Advanced Analysis: Factorial Designs and Interactions

Scenario:

Investigating in multi-sensory regions

Specific questions:

What regions show responses to vision, touch

What regions respond significantly to both?

Are responses additive where there is both visual and touch stimulation, or is there an interaction?

Solution:

Specific regressors

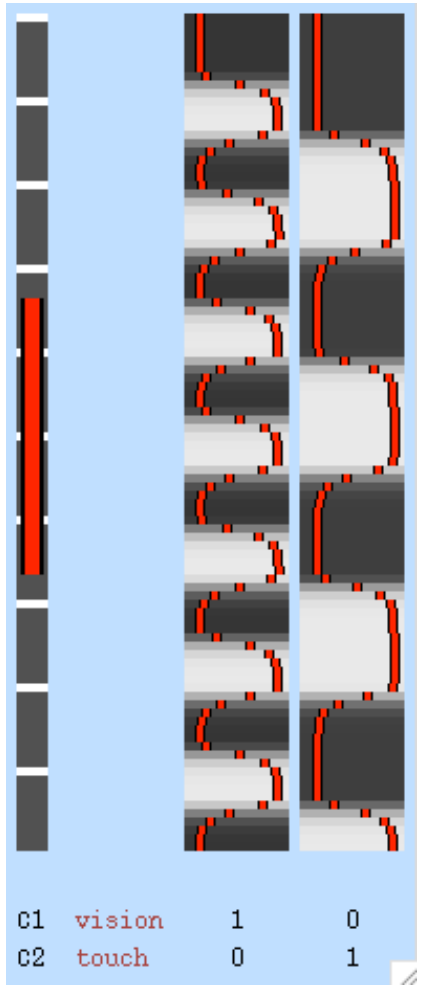
Contrast masking

Multisensory study

- EV1 models vision on/off
- EV2 models touch on/off

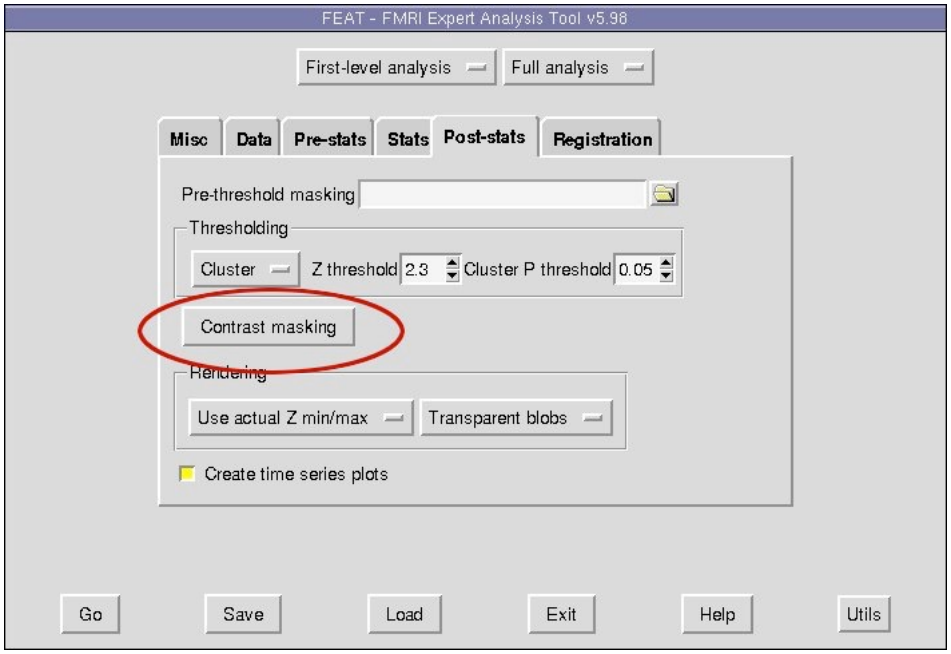
- Can generate simple contrasts for:
- vision activation/deactivation [1 0]
- touch activation/deactivation [0 1]
- differences in responses [1 -1]

- Regions showing both visual and tactile response??
- Not [1 1]: this only assesses the average



Contrast Masking

- Often it is of interest to identify regions showing significant effects in multiple contrasts (e.g. responds to visual AND tactile stimulations)
- This can be achieved by masking a thresholded z image for a chosen contrast using the thresholded z image from one or more other contrasts.



