Rest Matters: Kinetics of the BOLD response depend on inter-stimulus interval.

1Kimberlee D’Ardenne McClure, 2,3Samuel M. McClure, 3Marlene C. Richter, 2,3Jonathan D. Cohen, and 1,3Wolfgang Richter
1Department of Chemistry, 2Department of Psychology, 3Center for the Study of Brain, Mind, and Behavior
Princeton University, Princeton, New Jersey, USA

Introduction

Because the BOLD signal persists after stimulus cessation, the temporal dynamics must be accounted for in data analysis - regressor selection is important for event-related experimental designs.

Is there a standard BOLD response? Investigations of underlying physiology - regional variation (e.g. Huettel 2001) - subject age (e.g. Richter 2003) - experimental design (e.g. Bandettini 2000)

Here we investigate the dependence of signal recovery to a steady state activated equilibrium on the length of the inter-stimulus interval (ISI).

Methods

Subjects: 13 subjects (mean age 20 y; 8 male) underwent 2 scanning sessions
Scanning parameters: 3T Siemens Allegra scanner
Functional data collected with EPI scans: - 5 oblique slices aligned parallel to calcarine fissure (Fig. 1) - TR 2.97 ms; TE 30 ms; FA 30; 3mm x 3mm x 3mm voxels

Experiment:
Visual activation was elicited with alternating checkerboard: on for 60 s, rest period varied between 2 s and 60 s (Fig. 2)

Results

Latency of BOLD response to a subsequent stimulus increases with decreasing ISI. Group average (Fig. 4) shows time course for all experiments.

Data analysis:
Data motion corrected with MCFLIRT (Jenkinson 2002)
Active voxels identified through cross-correlation with step function
Time courses from active voxels time-locked averaged with respect to stimulus onset and offset (Fig. 3)

Conclusions

Magnitude (Bandettini 2000) and latency of BOLD response are affected by length of ISI.
Rise time of the BOLD response depends on ISI: rise time increases with shorter ISI.

References