METHODS - ACQUISITION

Structural Motion Correction and Cortical Surfaces: a comparison of various motion correction algorithims using reconstructed cortical surfaces

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Structural images from an MR are susceptible to noise from a variety of sources. Averaging data from a number of scans can reduce the effect of noise but requires algorithms to correct for inter-scan motion. Since not all motion correction algorithms minimize motion artifacts equally, a method of comparing the various algorithms would be useful. Here we used the generation of a model of the cortical surface (as described by Dale and Sereno 1993, Dale et al. 1998, Fischl et al. 1998) and its associated Euler number to analyze the effectiveness of various motion correction algorithms: Statistical Parametric Mapping (SPM) motion correction, Montreal Neurological Institute (MNI) motion correction and AFNI.

Topological errors in the cortical surface arise for two reasons: 1)presence of anatomical structures(not resulting from motion artifacts) and 2) errors in segmentation, some of which result from motion artifacts. These topological errors are reflected in the Euler number of the surface, which can be used to calculate the number of holes and/or handles in the surface model. The number of holes can, in turn, be used as a measure of the effectiveness of the motion correction algorithm. The more holes a surface has (the more negative the Euler number), the less effective the motion correction algorithm used to generate the surface. We automatically reconstructed the brains of five subjects first with a variety motion correction algorithms (MNI, SPM and AFNI). Calculation of individual Euler numbers and group (SPM, AFNI, MNI) average revealed the fewest holes for MNI motion correction followed by SPM and then AFNI (refer to Table 1). Thus, preliminary evidence obtained using surface topology,as reflected by the Euler numbers as a measure of motion correction effectiveness shows MNI motion correction to be most effective at mizimizing motion artifacts.

	Number of Holes					
	SPM (RH)	SPM (LH)	AFNI (RH)	AFNI (LH)	MNI (RH)	MNI (LH)
Subject 1	17	26	20	25	23	22
Subject 2	15	25	13	35	13	18
Subject 3	8	14	19	24	10	14
Subject 4	20	30	38	31	18	24
Subject 5	30	24	32	37	20	23
Average	18	24	24	30	17	20