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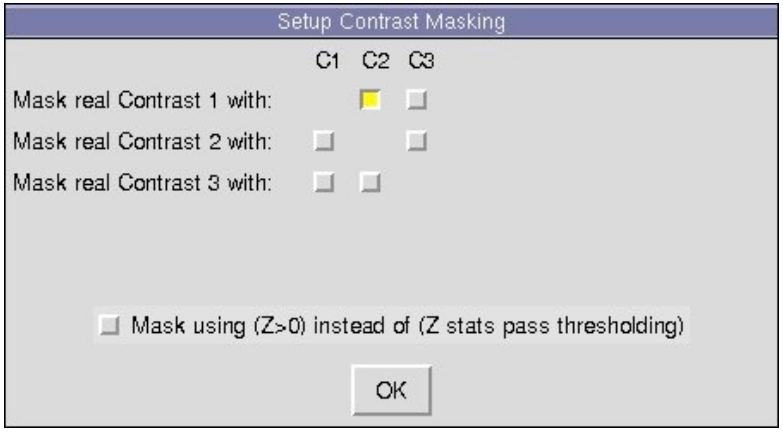
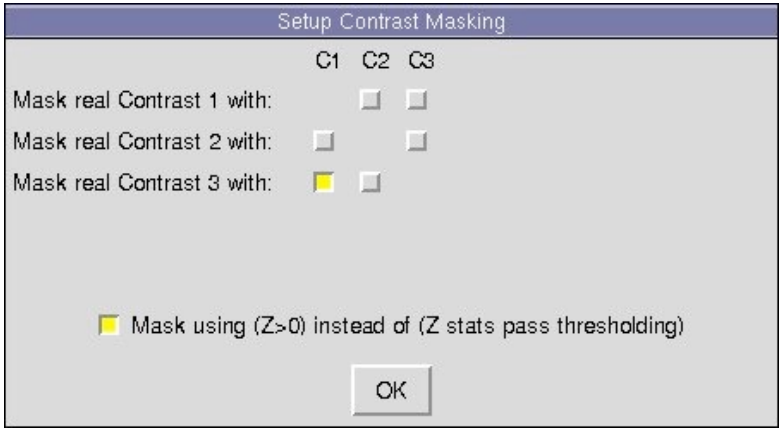


For example, say we had two t contrasts C1 (1 0) and C2 (0 1). We may be interested in only those voxels which are significantly "active" for both contrasts

Contrast Masking

- Rather than masking with voxels which survive thresholding, it may be desirable to mask using positive z statistic voxels instead



For example, say that we have two t contrasts C3 (1 -1) and C1 (1 0). It may be desirable to see those voxels for which EV1 is bigger than EV2, only when EV1 is positive

