Appendix A: MRI Imaging Protocol

MRI imaging was performed on a 3 Tesla Siemens Skyra (Erlangen, Germany) MR system. High-resolution T1-weighted anatomical images were acquired using an MP-RAGE pulse sequence with the following parameters: TE=2.57 ms, TR=1.9 s, 192 slices, FOV = 230 mm x230 mm, matrix size = 512 x512, and slice thickness = 1mm. Blood oxygenation level-dependent (BOLD) weighted functional images were acquired using a single-shot gradient echo EPI sequence with the following parameters: TE= 30 ms, TR= 3 s, slices = 36, FOV= 230 mm x 230 mm, matrix size = 128 x 128, slice thickness = 4 mm, number of acquisitions = 240, acquisition time = 12 min. Functional images were acquired with PACE, an on-line prospective motion correction acquisition algorithm, and these motion corrected images were used in all analyses. Functional imaging was performed during the resting state where subjects were instructed to relax, clear their mind, and to keep their eyes open.

Image pre-processing and data analysis were performed using the CONN toolbox as this software package incorporates tools that minimize the effects of motion artifacts and physiological noise and allows for valid interpretation of negative correlations [24]. For pre-processing resting state data was realigned, slice-time corrected, normalized to MNI stereotactic space and spatially smoothed with an 8-mm FWHM Gaussian kernel. Using the CONN artifact reduction tool (ART) single functional images containing outliers in motion and global signal were identified and then defined as nuisance parameters within first level general linear models. For ART a global-signal z-value threshold of 5 and a subject-motion threshold of 0.9 mm were used. Using the CONN aCompCor tool physiological and spurious sources of noise were identified and also used as nuisance parameters within first level general linear models. For aCompCor each subjects' high-resolution anatomical images were used to segment grey matter (GM), white matter (WM) and cerebrospinal fluid (CSF). These masks were then applied to the BOLD images, and the first three principle components of the BOLD time series from WM and CSF included as nuisance parameters. Finally, residual BOLD time-series were then temporally band-pass filtered ($0.008 < f < 0.09$). First-level ROI-to-ROI correlation maps were generated by extracting the residual BOLD time series from each ROI and calculating Pearson's correlation coefficients between all ROIs (164x164). Correlation coefficients were transformed into Fisher Z's for use in second-level analyses.