Portfolio 9, Study Group 10

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1.a. Order of conditions

Open one of the paradigm files in Matlab. The variable "names" indicates the order of conditions in the design specification. Report the order of conditions:

The order of conditions taken from the paradigm files is as follows: Blue_neutral, Blue_fearful, Yellow_neutral & Yellow_fearful.

1.b. Comprehension question

What will the seven contrasts provided in the contrast specification test for? Add a bit of prose to the hypotheses that each contrast could test

Contrast 1 will test for where there is activation in the brain during trial. According to H1 "An activation is expected in the Occipital Face Area (OFA) and Fusiform Face Area (FFA) across all stimuli." This can be tested with contrast 1, as we are looking at the overall activation to the stimuli.

Contrast 2 will test for the difference in brain activity between being shown blue smileys or yellow smileys. According to H4: "Infrequent stimuli will yield stronger BOLD response than frequent in brain areas relevant for perception of faces and motor responses" if the participant is shown the yellow smileys more frequently.

Contrast 3 will test for the difference between the fearful smileys and the neutral smileys. According to H2: "Fearful faces will yield a greater response than neutral images." and therefore H2 can be tested with this contrast.

Contrast 4 will test to see if there is an interaction between the emotion of the smiley and the colour of the smiley.

Contrast 5 will test for the difference between the yellow and the blue smileys. According to H3: "The index finger (blue) trials will lead to a smaller BOLD response in the motor cortex than middle finger (yellow) trials, due to the hand being more adapted to using the index finger:" This contrast can therefore test H3. Contrast 5 will also be able to test for H4: "Infrequent stimuli will yield stronger BOLD response than frequent in brain areas relevant for perception of faces and motor responses" if the participant has the blue smileys as the most frequent stimuli.

Contrast 6 will test for the interaction between the emotion of the face and the colour of the smiley.

Contrast 7 will test for the difference between the fearful and the neutral smileys.

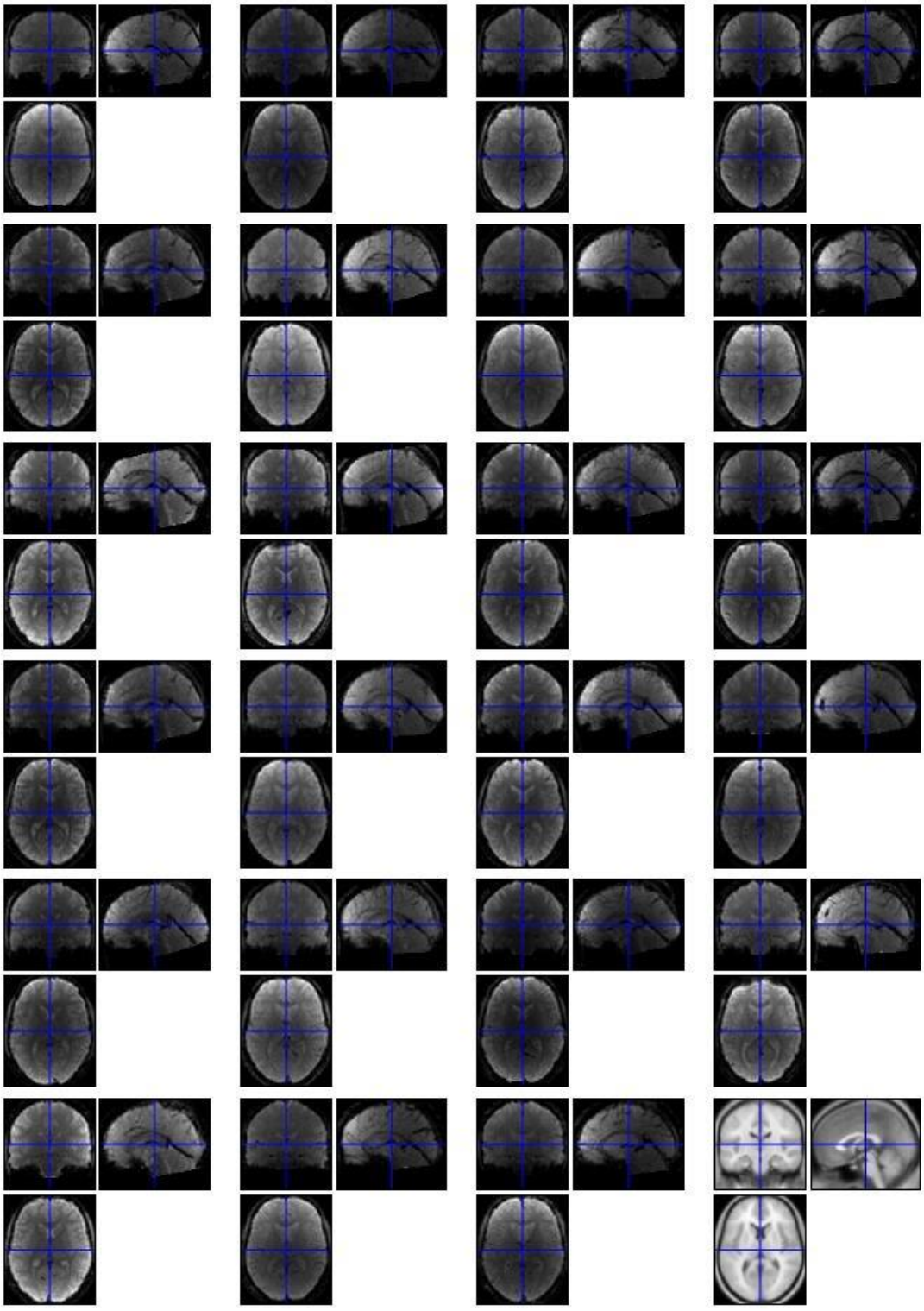
1.c. Run the preprocessing and participant analyses using the loop Run the batch loop script. Report the collected time it took to analyse all participants.