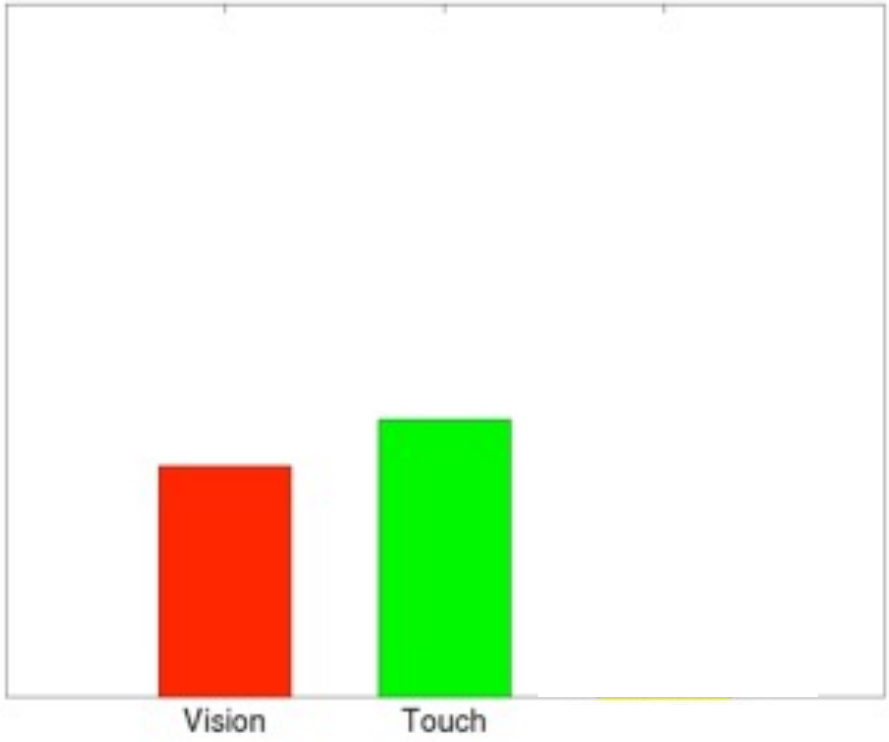
Factorial design

	No Vision	Vision
No Touch		
Touch		

- Allows you to characterise interactions between component processes
  - i.e. effect that one component has on another

