VMM FSL tables

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## Combine FSL output

# get one type of input from each contrast  
ls.files = dir(pattern = '.\*MNI-AAL.csv', path = "./results\_sig")  
  
for (file in ls.files) {  
 contrast = gsub("\_MNI-AAL.csv", "", file)  
 type = substr(contrast, nchar(contrast)-5, nchar(contrast)-5)  
 maxima = read\_csv(file.path("results\_sig", file), show\_col\_types = F)  
 if (nrow(maxima) == 0) next  
 summary = read\_delim(file.path("results\_sig",   
 paste0(contrast, '\_cluster-summary.txt')),   
 show\_col\_types = F)  
 output = read\_delim(file.path("results\_sig",   
 paste0(contrast, '\_randomise\_output\_all.txt')),   
 show\_col\_types = F)  
   
 relinfo =   
 merge(  
 output %>% select(`Cluster Index`, Voxels),   
 maxima %>% select(`Cluster Index`, `Value`, MNIx, MNIy, MNIz, AALname)  
 ) %>%  
 mutate(  
 H = if\_else(MNIx >= 0, "R", "L")  
 ) %>%  
 rename(  
 `Cluster size` = "Voxels",   
 "Region" = "AALname",  
 "x" = "MNIx",  
 "y" = "MNIy",  
 "z" = "MNIz"  
 ) %>%  
 arrange(desc(`Cluster Index`), desc(Value)) %>%  
 relocate(`Cluster Index`, Region, `Cluster size`, H)  
 colnames(relinfo)[colnames(relinfo) == "Value"] = paste0(type, "-value")  
   
 write\_csv(relinfo, file = file.path("results\_sig", paste0(contrast, '.csv')))  
   
}

## Hypothesis-guided ROI analysis

# COMP: same areas as Stefanics et al. (2019), Neuroimage  
  
read\_csv(file.path("results\_sig", 'hgf\_ctr\_eps\_c\_ROI\_fstat1.csv'), show\_col\_types = F) %>%  
 kable(., caption = 'COMP: colour prediction error')

COMP: colour prediction error

| Cluster Index | Region | Cluster size | H | f-value | x | y | z |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Fusiform gyrus | 241 | R | 24.3 | 30 | -70 | -10 |
| 1 | Fusiform gyrus | 241 | R | 23.1 | 32 | -60 | -14 |
| 1 | Fusiform gyrus | 241 | R | 22.9 | 28 | -60 | -16 |
| 1 | Fusiform gyrus | 241 | R | 20.8 | 30 | -64 | -16 |
| 1 | Fusiform gyrus | 241 | R | 17.8 | 28 | -52 | -18 |
| 1 | Fusiform gyrus | 241 | R | 14.2 | 32 | -78 | -6 |

read\_csv(file.path("results\_sig", 'hgf\_ctr\_mu\_e\_ROI\_fstat1.csv'), show\_col\_types = F) %>%  
 kable(., caption = 'COMP: emotion prediction strength')

COMP: emotion prediction strength

| Cluster Index | Region | Cluster size | H | f-value | x | y | z |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Precuneus | 3 | R | 26 | 6 | -76 | 52 |

# pooled: same areas as Stefanics et al. (2019), Neuroimage  
  
read\_csv(file.path("results\_sig", 'hgf\_all\_eps\_c\_ROI\_fstat1.csv'), show\_col\_types = F) %>%  
 kable(., caption = 'Pooled: colour prediction error')

Pooled: colour prediction error

| Cluster Index | Region | Cluster size | H | f-value | x | y | z |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 7 | Fusiform gyrus | 230 | R | 39.8 | 32 | -60 | -16 |
| 7 | Fusiform gyrus | 230 | R | 35.9 | 28 | -70 | -12 |
| 7 | Fusiform gyrus | 230 | R | 24.5 | 34 | -74 | -14 |
| 6 | Superior temporal gyrus | 58 | R | 19.2 | 50 | -40 | 22 |
| 5 | Insula | 57 | R | 23.3 | 32 | 24 | -4 |
| 5 | Insula | 57 | R | 22.3 | 42 | 26 | -4 |
| 5 | Insula | 57 | R | 16.1 | 42 | 22 | -10 |
| 4 | Anterior cingulate cortex, supracallosal | 47 | R | 22.0 | 8 | 34 | 24 |
| 3 | Fusiform gyrus | 28 | L | 32.1 | -28 | -56 | -16 |
| 2 | Superior temporal gyrus | 15 | R | 17.9 | 52 | -6 | -14 |
| 1 | Superior temporal gyrus | 2 | R | 13.9 | 50 | -18 | -8 |

