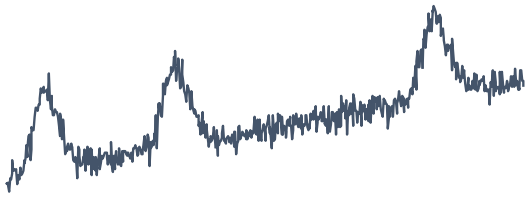
fMRI data analysis

Part 4: Potential Pitfalls & Issues

Potential Pitfalls in regression analysis

- Multi-collinearity

2 regressors cannot be the same



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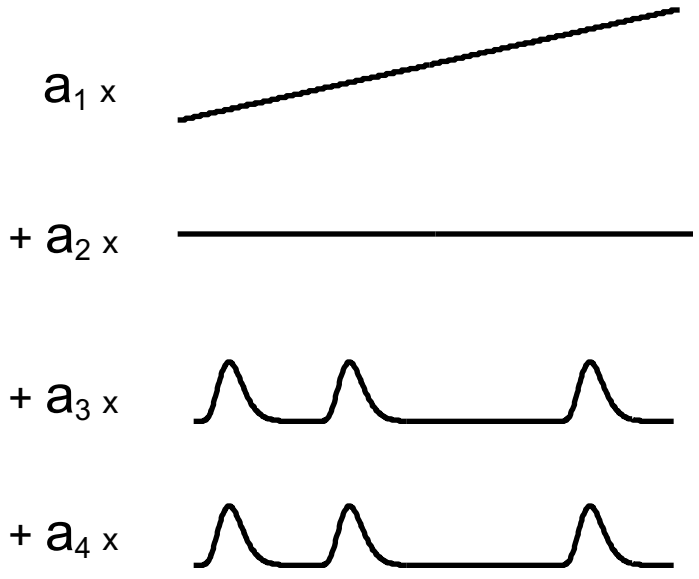