The collected time it took to analyse all participants ranged between 2 hours and 11 minutes and 13 hours.

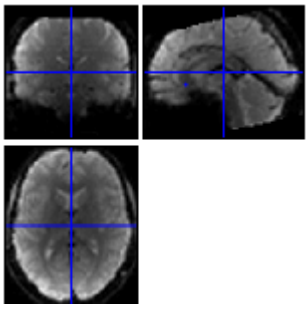
1.d. Checking preprocessing

Check if the preprocessing went well, by loading an unsmoothed, normalized image from each participant (files called “wfSubject..nii”) into “check reg” together with a standardized image of the brain (look in the “canonical” folder in SPM). You can include up to 24 images at the same time. Include screenshots of these images in your report with a short written evaluation of any concerns related to data from particular participants.

During scanning of one participant, the scan seems not to have covered the whole brain. Which participant is this?



Subject no 0010-0008-00001-000001-01.nii, 1;

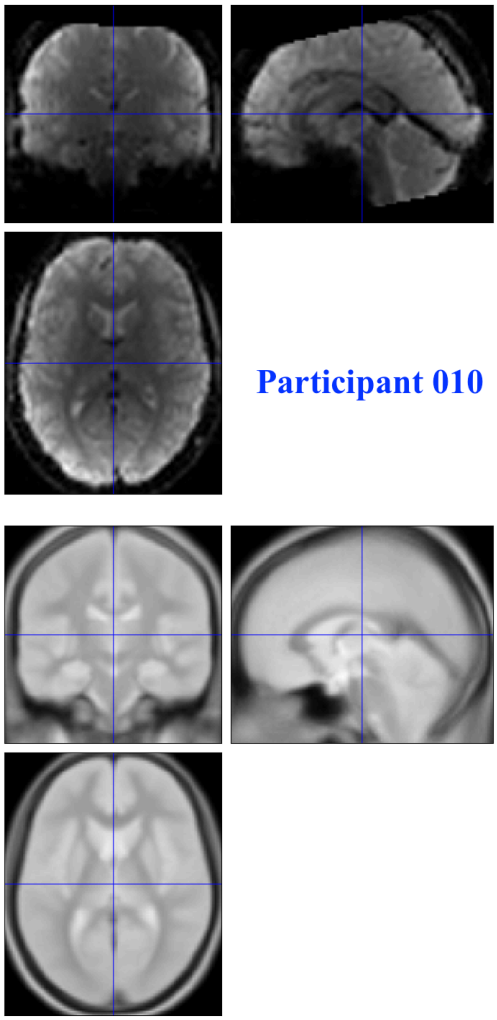


Only brain areas present in all participants can be analysed. What are the pros and cons of keeping this participant in the dataset, given the hypotheses?