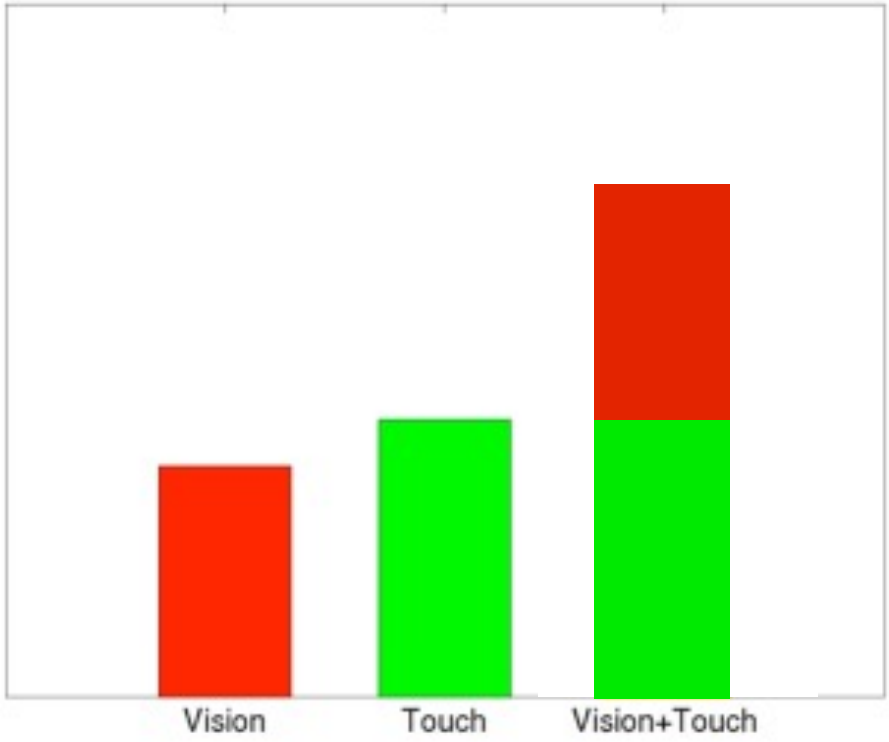
No Interaction Effect

	No Vision	Vision
No Touch		
Touch		



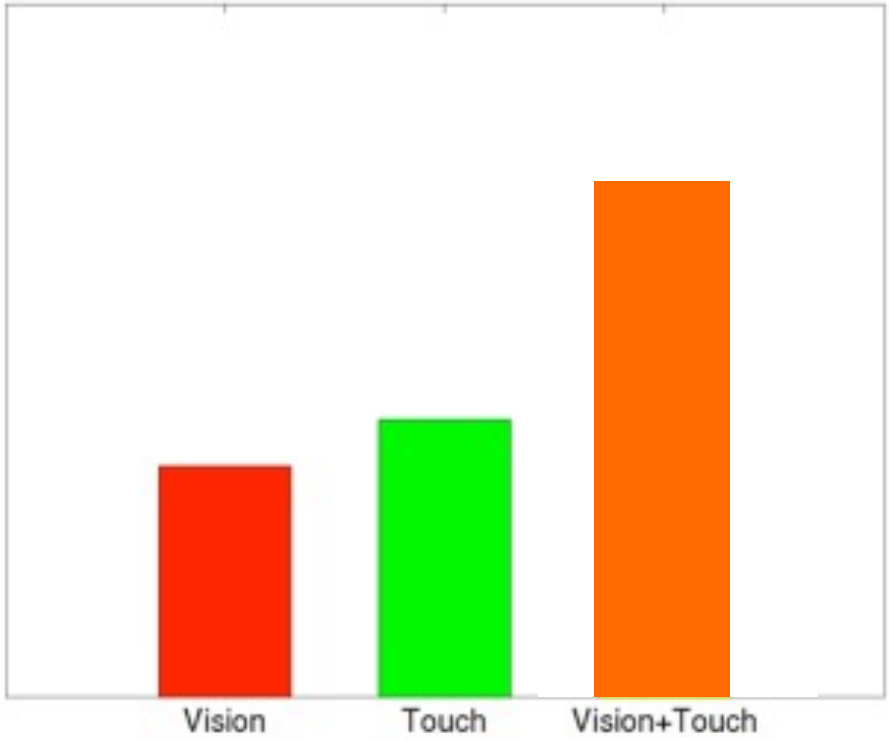
No Interaction Effect

	No Vision	Vision
No Touch		
Touch		



No Interaction Effect

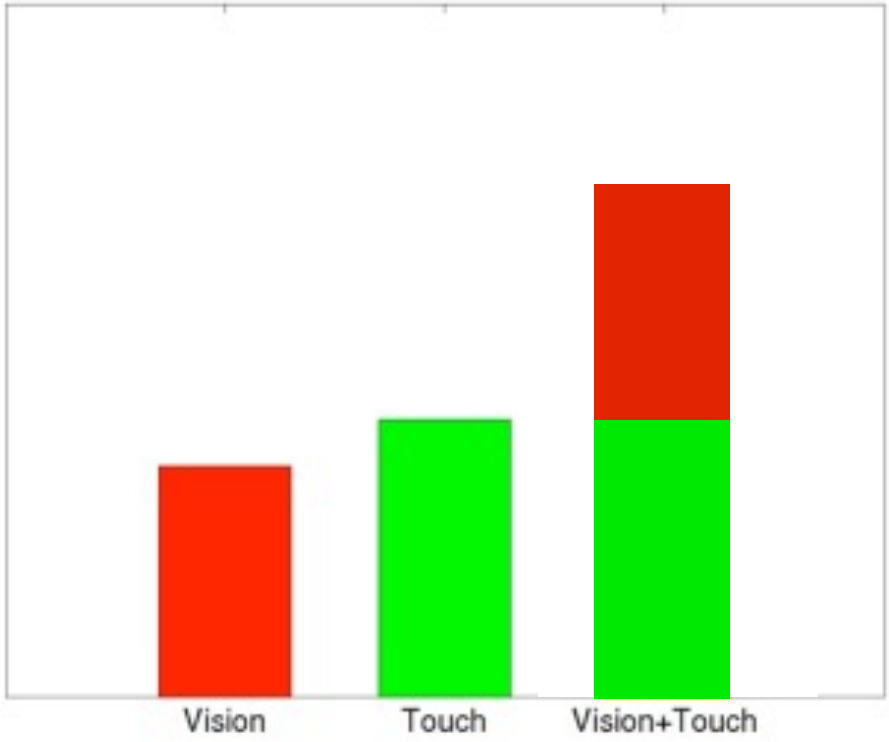
	No Vision	Vision
No Touch		