$$S(t) = \beta \cdot r(t) + \eta$$

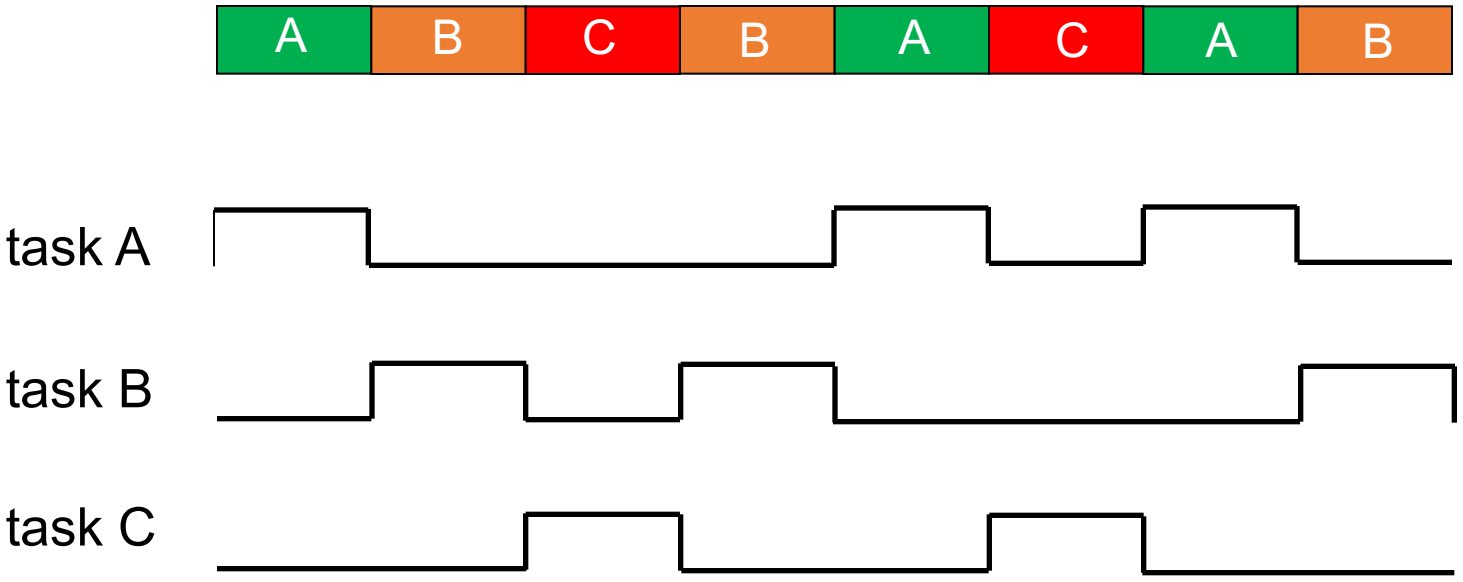
$$S = R\,\beta + \eta \qquad ?$$

$$\beta = (R^T R)^{-1} R^T S$$

Not invertible

Issues - Multi-collinearity

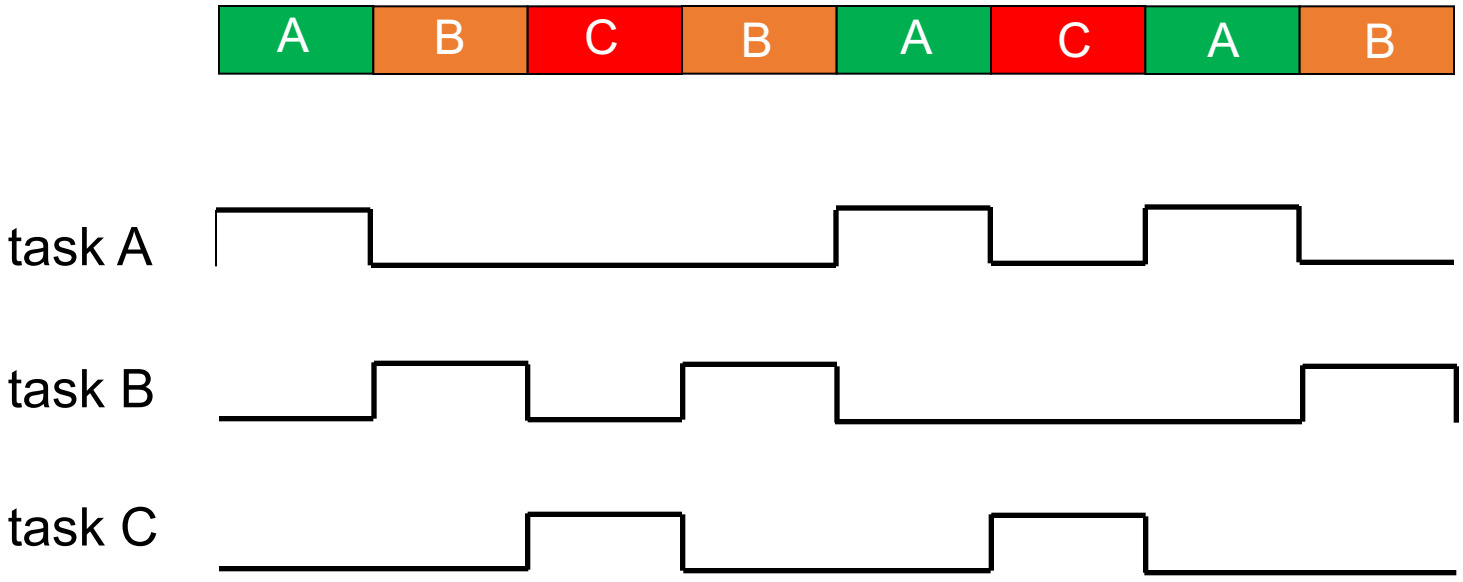
Linear combination of any regressors cannot be equal to another regressor



Sum of regressors = constant ⇒ Problem!