In participant 10 (on the picture above) it is made clear that some of the brain has been ‘cut off’ in the scanner. It seems that the motor cortex cannot be analyzed in this participant. Therefore the cons by keeping this participant in the analysis is that we cannot collectively compare the motor cortex of this participant with the other participants. The pros of keeping this participant is of course statistical power, as we would like to include as much data as we possibly can in our analysis.

What would you choose?

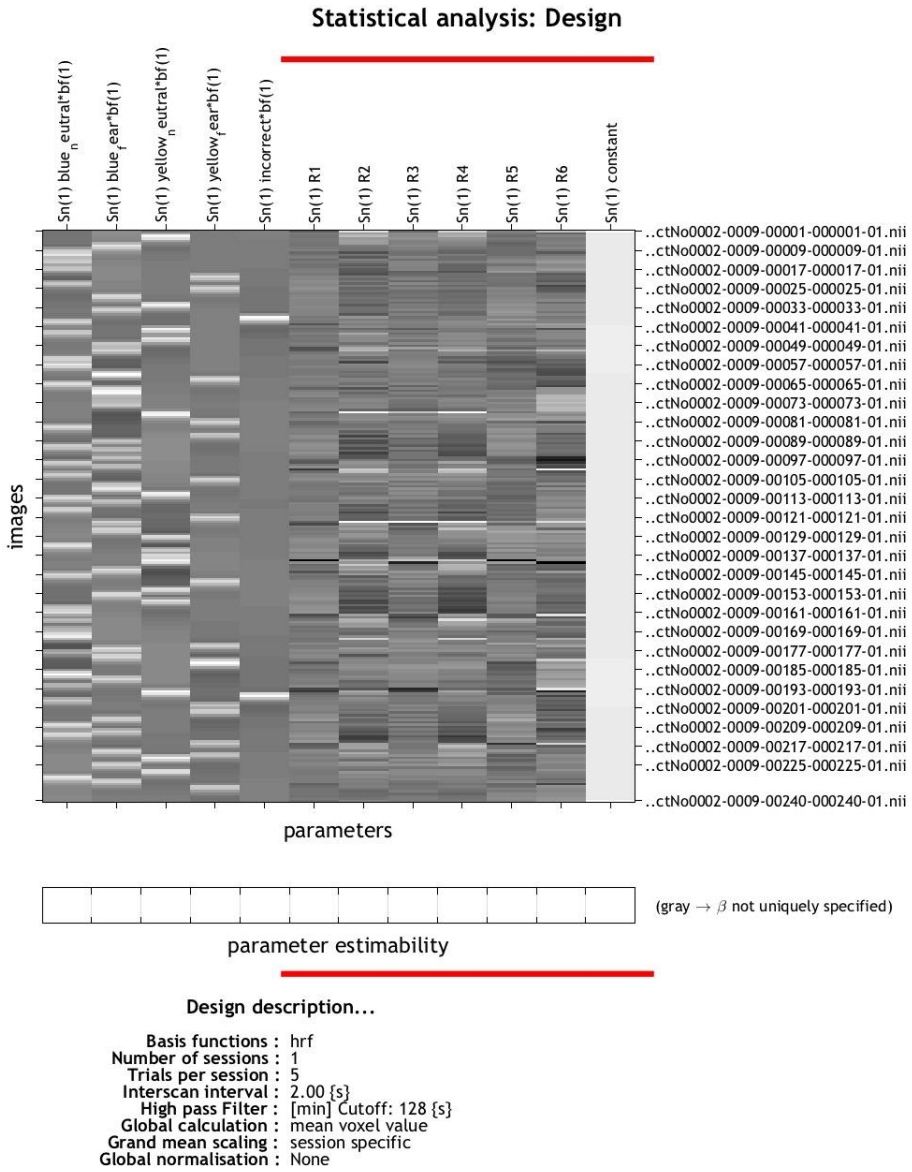
Our main analysis is regarding the FFA and OFA and is therefore not cut out from the image. We will therefore make the decision to keep this participant in our analysis.



2. Investigating analysis of a single participant

2.a. Investigate the design matrix

Investigate the design matrix of a single participant using the “Review” function in SPM12 (select a SPM.mat file from a participant). Put a figure of the design matrix in the report.



