Week 6 – First-level fMRI data analysis

L06-06. Making Custom Regressors (onsets2fmridesign.m)

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❖ Contents

❖ **onsets2fmridesign.m** function in CanlabCore


```
1  function [X, delta, delta_hires, hrf] = onsets2fmridesign(ons, TR, varargin)
2  % Builds design matrix X and delta function, given cell array of onset times in s
3  % One cell per condition per session, e.g., ons{1} = [24 27 29 44]';
```

❖ Why do we need custom regressors?
- When single-trial model is not appropriate, and you want to make "customized" regressor in a more flexible manner
- When you have multiple experimental conditions and want to identify brain regions that preferentially track each variable controlling for other variables, you need to make custom regressors for each variable
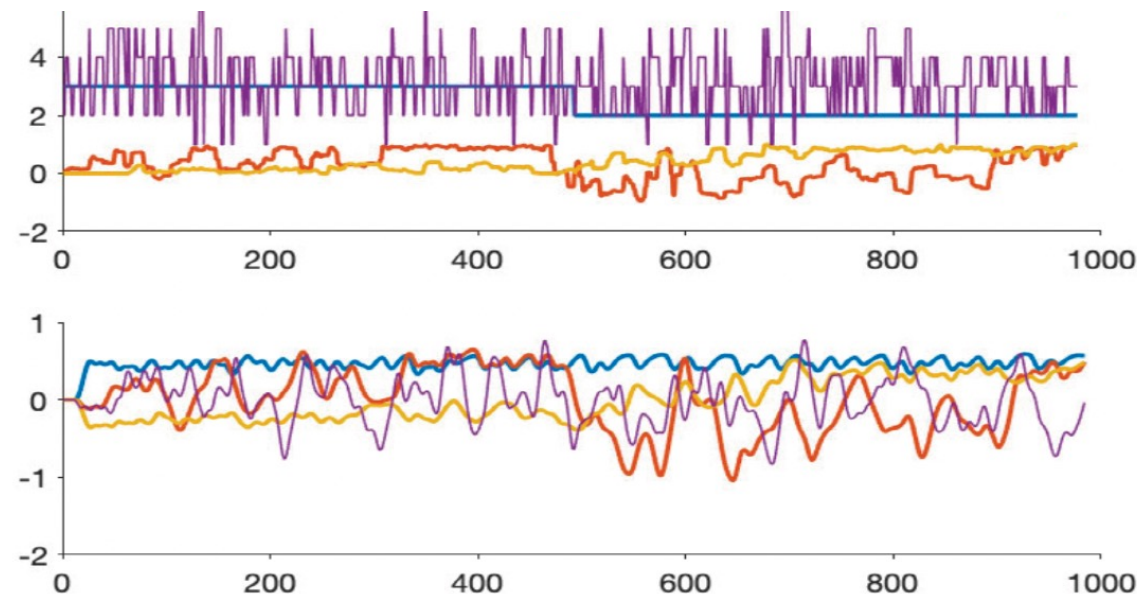
❖ How do we make custom regressors?

- Use onsets2fmridesign.m to apply HRF to the design matrix

```
X{run_i} = onsets2fmridesign([onsets{run_i}, durations{run_i}], 0.46, m*0.46, spm_hrf(1));
```

Onsets and durations
(in two columns)

TR (in seconds)