Issues - Multi-collinearity

Linear combination of any regressors cannot be equal to another regressor



Solution: choose one condition to be the “control”

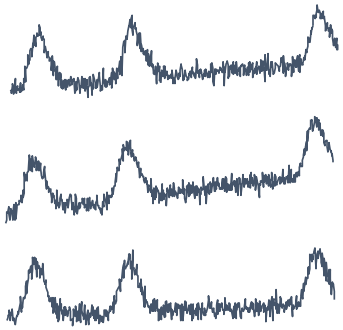
Other tasks are then compared relative to this control

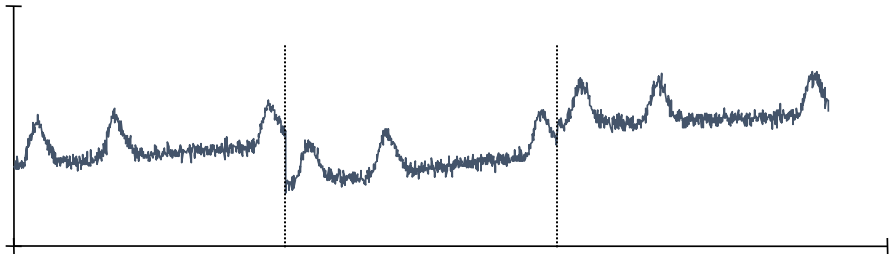
Issues – Multiple Runs

Easy – just concatenate the runs

Special Considerations:

- Stimuli from one run can't affect signals in next run
- Each run can have different mean and linear trend



