IPD Contrast Key

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Subject Key: These subjects require unique model specifications due to one or more conditions being excluded due to homogeneous choices.

103 – exclude SD PRO

103\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_103\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

spm\_analysis\_103\_1st\_level\_IPD\_2sessions\_addcompcor.m (bichoice basic)

103\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis.mat (bichoice basic)

spm\_analysis\_103\_1st\_level\_IPD\_2sessions\_monochoice\_RT\_ajk.m (variable choice duration based on RT)

107 – exclude SR ANTI

107\_118\_124\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_107\_118\_124\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

spm\_analysis\_107\_118\_124\_1st\_level\_IPD\_2sessions\_addcompcor.m (bichoice basic)

107\_118\_124\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis.mat (bichoice basic)

112 – exclude SR PRO and SD PRO

112\_120\_122\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_112\_120\_122\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

spm\_analysis\_112\_120\_122\_1st\_level\_IPD\_2sessions\_addcompcor.m (bichoice basic)

112\_120\_122\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis.mat (bichoice basic)

113 – exclude SD ANTI

113\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_113\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

113\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis.mat (bichoice basic)

Spm\_analysis\_113\_1st\_level\_IPD\_2sessions\_addcompcor.m (bichoice basic)

118 – exclude SR ANTI

107\_118\_124\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_107\_118\_124\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

120 – exclude SR PRO and SD PRO

112\_120\_122\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_112\_120\_122\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

122 – exclude SR PRO and SD PRO

112\_120\_122\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_112\_120\_122\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

123 – exclude SR PRO

123\_126\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice

spm\_analysis\_123\_126\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

spm\_analysis\_123\_126\_1st\_level\_IPD\_2sessions\_addcompcor (bichoice basic)

124 – exclude SR ANTI

107\_118\_124\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice.mat

spm\_analysis\_107\_118\_124\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

126 – exclude SR PRO

123\_126\_1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice

spm\_analysis\_123\_126\_1st\_level\_IPD\_2sessions\_monochoice\_ajk.m

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1. Conservative Choice Model n=12

Description: C>base, D>base, C>D, but only including subs that had variety in choice for both SR/SD and PRO/ANTI.

% IDs = {'Sub102\*'; 'Sub104\*'; 'Sub105\*'; 'Sub106\*'; 'Sub108\*'; 'Sub114\*'; 'Sub115\*'; 'Sub117\*'; 'Sub119\*'; 'Sub121\*'; 'Sub128\*';};

Cons

1 'CoopVSBaseline'...

2 'DefectVSBaseline'...

3 'CoopVSDefect'...

4 'CoopVSBaseline\_SR',...

5 'DefectVSBaseline\_SR'...

6 'CoopVSDefect\_SR'...

7 'DefectVSCoop\_SR'...

8 'CoopVSBaseline\_SD'...

9 'DefectVSBaseline\_SD'...

10 'CoopVSDefect\_SD'...

11 'DefectVSCoop\_SD'...

**10/9 – don’t trust these contrasts as order of onsets ANTI/PRO may be off for those with ANTI, then PRO. Correct for Pro, then ANTI. Needs to be checked.**

Checked = 102, 103, 104, 105, 106, 107, 108, 112, 113, 114, 115, 117, 118, 119, 120, 121, 122, 123, 124, 126,128

NOTE: The batch models have been fixed but **the script still assumes PRO followed by ANTI.** Suggestion for fix: Hard-set all run1’s to PRO, all run2’s to ANTI. This is fine, and allows us to easily test Anti vs PRO, but not easy to test 1st vs 2nd run.

IPD Contrast Key

1. Basic Choice Model n=21 spm\_analysis\_1st\_level\_IPD\_2sessions\_addcompcor.m

Description: C>base, D>base, C>D, had some variation SR vs SD (at least 1 run has variability in both conditions (PRO andor ANTI).

% IDs = {'Sub102\*'; 'Sub103\*'; 'Sub104\*'; 'Sub105\*'; 'Sub106\*'; 'Sub107\*'; 'Sub108\*'; 'Sub112\*'; 'Sub113\*'; 'Sub114\*'; 'Sub115\*'; 'Sub117\*'; 'Sub118\*'; 'Sub119\*'; 'Sub120\*'; 'Sub121\*'; 'Sub122\*'; 'Sub123\*'; 'Sub124\*';'Sub126\*';'Sub128\*';};

Cons

1 'CoopVSDefect'...

