



Multi-Session & Multi-Subject

- 5 subjects each have three sessions.

Does the group activate on average?

- Use three levels: in the **second level** we model the within-subject repeated measure

General Linear Model

EVs Contrasts & F-tests

Number of EVs 5

Number of groups 1

	Group	EV1	EV2	EV3	EV4	EV5
Input 1	1	1	0	0	0	0
Input 2	1	1	0	0	0	0
Input 3	1	1	0	0	0	0
Input 4	1	0	1	0	0	0
Input 5	1	0	1	0	0	0
Input 6	1	0	1	0	0	0
Input 7	1	0	0	1	0	0
Input 8	1	0	0	1	0	0
Input 9	1	0	0	1	0	0
Input 10	1	0	0	0	1	0
Input 11	1	0	0	0	1	0
Input 12	1	0	0	0	1	0
Input 13	1	0	0	0	0	1
Input 14	1	0	0	0	0	1
Input 15	1	0	0	0	0	1

View design Covariance Done

General Linear Model

EVs Contrasts & F-tests

Contrasts 5 F-tests 0

	Title	EV1	EV2	EV3	EV4	EV5
C1	subject 1	1	0	0	0	0
C2	subject 2	0	1	0	0	0
C3	subject 3	0	0	1	0	0
C4	subject 4	0	0	0	1	0
C5	subject 5	0	0	0	0	1

View design Covariance Done



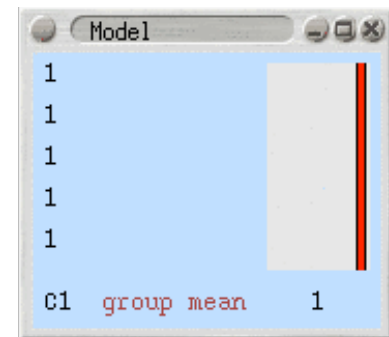
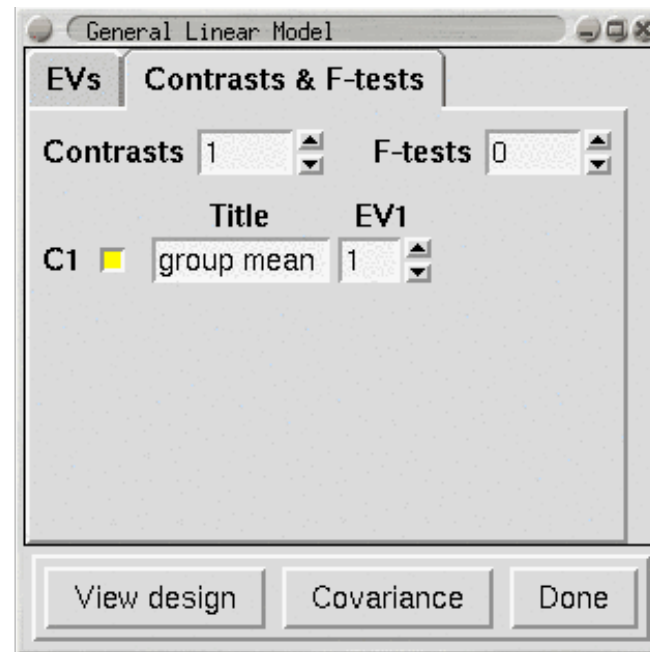
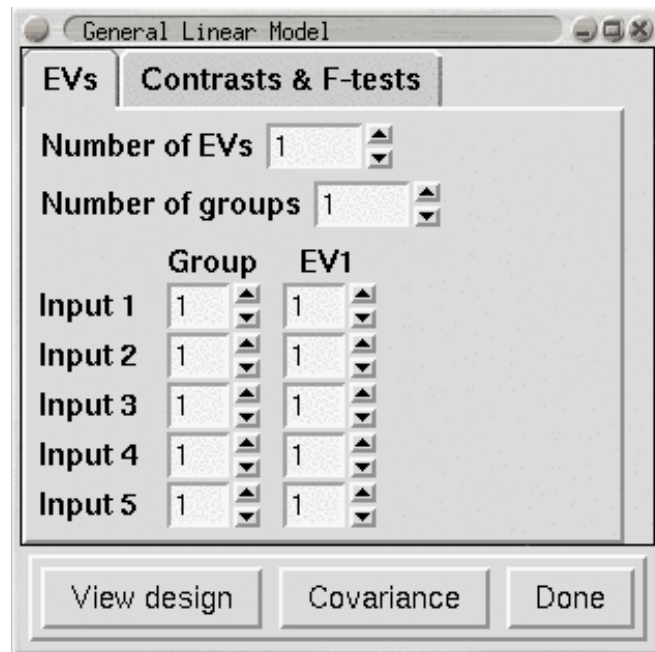