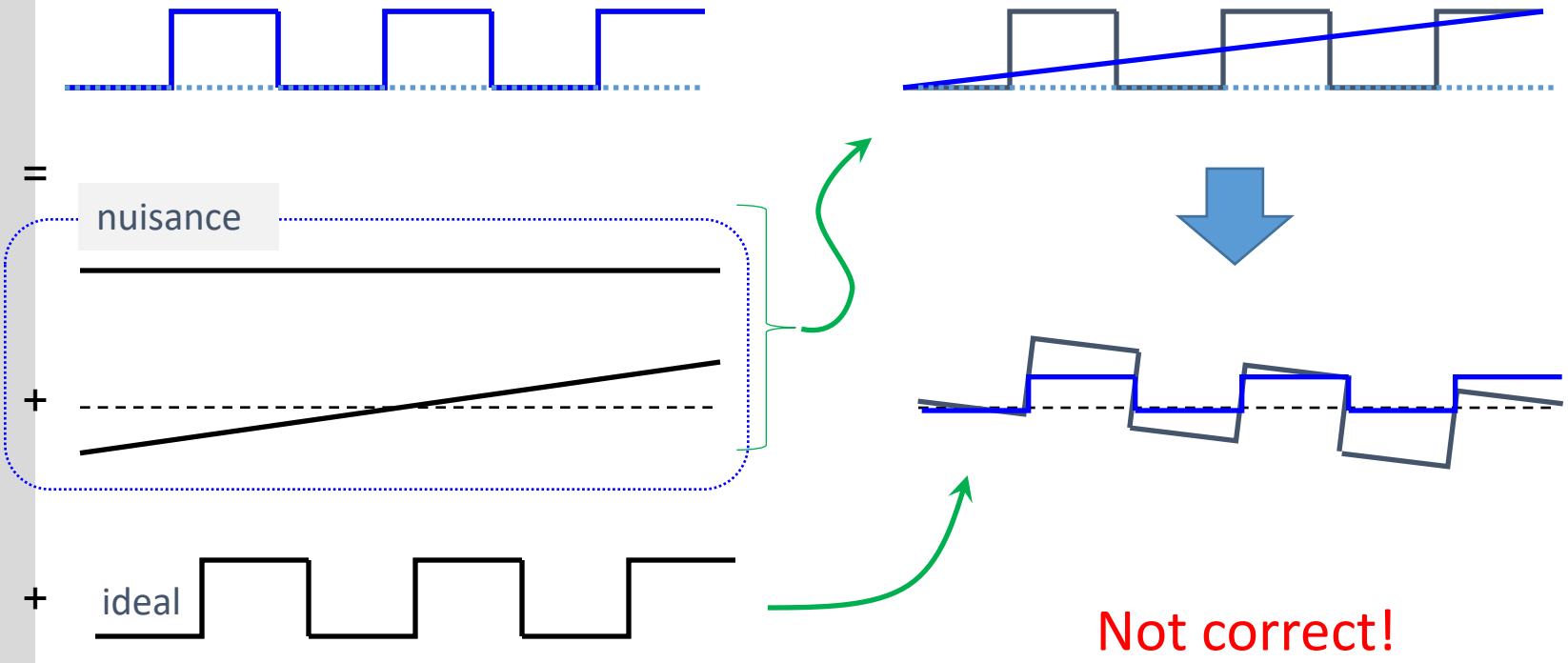


Nuisance variables – regress out first?

One regression
(ideal & nuisance)

Regress nuisance first …

… then fit ideal



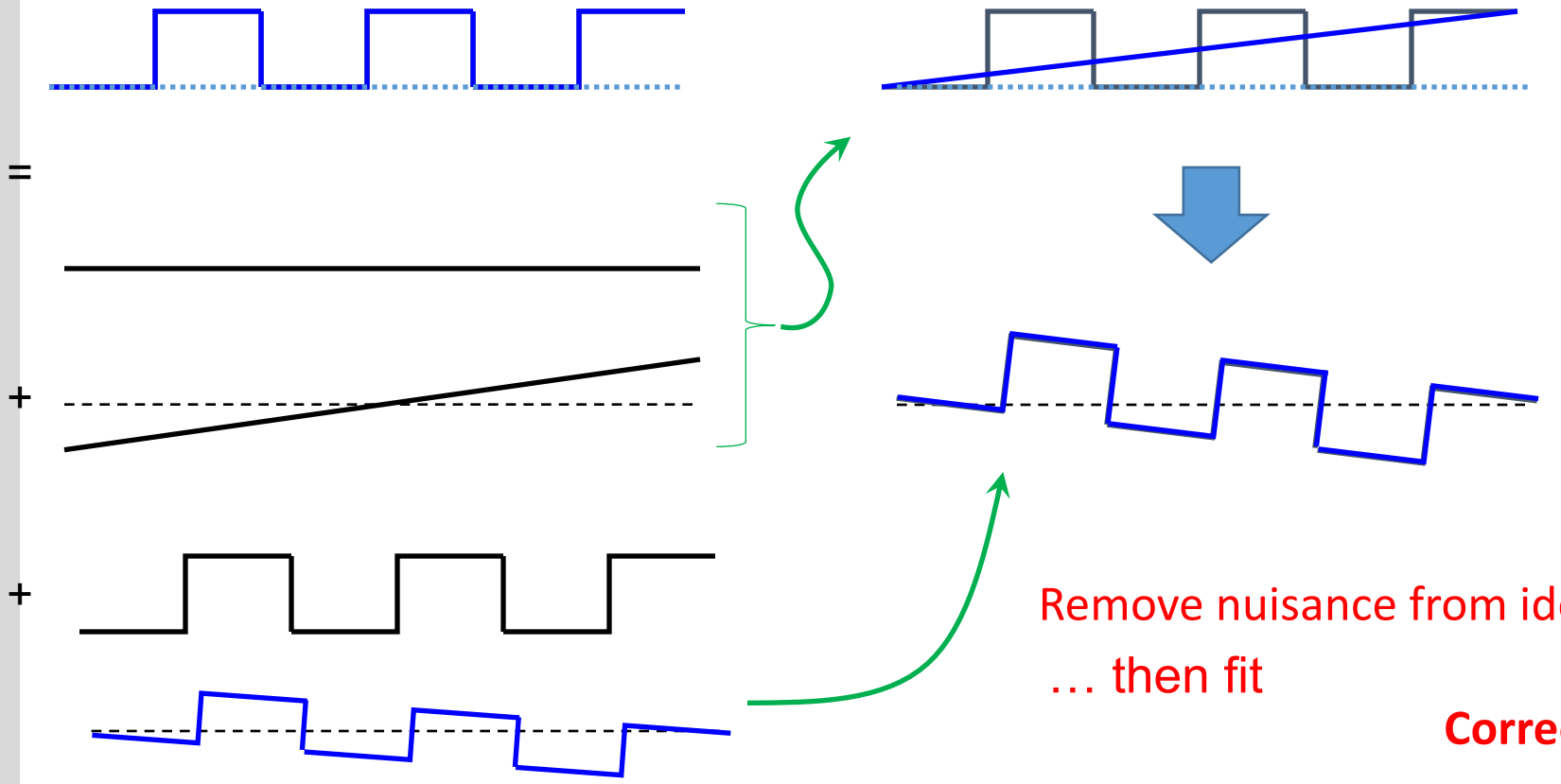
Not correct!