m = number of measurements in the run

spm_hrf(1)

```
>> [onsets{run_i}, durations{run_i}]

ans =

    51.5173    4.8831
    95.2491    4.7993
   147.8637    4.8545
   185.5474    4.8480
   238.1989    4.8658
   282.9421    4.7877
   335.6083    4.7865
   377.0859    4.9743
   429.9263    4.7983
   476.5022    4.8878
   513.1364    4.9307
   565.8369    4.8828
   616.6137    4.7663
   661.2807    4.7860
   707.9787    4.9814
```
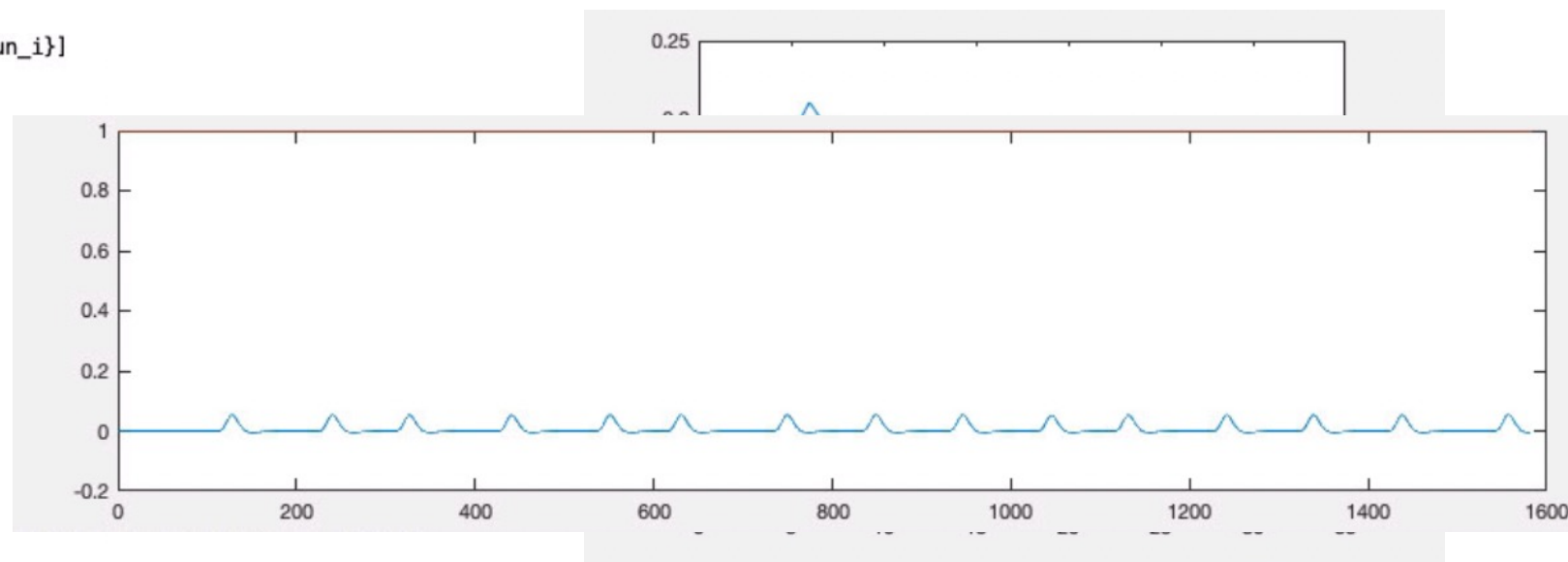
❖ How do we make custom regressors?