Multi-Session & Multi-Subject

- 5 subjects each have three sessions.

Does the group activate on average?

- Use three levels: in the **third level** we model the between-subjects variance





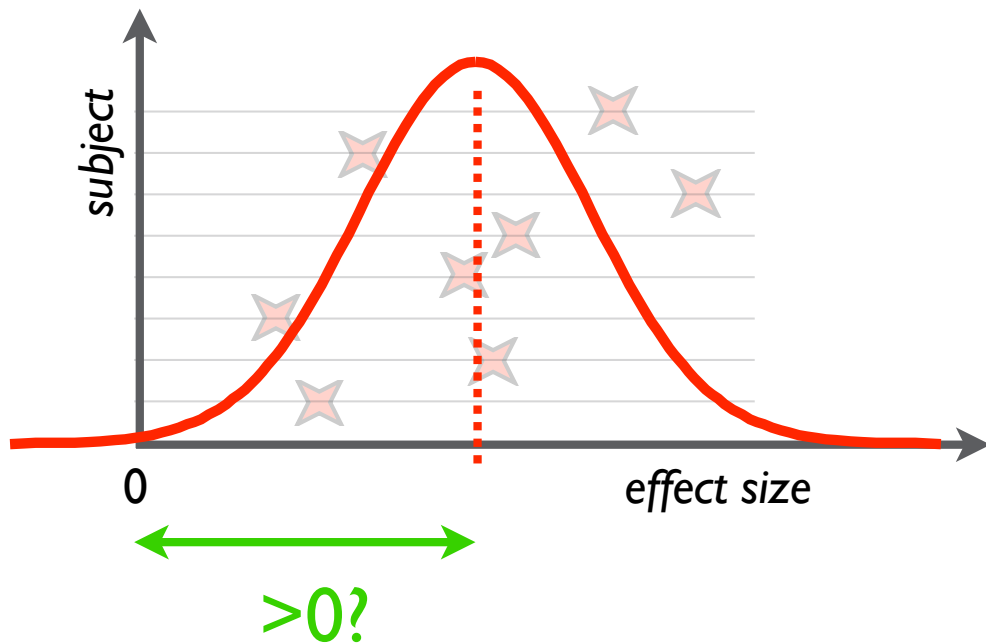
Multi-Session & Multi-Subject

- 5 subjects each have three sessions.
- Does the group activate on average?
- Use three levels:
 - in the second level we model the within subject repeated measure typically using **fixed effects**(!) as *#sessions* are small
 - in the third level we model the between subjects variance using fixed or mixed effects