In this particular participant, which stimulus colour was the more frequent, judging from the design matrix?

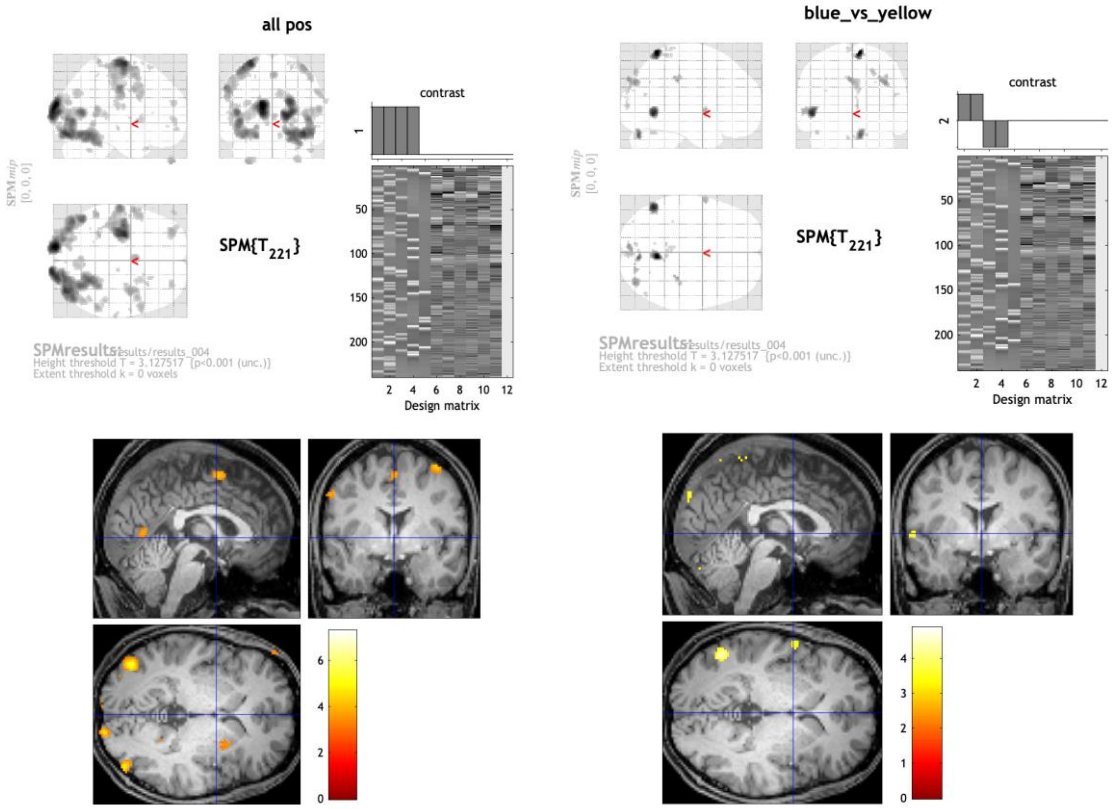
It looks like this participant has the condition where blue faces were presented most frequently. This can be seen as there are more white colours in the first two columns, which is when a participant is presented with blue faces, compared to the next 2 columns which is for yellow faces.

How many, if any incorrect responses did the participant have?

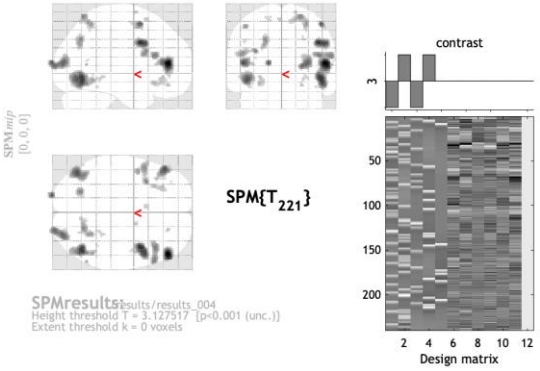
In column 5 one can see that the participant had 2 incorrect responses. This can be seen as white rows in column 5.