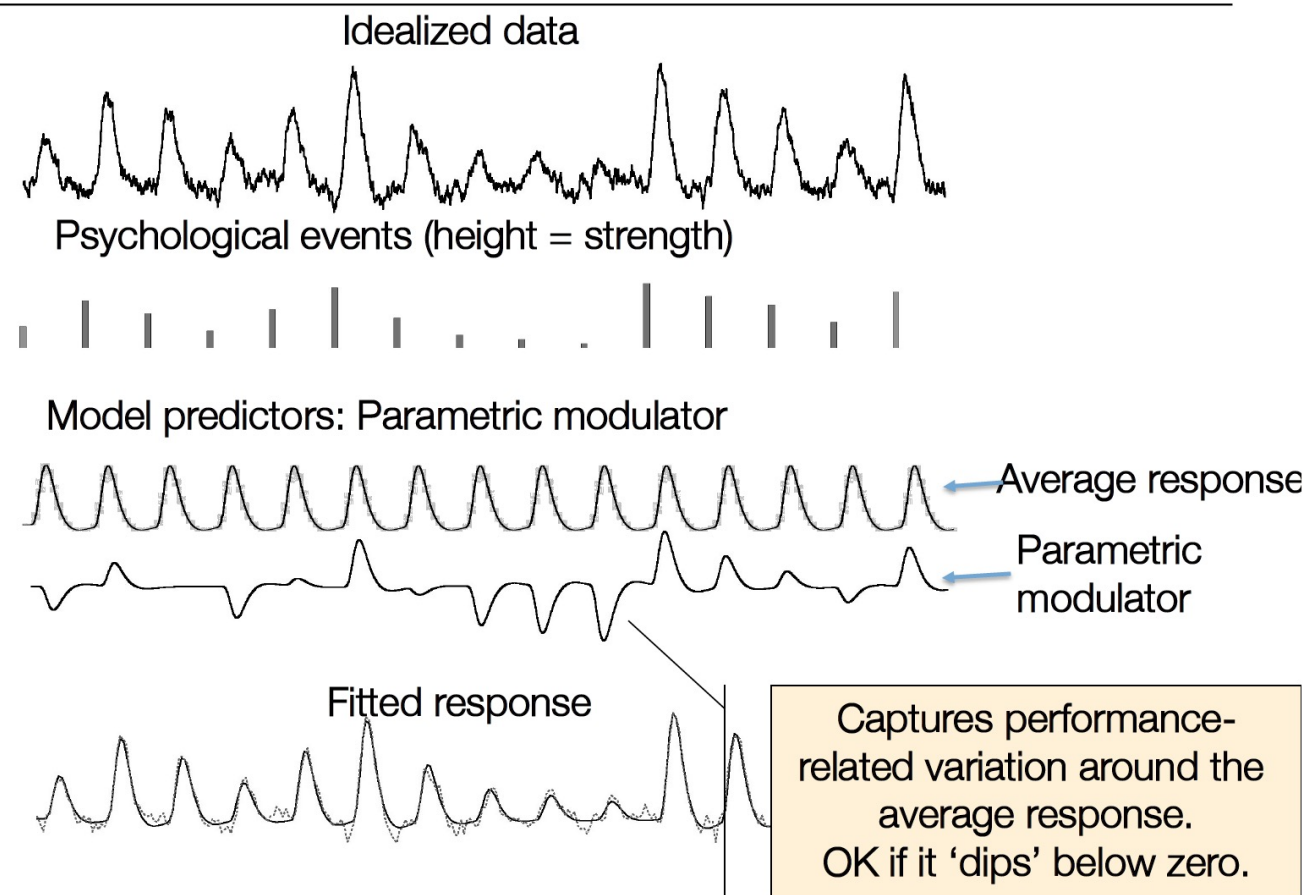1. If you want to parametrically modulate onsets by modulator values, you can use 'parametric_standard' option and put two regressors per event type. (One to model the average response, and one for the mean-centered modulator values of modulator values in each cell).

```
X = onsets2fmridesign({[temp_onset', (temp_dur-minus_onset)']}, 0.46, m*0.46, spm_hrf(1), 'parametric_standard', {temp_wordnum'});
```
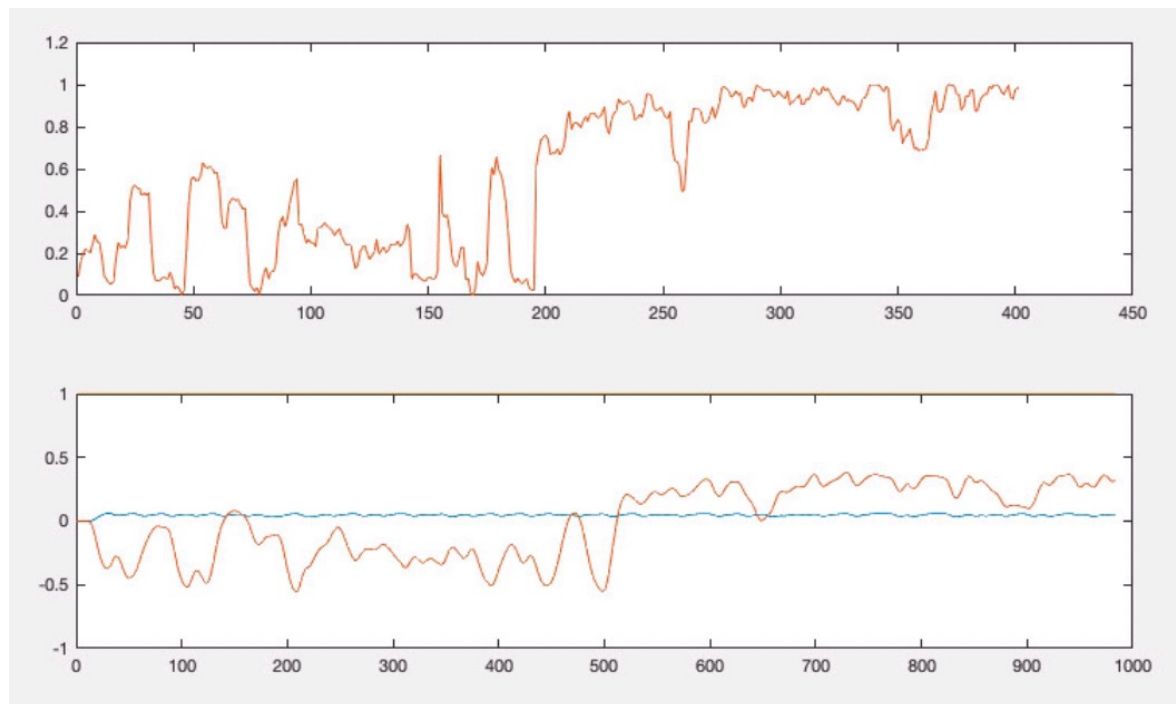
❖ For more details about parametric modulation, please watch: Coursera (Principles of fMRI) - Part2: module10 – parametric modulation (https://www.youtube.com/watch?v=iqwZmGOKqfM)

Parametric modulation

Idealized data

Psychological events (height = strength)

Model predictors: Parametric modulator

Average response

Parametric modulator

Fitted response

Captures performance-related variation around the average response.
OK if it 'dips' below zero.

Cocoan 101

https://cocoanlab.github.io

Computational Cognitive Affective Neuroscience Lab (Cocoan Lab) https://cocoanlab.github.io