Touch		



No interaction -
effects add linearly

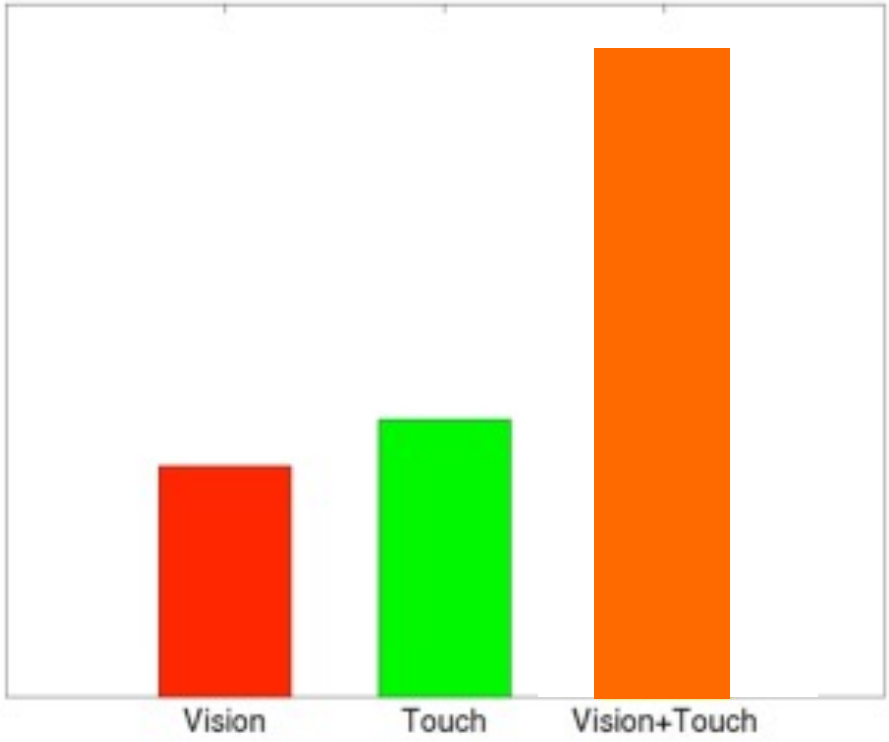
Positive Interaction Effect

	No Vision	Vision
No Touch		
Touch		



Positive Interaction Effect

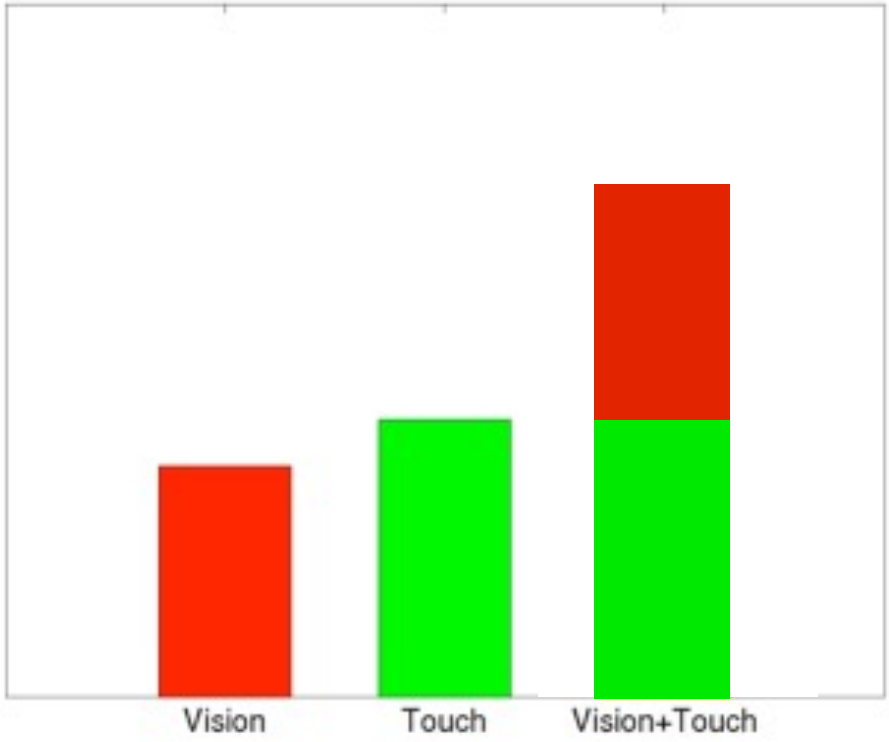
	No Vision	Vision
No Touch		
Touch		



Positive interaction - "superadditive"

