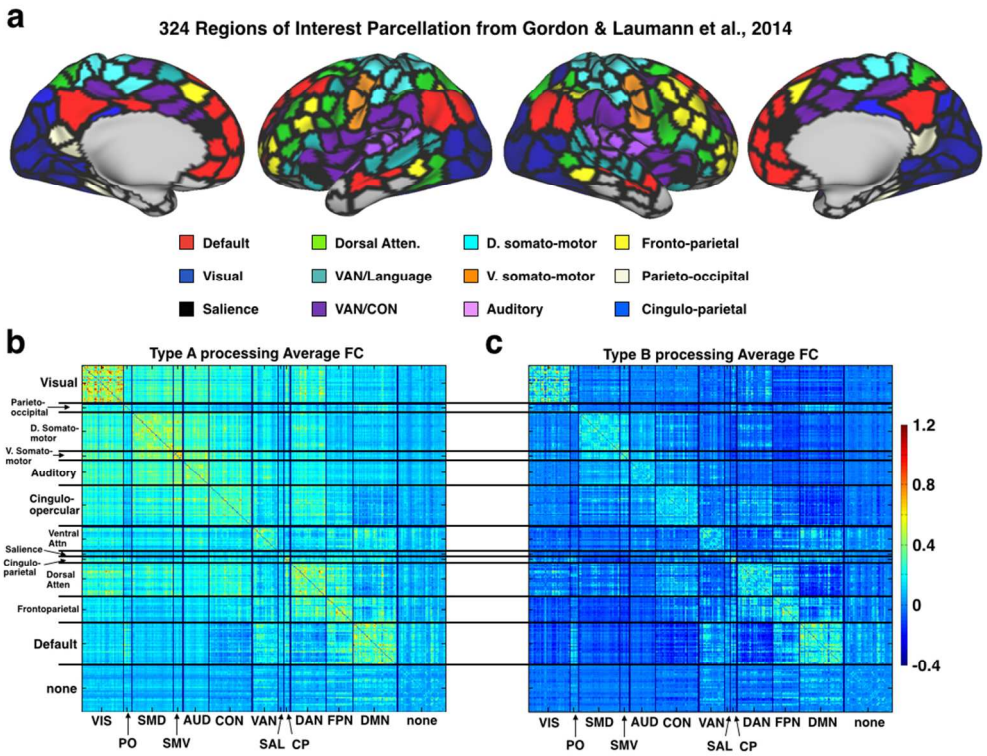

Figure S1. Cortical Parcellation and group average correlation values. (a) 324 region of interest parcellation from Gordon & Laumann et al., 2014. Regions are color coded by RSN membership. The average Fisher z-transformed correlation matrices are shown for all 457 subjects following Type A processing (b) and for 435 retained subjects following Type B processing (c).

92x70mm (300 x 300 DPI)