Nuisance variables – regress out first?

One regression
(ideal & nuisance)

Regress nuisance first …

… then fit ideal



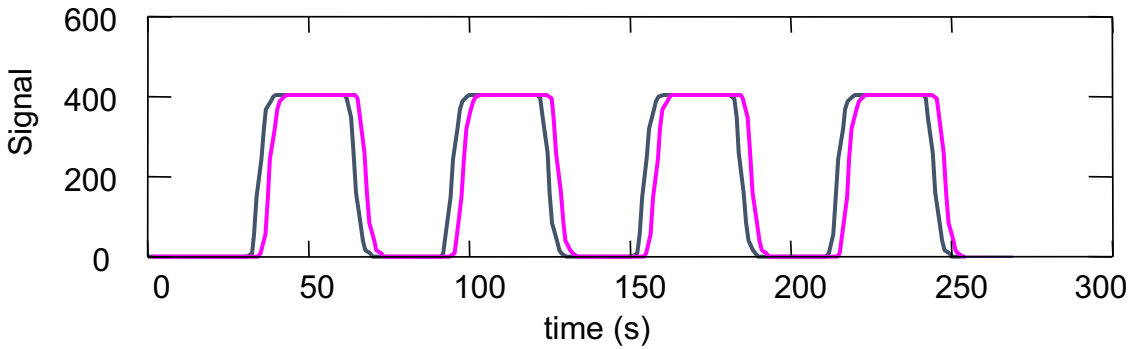
Remove nuisance from ideal

… then fit

Correct!

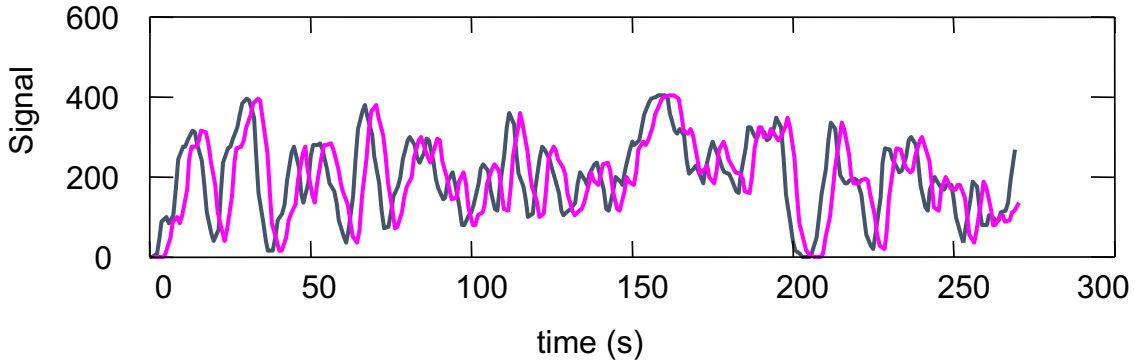
Issues - Timing

Event-related designs are more sensitive to timing errors



Shift = 3s

CC = 0.907



CC = 0.512