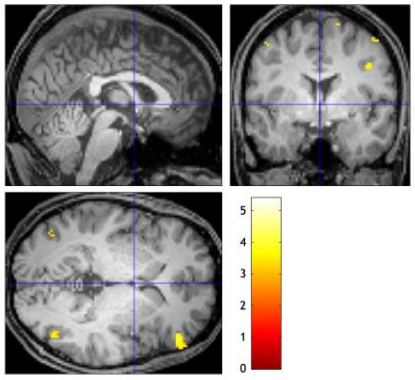
Why is it usually a good idea to discard or separately model incorrect responses?
It is usually a good idea to discard or separately model incorrect response, because incorrect responses might indicate that the participant didn't pay attention and therefore the brain activity doesn't reflect the stimuli that was represented.

2.b. Investigate the results of the different contrasts. Choose one participant and report results at p<0.001 uncorrected for multiple comparisons with a nice overlay.
Briefly explain if you find signs to support the hypotheses.

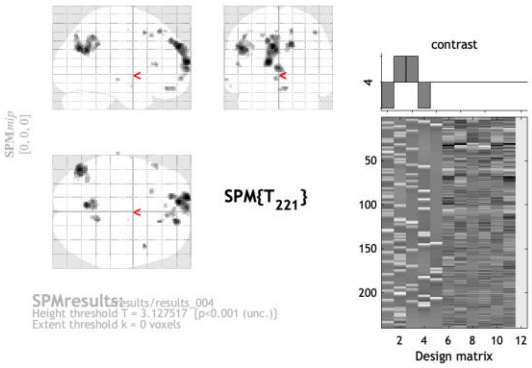


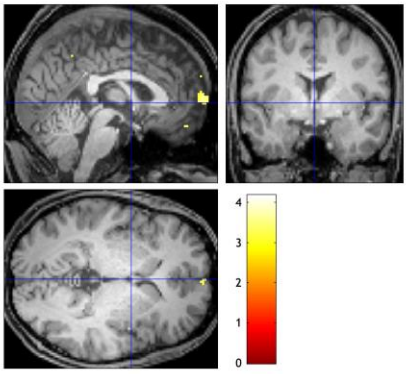
fearful>neutral



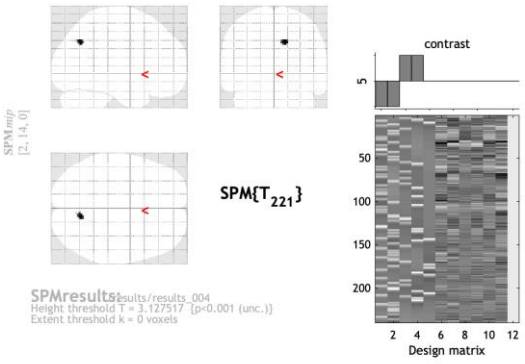


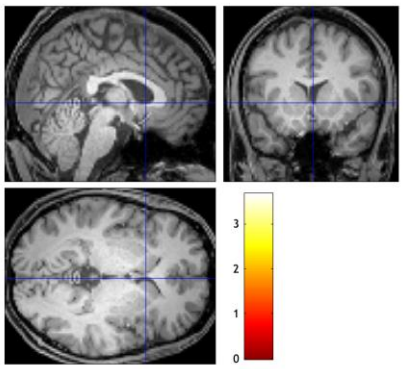
interaction



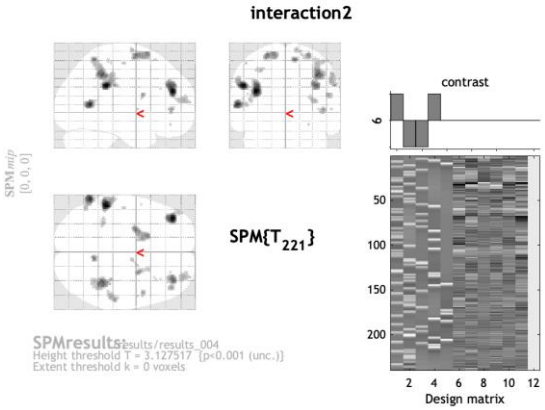


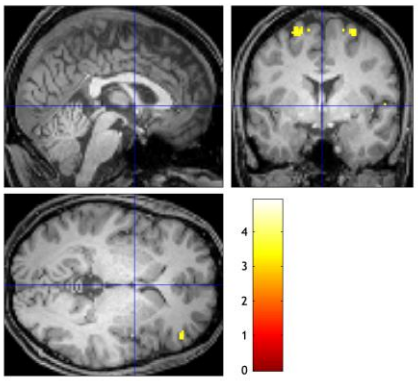
yellow_vs_blue

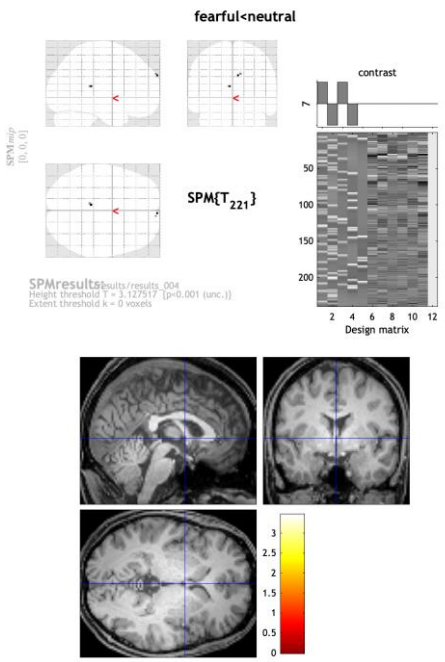




interaction2







It seems as if participant 4 has activation in the Occipital face area but not any activation in the FFA. Also, there seems to be activation in the lPPA. This would support H1.

There does not seem to be any response of the amygdala in contrast 3, which would indicate H2 is not true.

From contrast 1 it seemed that there was activation in the motor area, but when contrasting the blue to the yellow frequency it did not seem to give any significant response. Which would not give any evidence for H3.