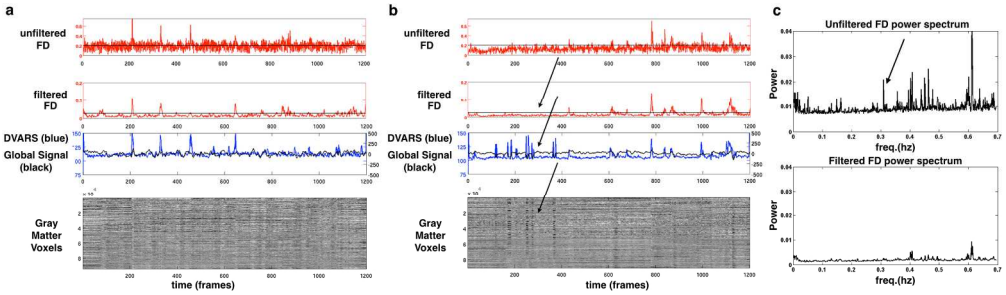

Figure S2: Pervasive high frequency noise in unfiltered FD traces. (a) The top panel shows 1200 frames of raw FD values (red trace) for subject 519950. The black line indicates a 0.2 FD cutoff for frame censoring, as implemented previously (Power et al. 2012, 2014). The panel second from the top shows FD values after low pass filtering with a 0.3Hz Butterworth filter (red trace) for the same run, with the black line indicating a 0.025 FD cutoff. The third and fourth panels show the corresponding DVARS values (blue trace), mean global signal (black trace), and gray plot. The frames that would be censored by use of the filtered FD values are well-aligned with peaks in the DVARS trace and perturbations in the gray plot characteristic of head motion (Power et al. 2012, 2014), whereas many more frames would be censored if the unfiltered FD values were used. (b) In some HCP R-fMRI runs, FD and DVARS do not correspond as well. Observe that for subject 510326 there are several peaks in the DVARS trace between frames 100 and 400 that are well-aligned with perturbations in the gray plot characteristic of head motion (Power et al. 2012, 2014); however, these peaks are not reflected in either FD trace (see black arrows). Thus, a DVAR threshold of 105% of median was used for scrubbing. (c) Spectrogram of FD traces before averaged across all runs from all subjects before (top) and after (bottom) low-pass filtering to remove the respiration peak. Prior to filtering, a peak is present above 0.3 hz (black arrow), consistent with respiration.

201x57mm (300 x 300 DPI)

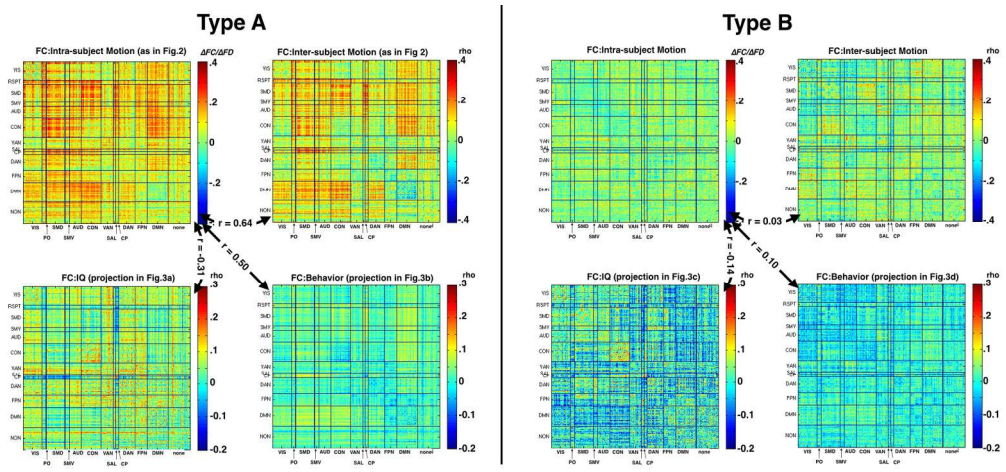

Figure S3: FC:FD and FD:Behavior relationships used in Figure 3 shown as matrices. Arrows between matrices provide Pearson correlation coefficients between matrices. RSN abbreviations: VIS = Visual network (38 ROIs), PO = parieto-occipital (7 ROIs), SMD = dorsal somato-motor (37 ROIs); SMV = ventral somato-motor (8 ROIs); AUD = auditory (23 ROIs); CON = cingulo-opercular (39 ROIs); VAN = ventral attention (23 ROIs); SAL = Salience (4 ROIs), CP = Cingulo-parietal (5 ROIs), DAN = dorsal attention network (32 ROIs); FPN = frontoparietal control network (24 ROIs); DMN = default mode network (40 ROIs), NON = no assigned network (44 ROIs).