'DefectVSCoop'...

'ChoiceALLVSBaseline',...

'CoopVSDefect\_SR'...

'DefectVSCoop\_SR'...

'ChoiceALLVSBaseline\_SR'...

'CoopVSDefect\_SD'...

'DefectVSCoop\_SD'...

'ChoiceALLVSBaseline\_SD'...

'CoopVSBaseline'...

'DefectVSBaseline'...

'CoopVSBaseline\_SR'...

'DefectVSBaseline\_SR'...

'CoopVSBaseline\_SD'...

'DefectVSBaseline\_SD'...

Editing the basic bichoice script. Will now assume that R\_16 exists for all runs. Will additionally call helper scripts for unique\_IDs subjects.

* Script now runs on all basic subs
* To do next: Make helper scripts for unique subs. Already have general purpose add\_contrast\_bichoice\_basic function.
  + Group 103 done.
  + Group 107 done.
  + Group 112 done.
  + Group 123 done.
  + Group 113 done.
* %dataFolders = {'CoopVSDefect','DefectVSCoop','ChoiceALLVSBaseline','CoopVSDefect\_SR','DefectVSCoop\_SR','ChoiceALLVSBaseline\_SR','CoopVSDefect\_SD','DefectVSCoop\_SD','ChoiceALLVSBaseline\_SD', 'CoopVSBaseline', 'DefectVSBaseline', 'CoopVSBaseline\_SR', 'DefectVSBaseline\_SR', 'CoopVSBaseline\_SD', 'DefectVSBaseline\_SD'};
* %ConNum={'01','02','03','04','05','06','07','08','09','10','11','12','13','14','15'};

3. Choice with RT as parametric modulator.

Description – Basic choice model with extra parametric modulator (RT in seconds). This reduces the total number of subjects from the basic model (n=21) because requires at least 2 levels for every factor (must coop and defect at least twice in a run).

\*\* = usable contrasts

Include: 104, 106, 108, 114,115,119,121,

Include but needs unique contrast vector: 103(has compcor\*\*)\*,107\*\*, 118\*\*,120\*\*,122\*\*,123\*\*

Exclude(?, due to having only 1 para-modulator param in a run) – 102(can’t make contrasts, unknown error), 105\*\*, 117\*\*, 128(warning on contrast #5, Con numbers shifted, exclude for now), 112 (Warning here too, exclude for now),113(similar con issues),124\*\*(can exclude SD run 2 – this was able to be estimated and looks reasonable, not sure why it works), 126

^*Some of these seem to be estimable, not sure why.*

1. 'CoopRTVSBaseline'...

2. 'DefectRTVSBaseline'...

3. 'CoopRTVSDefectRT'...

4. 'CoopRTVSBaseline\_SR',...

5. 'DefectRTVSBaseline\_SR'...

6. 'CoopRTVSDefectRT\_SR'...

7. 'CoopRTVSBaseline\_SD'...

8. 'DefectRTVSBaseline\_SD'...

9. 'CoopRTVSDefectRT\_SD'...

4. monoChoice\_model\_basic (no RT paramod)  
New approach for choice model design.

Column 1 -ChoiceALL- task regressor choice onsets

ALL CHOICE ONSETS IN THIS COLUMN

Column 2 –CHoiceType- ParaMod on Regressor1

1 – COOP CHOICE

-1 – DEFECT CHOICE

*Optional*

Column 3 – ParaMod2 on Regressor1

RT for each choice; combine with weight on PMod1 to examine ChoiceType\*RT

Monochoice (no RT)

'CoopVSDefect'...

'DefectVSCoop'...

'ChoiceALLVSBaseline',...

'CoopVSDefect\_SR'...

'DefectVSCoop\_SR'...

'ChoiceALLVSBaseline\_SR'...

'CoopVSDefect\_SD'...

'DefectVSCoop\_SD'...

'ChoiceALLVSBaseline\_SD'...