Our participant is in the group that was shown more pictures of blue stimuli. Therefore we would expect results in contrast 5 to find evidence for H4. There does not seem to be any indication of this being the case as there is no significant results in the areas in question in contrast 5.

3. Group analysis

Make a new folder called “2nd level analyses”. In this folder, make a folder for each of the analyses below.

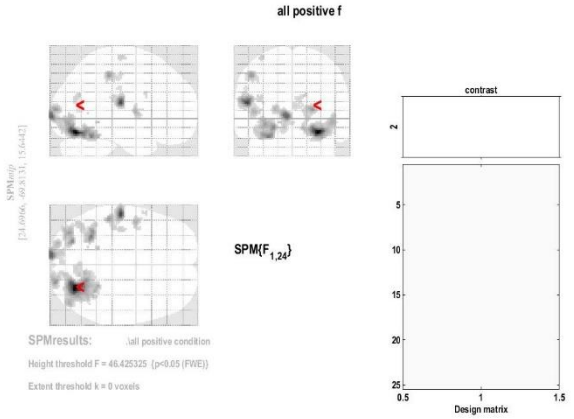
3.a. All positive condition

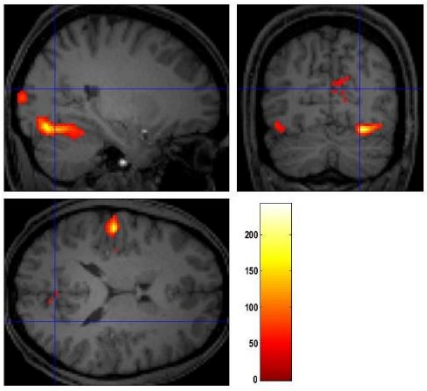
Take the contrast images for the “all positive” contrast. Use them to conduct a one-sample t-test, testing if any regions were consistently activated when seeing a face in general. Which contrast would you use on this analysis in order to find positive effects?

in this case we would simply use a [1] f - contrast to get everything that is positive. ????

Report data (image and coordinates) at P<0.05 FWE-corrected for multiple comparisons. If significant, include a nice overlayed image, displaying the most significant/interesting effects. Write a few sentence, interpreting the findings in relation to the hypotheses.

If there are results in areas not related to the hypotheses, can these then be explained by the way the study was designed?