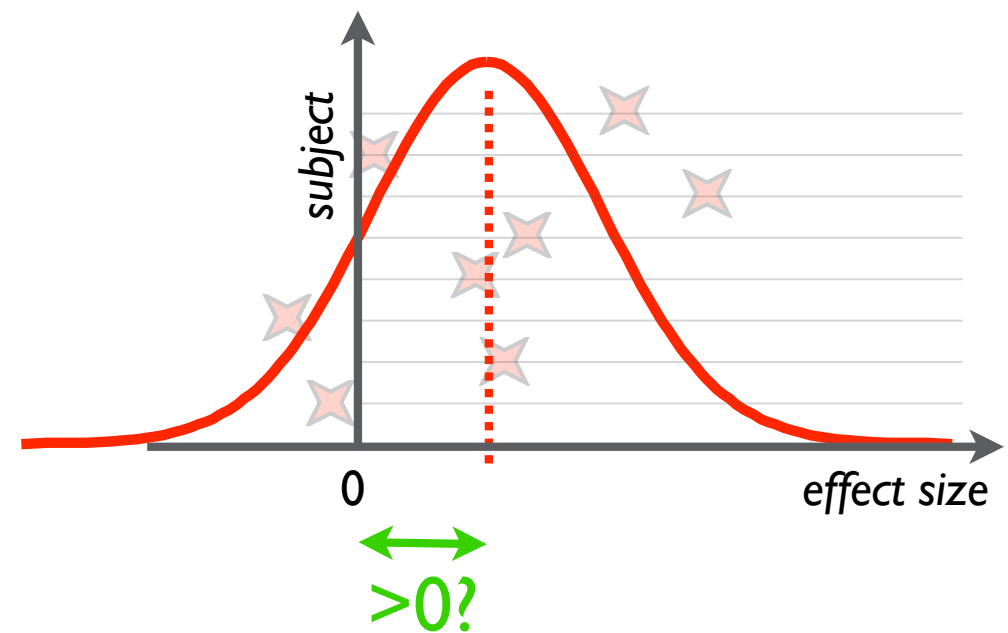


Reducing variance

Does the group activate on average?