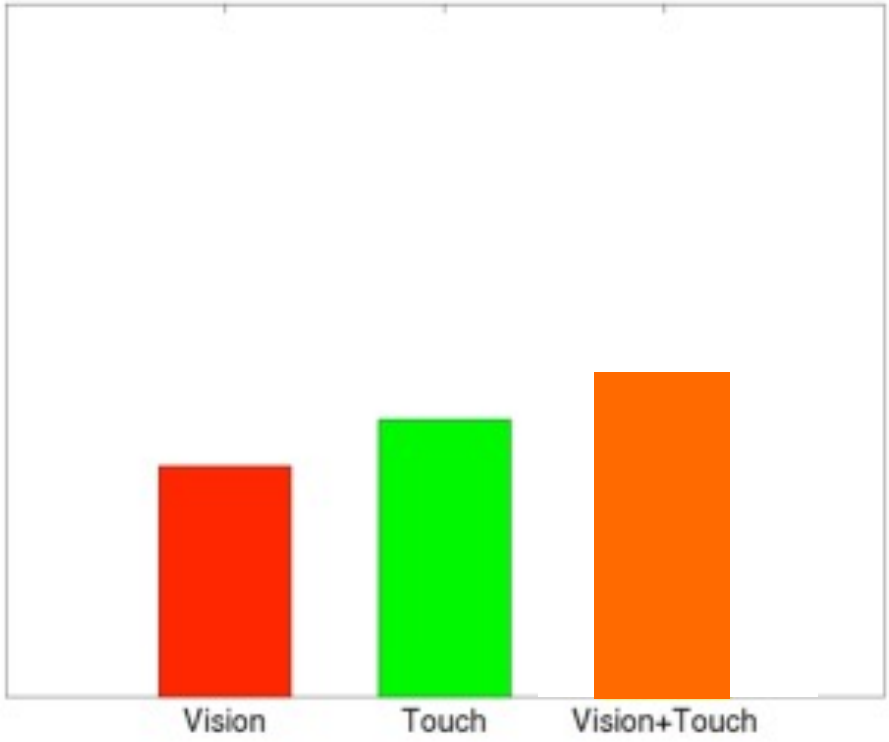
Negative Interaction Effect

	No Vision	Vision
No Touch		
Touch		



Negative Interaction Effect

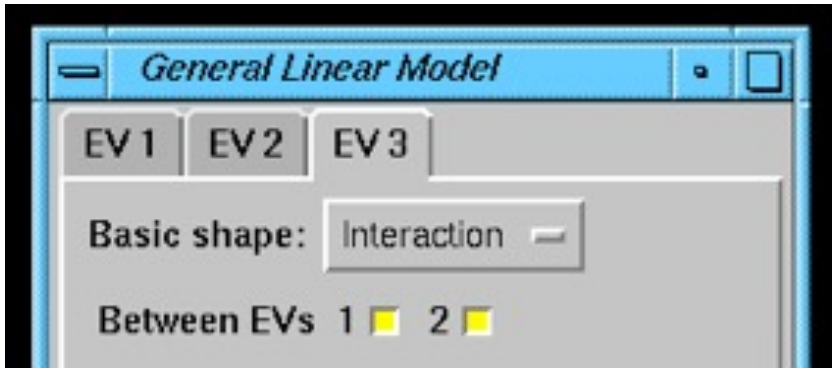
	No Vision	Vision
No Touch		
Touch		



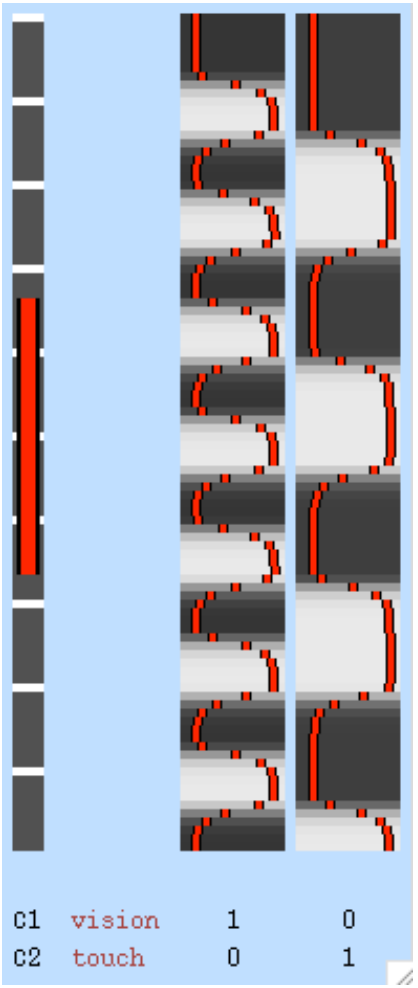
Negative interaction
- "subadditive"