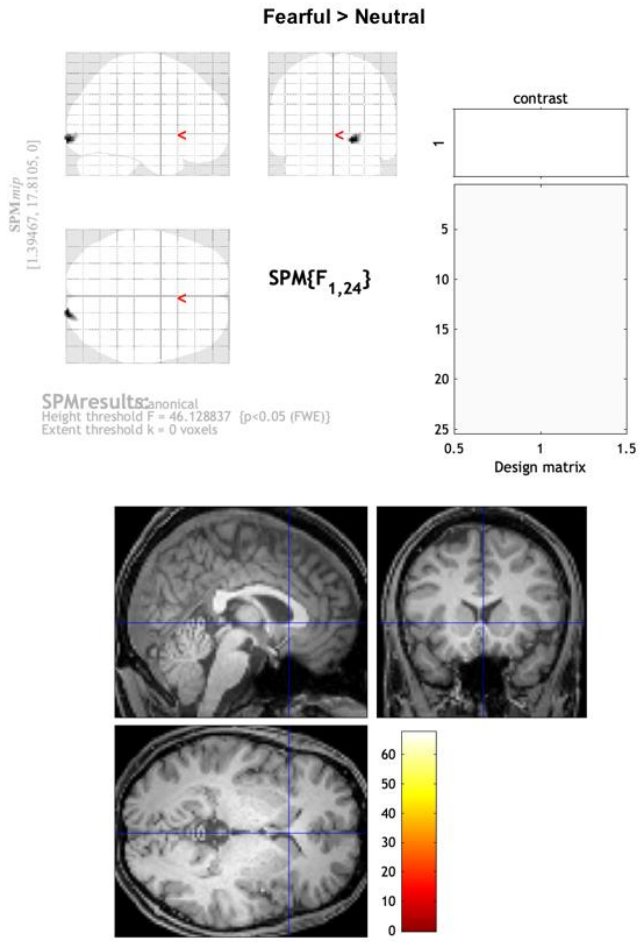




It looks like the occipital face area and the fusiform face area are activated in both hemispheres. In the left hemisphere there seems to be a stream of activation between the occipital and temporal lobe. These findings suggests that the null hypothesis for H1 should be rejected. according to the paper by Katja Weiber the occipital face area in the right hemisphere should be placed in MNI coordinates in x=48 y=76 z=8, this voxel is significant in this experiment, which again indicates that the null hypothesis for H1 should be rejected. No other voxels for the occipital face area or fusiform face area found in the paper was significant in this FMRI experiment, which might be due to a difference in brains.

3.b. Effect of emotion

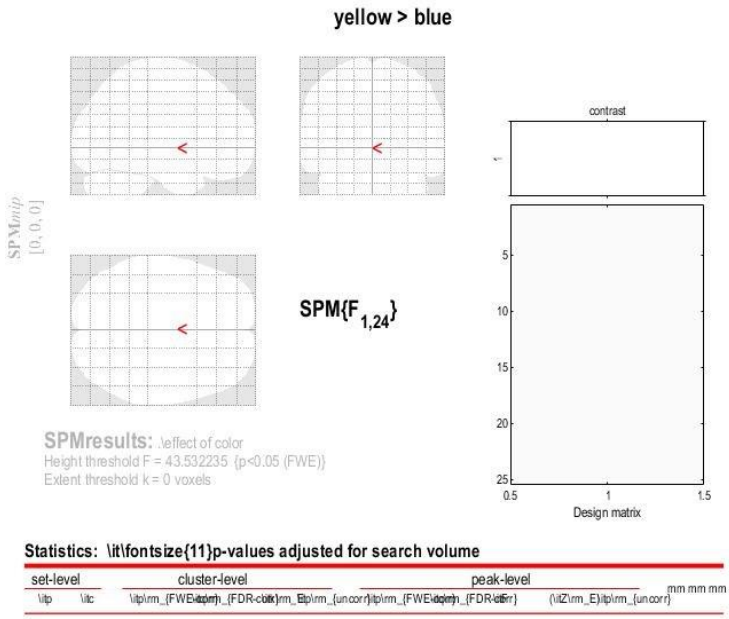
Take the contrast images for each participant for the Fearful>Neutral condition. Use them to conduct a one-sample t-test, testing if any region (OFA and FFA in particular) consistently has more activation for the fearful than the neutral faces across participants. Report data (image and coordinates) at P<0.001 uncorrected or P<0.05 FWE-corrected. If significant, include a nice overlayed image, displaying the most significant/interesting effects. Write a few sentence, interpreting the findings:



From the picture above it does not seem that there is any emotional effect, because we do not see any significant activation in amygdala. There seems to be some significant effect around v1. this is probably due to the participant processing the more complex visual scene, and there is some modulation of the visual area.The activation we see in the occipital lobe could be explained by the visual nature of the stimulus. This is where we would expect visual stimuli to show an effect (in the primary visual cortex). Therefore we do not find significant evidence here to be able to indicate that H2 is true.