mean effect size large
relative to std error

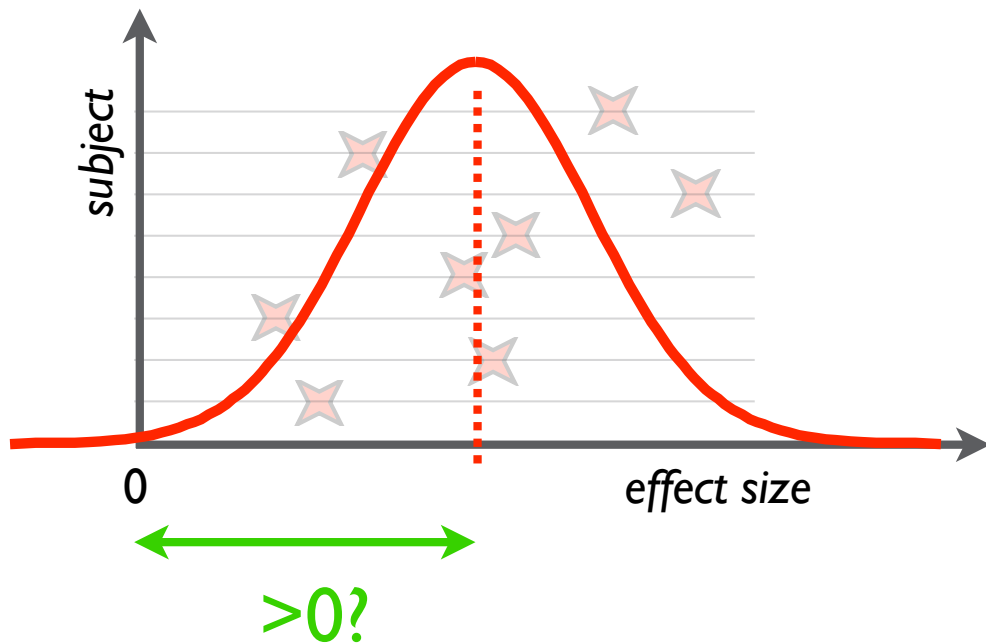


mean effect size small
relative to std error

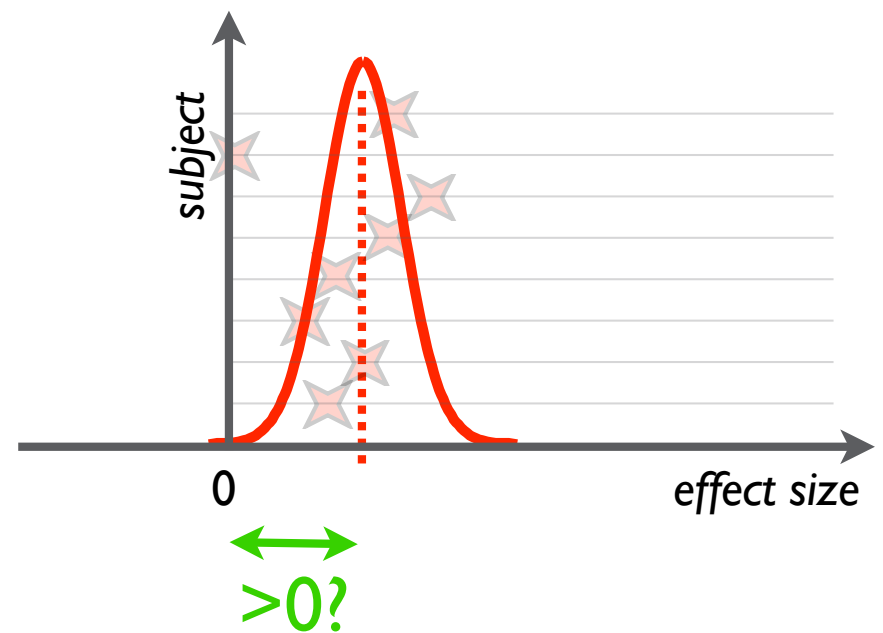


Reducing variance

Does the group activate on average?



mean effect size large
relative to std error



mean effect size large
relative to std error

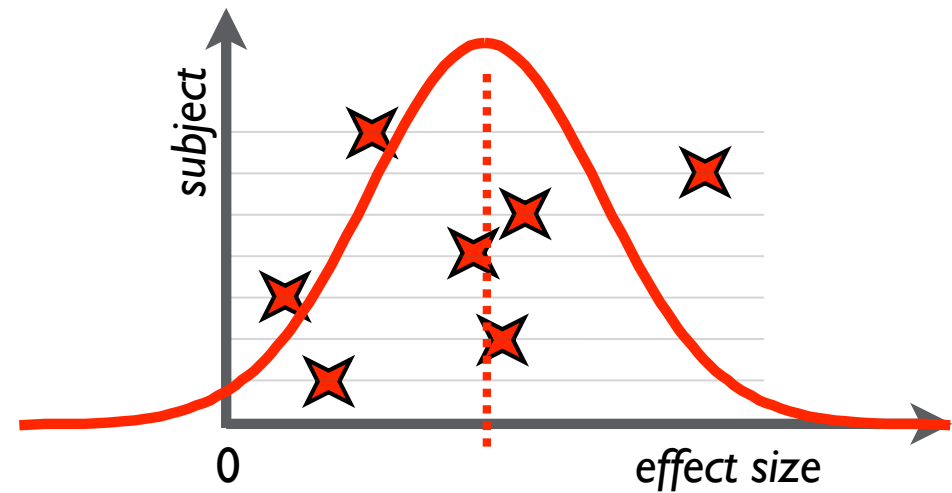


Single Group Average & Covariates

- We have 7 subjects - all in one group. We also have additional measurements (e.g. age; disability score; behavioural measures like reaction times):

Does the group activate on average?

- use covariates to 'explain' variation
- estimate mean
- estimate std-error (FE or ME)



