

Noise: Summary of Autocorrelation Modeling

Model	Autocorrelation V known or estimated?	Estimation of β	Variance of $\hat{\beta}$	Estimation of σ^2
Independent	n/a	Unbiased	Suboptimal	Biased-worst
Prewhitening	Known	Unbiased	Optimal	Unbiased
Prewhitening	Est.	Unbiased	Suboptimal*	Biased-worse*
Pre-coloring	Known	Unbiased	Suboptimal	Unbiased
Pre-coloring	Est.	Unbiased	Suboptimal-worse*	Biased*

* From "To Smooth or Not to Smooth"

K.J. Friston, O. Josephs, E. Zarahn, A.P. Holmes, S. Rougette, and J.-B. Poline. "To smooth or not to smooth? Bias and efficiency in fMRI time-series analysis." *NeuroImage*, 12:196-208, 2000.

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- Friston *et al.* temporal smoothing justification
 - Accept suboptimal precision for $\hat{\beta}$,
 - In exchange for better precision of $\hat{\sigma}^2$, and
 - Robustness with respect to wrong intrinsic autocorrelation
 - With smoothing, get same results assuming either

$$\text{Var}(\epsilon) = I_n$$

$$\text{Var}(\epsilon) = \hat{V} \quad (\text{e.g. from AR}(p) \text{ model})$$
- Note this is *intrasubject* modeling issue
 - If only interest is in *intersubject*, random effects inference, none of this matters
 - In that case, only need unbiased $\hat{\beta}$, which the independence model offers