

Abstract Submitted
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BOLD Responses to Stimuli: Dependence on Frequency, Stimulus form, Amplitude, and Repetition Rate. PETER ROBINSON, PETER DRYSDALE, School of Physics, University of Sydney, Australia; Brain Dynamics Center, Westmead Hospital, Australia, HELENA VAN DER MERWE, ELIZABETH KYRIAKOU, MICHELLE RIGOZZI, BILJANA GERMANOSKA, School of Physics, University of Sydney, Australia, CHRISTOPHER RENNIE, School of Physics, University of Sydney, Australia; Brain Dynamics Center, Westmead Hospital, Australia — A quantitative theory is developed for the relationship between stimulus and the resulting Blood Oxygen Level Dependent (BOLD) functional MRI signal in the brain. The relationship of stimuli to neuronal activity during evoked responses is inferred from recent physiology-based modeling of evoked response potentials (ERPs). A hemodynamic model is then used to calculate the BOLD response to neuronal activity. The predicted response is analyzed vs. form, frequency, and amplitude of stimulus. The BOLD frequency response is very nearly linear in the parameter ranges of interest, with the form of a low-pass filter with a weak resonance at 0.07 Hz. For short stimuli, the response is closely proportional to the time-integrated stimulus-evoked activity, rather than the peak amplitude, as often assumed. There can thus be widely differing proportionalities between BOLD and peak activity, a likely reason for the weak expected correlation between ERPs and BOLD.

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