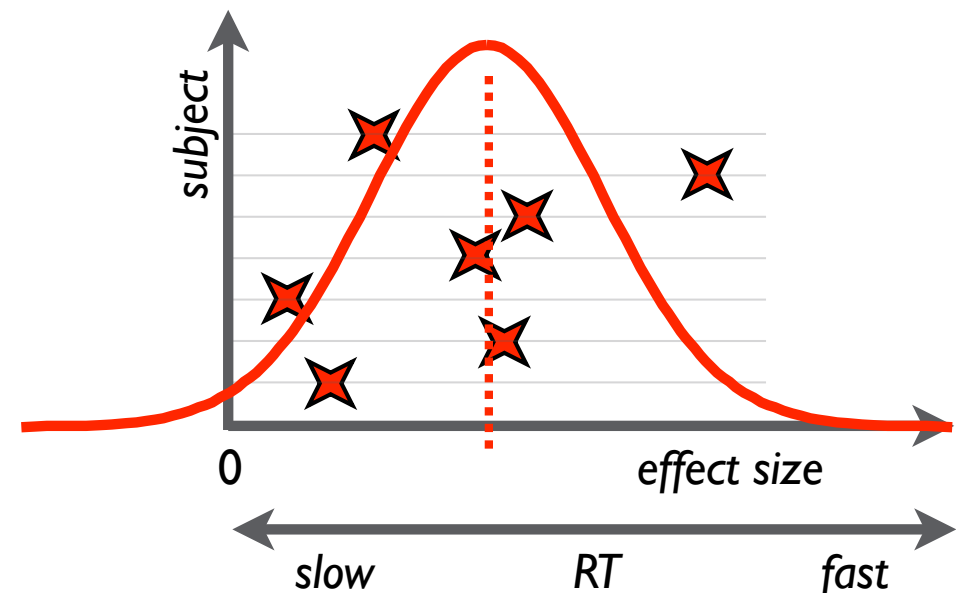


Single Group Average & Covariates

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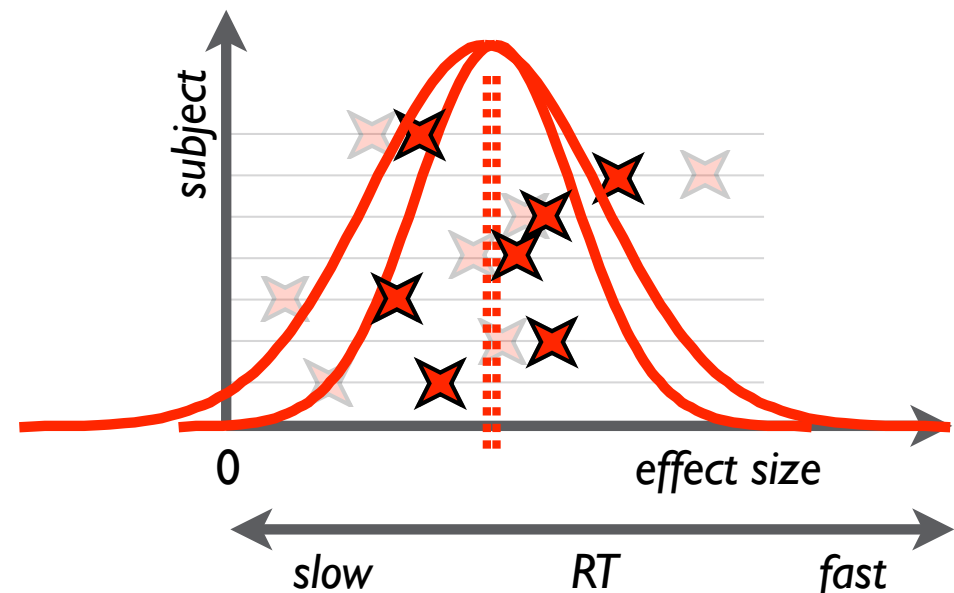


Single Group Average & Covariates

- We have 7 subjects - all in one group. We also have additional measurements (e.g. age; disability score; behavioural measures like reaction times):

Does the group activate on average?

- use covariates to 'explain' variation
- estimate mean
- estimate std-error (FE or ME)





Single Group Average & Covariates

Does the group activate on average?

- use covariates to ‘explain’ variation
- need to de-mean additional covariates!

General Linear Model

EVs Contrasts & F-tests

Number of EVs 2

Number of groups 1

	Group	EV1	EV2
Input 1	1	1	24
Input 2	1	1	-18
Input 3	1	1	-7
Input 4	1	1	5
Input 5	1	1	-4
Input 6	1	1	6
Input 7	1	1	-6