172x79mm (300 x 300 DPI)

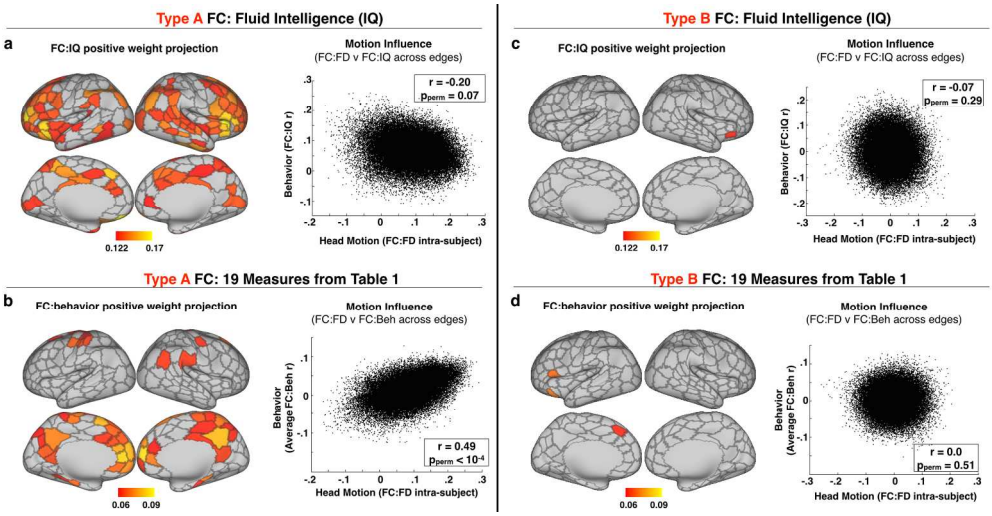

Figure S4. Motion influence on FC: across all 457 subject. Results presented here are calculated in a manner identical to Figure 3, except all 457 subjects (including those with reconstruction software version 1) were included.

186x94mm (300 x 300 DPI)

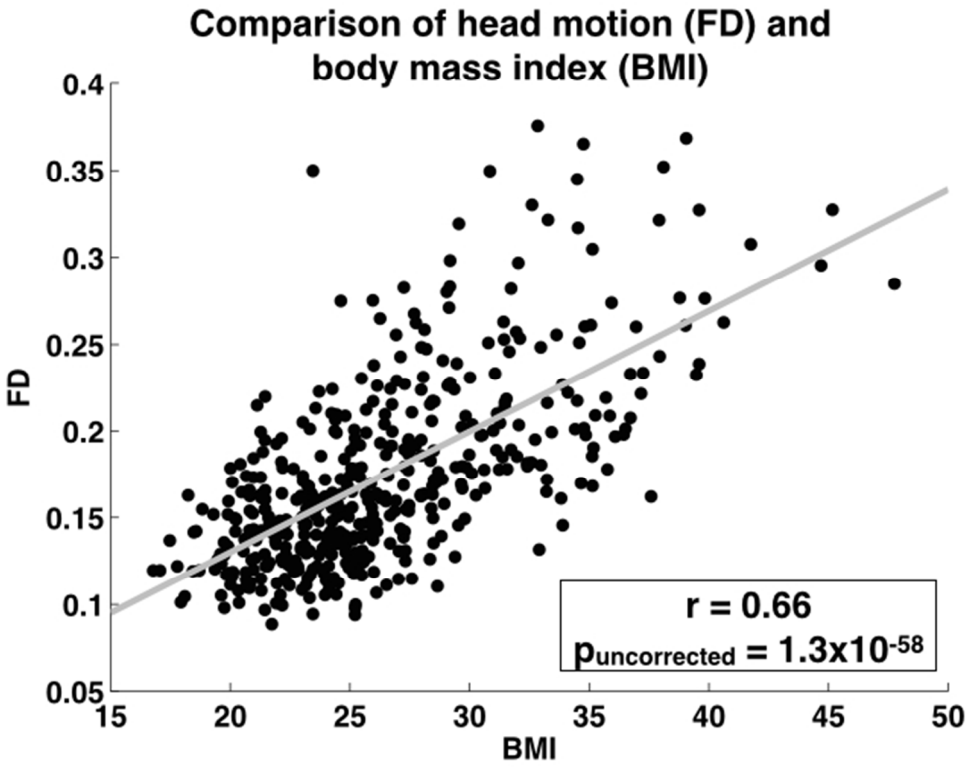

Figure S5. Average in scanner head movement versus Body Mass Index.

55x44mm (300 x 300 DPI)