Modelling Interactions Between EVs

	No Vision	Vision
No Touch		
Touch		

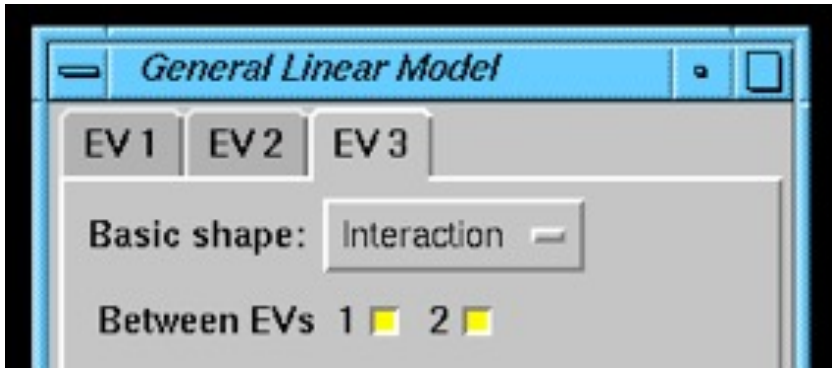


- EV1 models vision on/off
- EV2 models touch on/off

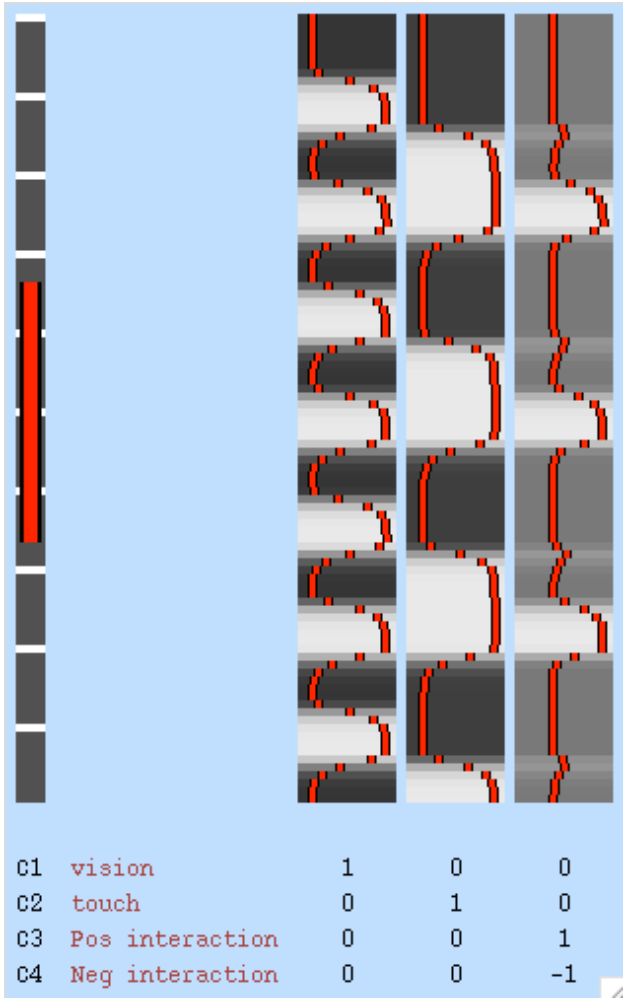


Modelling Interactions Between EVs

	No Vision	Vision
No Touch		
Touch		



- EV1 models vision on/off
- EV2 models touch on/off
- EV3 Models interaction



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Summary:

- Contrast masking allows questions of the form "A *and* B" to be asked
    - F-tests ask "A or B or both"
- Factorial design covers different combinations including the interaction
- Interaction can be positive, negative or none and is tested using an extra EV and a simple contrast