THE IMPACT OF PHYSIOLOGICAL ARTIFACT CORRECTION ON TASK FMRI GROUP COMPARISON

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Target audience: Researchers interested in task fMRI data and physiological artifacts.

Purpose: Physiological noise, such as from cardiac and respiratory processes, is known to impair the analysis of functional magnetic resonance imaging (fMRI) data. Although physiological noise correction is considered to be important in functional connectivity analyses[1] and brain stem fMRI[2], there is little known about the impact of physiological noise correction on task based fMRI group comparisons. We therefore investigated the effect of RETROICOR[3] regressors on a working memory paradigm comparing healthy adults to patients with ADHD.

Methods: We studied 24 control adults (14 females, age 33 (SD = 10)) and 19 patients with ADHD (11 females, age 37 (SD = 10)) using fMRI. The spatial working memory task consisted of eleven circles positioned on a circular grid. Positions of two (low load) or four (high load) filled circles had to be memorized. MRI data were acquired on a GE 3.0 T whole-body scanner. For fMRI, 35 axial slices covering the whole brain were acquired with a multi-slice echo planar imaging (EPI) sequence (TR = 1.925 s; voxel size = 3.75x3.75x3.3 mm^3). Physiological data were measured using the scanner vendor-provided pulse-oximeter and breathing belt. We used SPM 8 and standard pre-processing. The corresponding confound regressors were created using the physIO Toolbox of the TAPAS software collection[4]. We modeled the task once without the physiological regressors and once using the regressors, keeping all other parameters identical.

Results: In the task effect contrast between patients and controls, a number of regions in the brainstem and temporal lobes did not reach significance after including the physiological cofound regressors in the design (displayed in red in Fig. 1), despite considerable overlap in cortical regions. In addition to decreasing the effect of non-task relevant regions, the inclusion of RETROICOR regressors also improved the statistical power and extent of significant task-relevant regions (indicated in green in Fig. 1, overlap between the two analyses indicated in blue).

Discussion: By including physiological noise regressors into a task-based fMRI analysis, we observed an increase in power in task-relevant regions. At the same time, presumably spurious activation in areas previously associated with physiological noise[2] was diminished. Physiological noise correction for fMRI therefore appears to reduce the risk of interpreting group differences caused by physiological artifacts.

Conclusion: The inclusion of physiological confound regressors shows to be advantageous not just for brainstem and resting state fMRI, but also for task based fMRI group studies.

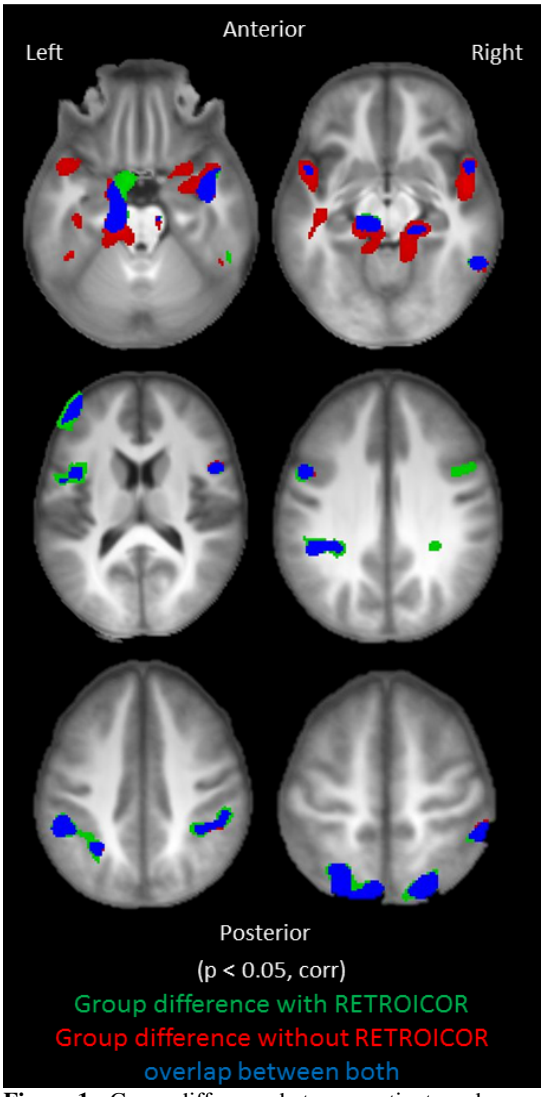

Figure 1 - Group difference between patients and controls with and without RETROICOR

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[2]Brooks, et al., Physiological noise in brainstem fMRI. Front. Hum. Neurosci. 2013;7, 623.
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