3.c. effect of color

Take the contrast images for each participant for the yellow-blue condition. Use them to conduct a one-sample t-test, testing for H3. Report data (image and coordinates) at P<0.001 uncorrected or P<0.05 FWE-corrected. If significant, include a nice overlayed image, displaying the most significant/interesting effects. Write a few sentence, interpreting the findings.



Statistics: \it\fontsize{11}p-values adjusted for search volume

set-level		cluster-level			peak-level				mm mm mm
\itp	\itc	\itp\rm_{FWE-corr}	\itq\rm_{FDR-corr}	\itk\rm_E	\itp\rm_{uncorr}	\itp\rm_{FWE-corr}	\itq\rm_{FDR-corr}	(\itZ\rm_E)	\itp\rm_{uncorr}	

no suprathreshold clusters

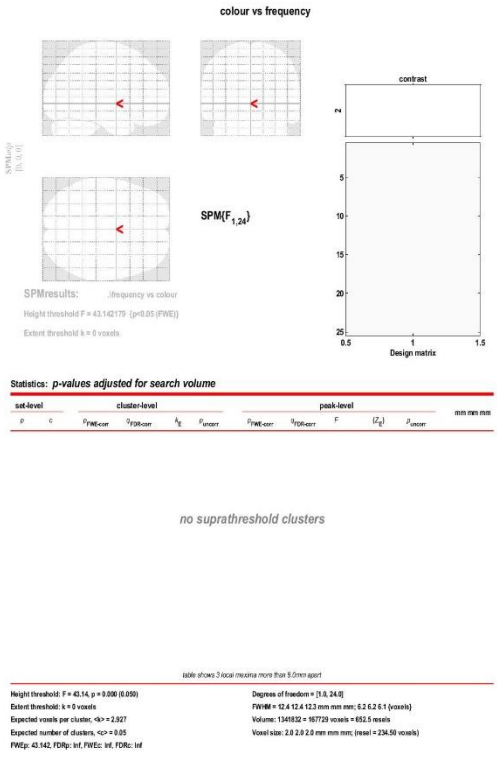
table shows 3 local maxima more than 8.0mm apart

Height threshold: F = 43.53, p = 0.000 (0.050)	Degrees of freedom = [1.0, 24.0]
Extent threshold: k = 0 voxels	FWHM = 12.1 12.1 12.0 mm mm mm; 6.1 6.1 6.0 {voxels}
Expected voxels per cluster, <k> = 2.718	Volume: 1341832 = 167729 voxels = 693.2 resels
Expected number of clusters, <c> = 0.05	Voxel size: 2.0 2.0 2.0 mm mm mm; (resel = 220.72 voxels)
FWEp: 43.532, FDRp: Inf, FWEc: Inf, FDRc: Inf	

There was no significant effects of colour. This disputes hypothesis 3, as there is no significant difference in activation of the motor cortex considering which finger was used to answer (blue / index finger or yellow / middle finger).

3.d. Frequency group x colour interaction

For each participant, find out which colour was the infrequent (e.g. see number of onsets in paradigm files, e.g. using the provided script “face_exp_which_freq_group.m”). If “Blue”" was the frequent trial, take the “yellow>blue” contrast (i.e. infrequent-frequent) If “Yellow”" was the frequent trial, take the “blue>yellow” contrast (i.e. again infrequent-frequent) Collect these and conduct a one-sample t-test, testing if any region (OFA, FFA and motor cortex in particular) has more activation for infrequent stimuli compared to frequent (this is equivalent to a mixed-effects 2-way (Frequency group x colour) interaction). Report data (image and coordinates) at P<0.001 uncorrected or P<0.05 FWE-corrected. If significant, include a nice overlayed image, displaying the most significant/interesting effects. Write a few sentence, interpreting the findings.



There was no significant interaction between the frequency group and the colour of the smiley the participant was viewing. This result supports the rejection of hypothesis 4, as there doesn't seem to have been a stronger response to infrequent or surprising stimuli.

Throughout all conditions and analyses we only found significant activation in the occipital lobe and right hemisphere OFA. This supports the rejection of the null hypothesis to H1. However, we cannot reject the null hypothesis relating to H2, H3 or H4 based on this data.