

Predictive Coding and Neural Communication Delays Produce Alpha-Band Oscillatory Impulse Response Functions

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Presentation Abstract Summary Alpha (8-12Hz) oscillations are ubiquitous in the human brain. For example, the cross-correlation between temporally modulated white-noise visual stimuli and EEG waveforms reveals an impulse-response function (IRF) that reverberates at alpha frequency for several cycles. Yet the exact functional role of alpha rhythms in visual perception is still unknown. Here, I show that in a simplified model of visual cortex where neurons at one level seek to “explain away” the neuronal activation pattern at the previous level (i.e. “predictive coding”), alpha-band oscillatory IRFs naturally arise when neural communication delays between the two levels are taken into account. In fact, alpha oscillations are most robust when neuronal time constants and inter-areal delays are chosen with biologically plausible values –around 15-25ms and 10-15ms, respectively. The pervasive correlation between alpha rhythms and visual perception reported in numerous experimental studies could thus represent, in part, the signature of a basic computational principle: predictive coding.

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