Introduction: The default mode network (DMN) has been studied in a number of psychiatric and neurological conditions. The changes detected in these disorders are assumed to reflect task-independent basic alterations of brain function. However, there is little data on physiological variation, in particular effects of gender. Given the structural differences in male and female brains, it appears conceivable that basic functional differences might emerge even in the absence of cognitive task. We tested the hypothesis that DMN activity under resting state (RS) conditions differs between male and female healthy volunteers.

Methods: We obtained RS fMRI series (3T, 3x3x3mm resolution, 45 slices, TR 2.55s, 210 volumes) in 67 healthy, right-handed subjects: 33 females (mean age 31.6±8.8), and 34 males (29.8±7.9), matched for age (T-test: p=0.39). All subjects were asked to lie in the MRI scanner keeping their eyes closed with no further specific instructions. Data were pre-processed using SPM8. Band pass (0.009-0.18Hz) frequency filters were applied. We applied FSL MELODIC yielding 30 IC, and an automated routine to select for each subject the component matching the anatomical DMN definition.

We then analyzed the frequency domains for this extracted DMN, estimating the power of a signal at different frequencies. The time course associated with each individual's DMN component was transformed from the time domain to the frequency domain using Welch's method (Welch, 1967).

Results: Our method reliably identified a DMN component in every subject, with no differences of the goodness of fit between groups (p=0.77). We found significant differences (p<0.05 FDR) with males showing larger extent of the network in left superior frontal gyrus (BA10) and left superior temporal gyrus (BA 39) and in women vs. men in a large prefrontal medial area including medial and superior frontal gyrus (BA10/11). We found a significant diagnosis x frequency interaction (F(12, 54)=2.485, p=0.011). T-tests performed post-hoc at each frequency bin showed that the women exhibited significantly higher spectral power than men at a frequency bin around 0.0784 Hz (F=8.038, p=0.006) and 0.1098 Hz (F=6.254, p=0.015).

Conclusions: Our findings provide robust evidence for gender-related modulation of DMN activity under RS. They contradict findings of a recent study (Weissman-Fogel, 2010) suggesting that male and female brains show no difference in DMN activity. In addition power spectrum analysis suggests different power distribution in frequency domain of DMN during RS between genders. Our results suggest that sexual dimorphisms in the brain are detectable already under RS conditions.