View design Covariance Done

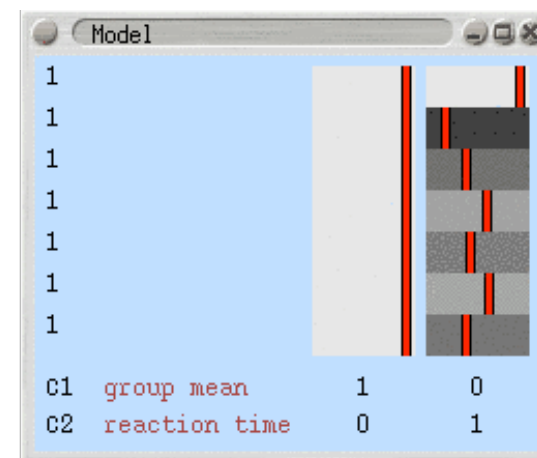
General Linear Model

EVs Contrasts & F-tests

Contrasts 2 F-tests 0

	Title	EV1	EV2
C1	group mean	1	0
C2	reaction time	0	1

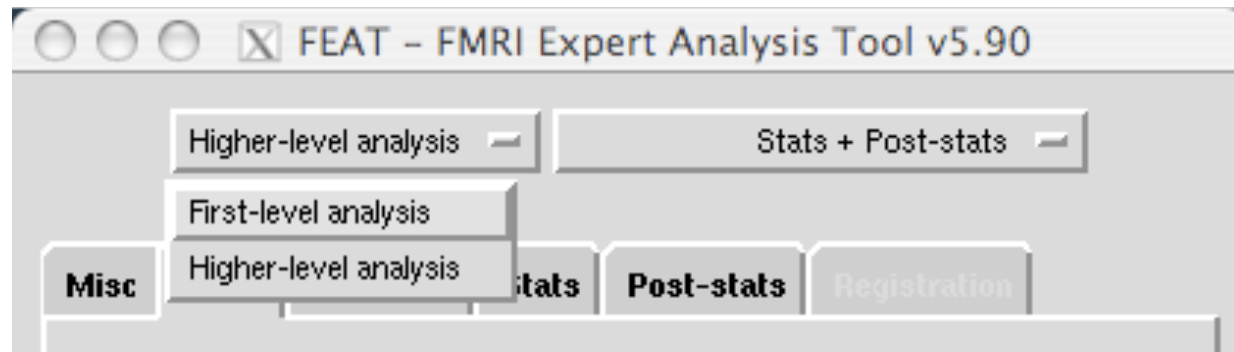
View design Covariance Done





FEAT Group Analysis

- Run FEAT on raw FMRI data to get first-level .feat directories, each one with several (consistent) COPEs



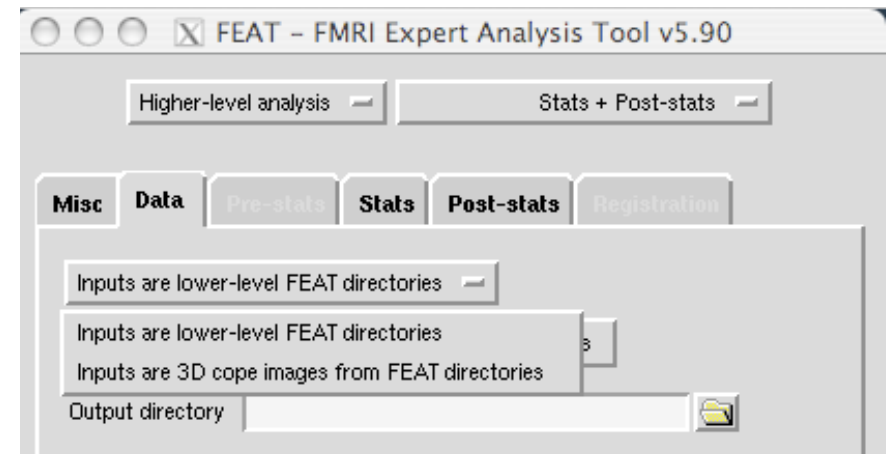
- low-res copeN/varcopeN → .feat/stats
- when higher-level FEAT is run, highres copeN/varcopeN → .feat/reg_standard



FEAT Group Analysis

- Run second-level FEAT to get one .gfeat directory

- Inputs can be lower-level .feat dirs or lower-level COPEs



- the second-level GLM analysis is run separately for each first-level COPE
- each lower-level COPE generates its own .feat directory inside the .gfeat dir



FMRI Group Analysis

Summary:

- Examples shown for: single group; unpaired group diff; paired t-test; multi-session/level; covariates
- Specific cases all generalise from the basic principles
- Use systematic order of inputs and remember it
- Fixed effects must be used for second-level in multi-session due to the low number of sessions
- Must demean covariate values *before* they go into GLM