%monochoice basic:

dataFolders={'CoopVSDefect', 'DefectVSCoop','ChoiceALLVSBaseline', 'CoopVSDefect\_SR', 'DefectVSCoop\_SR', 'ChoiceALLVSBaseline\_SR','CoopVSDefect\_SD', 'DefectVSCoop\_SD', 'ChoiceALLVSBaseline\_SD'};

ConNum={'01','02','03','04','05','06','07','08','09'};

5. monochoice RT

spm\_analysis\_1st\_level\_IPD\_2sessions\_monochoice\_RT\_ajk.m (global script)

1st\_level\_IPD\_Choice\_SRSD\_joint\_analysis\_monoChoice\_RT.mat (default template – variable duration based on RT)

!take step back here. Concerned about serial orthogonalization on pmods. In monochoice\_RTparamod, currently have 2 pmods on main task regressor, which is expected to absorb little to no variance based on the strength (weakness) of the contrasts in monochoice\_basic (1 paramod).

Suggestion1 – remove pmod1 (choice Type), leaving ChoiceOnset task regressors with pmod of RT. This would not account for choice-type but would model RT in all choices.

Starting to suspect that orthogonalizing regressors (*are regressors ortho’d like pmods are?—need to know this\**) has reduced power in ALL models, not just paramod. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126255>

>’*For example, when the model includes a regressor modeling response times (RT) along with a parametric regressor that has a direct effect on RT, such as stimulus intensity; because the onset times are identical for both regressors, the resulting parametric regressors will be correlated.’*

*>’ The SPM software package automatically performs orthogonalization for parametrically modulated regressors in versions 8 and older. However, due to how orthogonalization is performed when more than one set of parametric modulation values is used for a set of trials, it is possible to misinterpret the resulting inferences. In the case of a single parametrically modulated value per trial, for example RT, SPM first creates the unmodulated regressor and next creates a regressor where each trial is modulated by the reaction time. In this case the modulated regressor is automatically orthogonalized with respect to the unmodulated regressor. As discussed above, this is an appropriate use of orthogonalization for improving the interpretation of the unmodulated regressor.’*

So, if I have 1 paramod (RT, removing ChoiceType\_pmod), then keep orthog.

Also see: <http://andysbrainblog.blogspot.com/2012/09/duration-regressors-with-fmri.html>

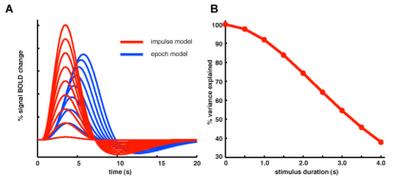
>*The argument against using RT-modulated regressors was that, at short time intervals (i.e., less than four seconds), using an impulse function was a good approximation to the resulting BOLD signal (cf. Henson, 2003).*

*>The authors found that the variable epoch model - in other words, convolving each event with a boxcar equal to the length of the subject's RT for that trial - captured more of the variability in the BOLD response, in addition to reducing false positives as compared to the other models.* *Therefore, these simulations suggest that for tasks requiring time - such as decision-making tasks - convolution with boxcar regressors is a more faithful representation of the underlying neuronal dynamics (cf.* ***the drift-diffusion model*** *of Ratcliff & McKoon, 2008).*

^This is **promising**. This says, replace the constant duration of 6s with the trial-specific RT for each onset. This will reduce the duration of the trials but may improve signal by removing post-decision related activity (?). It will also remove the issue of orthogonalizing pmods as we are only modulating duration on a per-trial basis.

See also: http://mindhive.mit.edu/node/55

>6. ***What's the best way to include reaction times in my model?*** *If you have events for which participants' response times vary widely (or even a little), your model will be improved by accounting for this variation (rather than assuming all events take identical time, as in the normal model). A common way of including reaction times is to use a parametric modulator, with the reaction time for each trial included as the parameter. In the most common way of doing this, the height of the HRF will be thus modulated by the reaction time. Grinband et al. (HBM06) showed this method actually doesn't work as well as a different kind of parametric regression - in which each event is modeled as an epoch (i.e., a boxcar) of variable duration, convolved with a standard HRF.*



*>In either case, as with most parametric modulation, the regressor including reaction time effects can be separate from the "trial regressor" that models the reaction-time-invariant effect of the trial. This corresponds to having one column in the design matrix for the condition itself (which doesn't have any reaction time effects) and a second, parametrically modulated one, which includes reaction times. If your goal is merely to get the best model possible, these don't need to be separated (only the second of the two, which includes RTs, could go in the model), but this will not allow you to separate the effect of "just being in the trial" from neural activations that vary with reaction time. To separate those effects, you need separate design matrix columns to model them. That choice depends on how interested you are in the reaction-time effect itself.*