read\_csv(file.path("results\_sig", 'hgf\_all\_mu\_c\_ROI\_fstat1.csv'), show\_col\_types = F) %>%  
 kable(., caption = 'Pooled: colour prediction strength')

Pooled: colour prediction strength

| Cluster Index | Region | Cluster size | H | f-value | x | y | z |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 7 | Precuneus | 2401 | L | 30.5 | -8 | -70 | 40 |
| 7 | Precuneus | 2401 | R | 28.0 | 12 | -46 | 42 |
| 7 | Precuneus | 2401 | R | 27.7 | 8 | -50 | 42 |
| 7 | Precuneus | 2401 | R | 26.8 | 4 | -56 | 50 |
| 7 | Precuneus | 2401 | R | 25.2 | 10 | -50 | 46 |
| 7 | Precuneus | 2401 | R | 24.1 | 2 | -62 | 48 |
| 6 | SupraMarginal gyrus | 553 | R | 25.5 | 58 | -44 | 36 |
| 6 | SupraMarginal gyrus | 553 | R | 24.4 | 58 | -46 | 44 |
| 6 | Superior temporal gyrus | 553 | R | 22.9 | 48 | -40 | 10 |
| 6 | SupraMarginal gyrus | 553 | R | 21.9 | 52 | -44 | 38 |
| 6 | SupraMarginal gyrus | 553 | R | 21.2 | 52 | -40 | 44 |
| 6 | Superior temporal gyrus | 553 | R | 20.4 | 58 | -50 | 18 |
| 5 | Anterior cingulate cortex, supracallosal | 254 | R | 22.4 | 10 | 24 | 26 |
| 5 | Anterior cingulate cortex, pregenual | 254 | R | 20.9 | 8 | 40 | 16 |
| 5 | Anterior cingulate cortex, pregenual | 254 | R | 15.1 | 8 | 46 | 14 |
| 4 | Insula | 171 | L | 23.3 | -28 | 22 | 4 |
| 4 | Insula | 171 | L | 22.4 | -32 | 20 | -8 |
| 4 | Insula | 171 | L | 21.2 | -28 | 26 | -4 |
| 4 | Insula | 171 | L | 16.8 | -36 | 16 | -2 |
| 3 | Insula | 119 | R | 26.9 | 32 | 24 | -4 |
| 3 | Insula | 119 | R | 24.2 | 38 | 26 | -4 |
| 3 | Insula | 119 | R | 22.1 | 42 | 20 | -8 |
| 3 | Insula | 119 | R | 14.6 | 44 | 22 | 0 |
| 2 | Precuneus | 63 | R | 13.1 | 20 | -54 | 20 |
| 2 | Precuneus | 63 | R | 11.9 | 14 | -54 | 18 |
| 1 | Precuneus | 3 | R | 12.5 | 4 | -46 | 14 |

read\_csv(file.path("results\_sig", 'hgf\_all\_mu\_e\_ROI\_fstat1.csv'), show\_col\_types = F) %>%  
 kable(., caption = 'Pooled: emotion prediction strength')

Pooled: emotion prediction strength

| Cluster Index | Region | Cluster size | H | f-value | x | y | z |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | Precuneus | 124 | R | 23.9 | 8 | -78 | 56 |
| 4 | Precuneus | 124 | R | 23.6 | 6 | -74 | 52 |
| 4 | Precuneus | 124 | R | 18.2 | 16 | -70 | 48 |
| 3 | Fusiform gyrus | 86 | R | 30.1 | 32 | -52 | -20 |
| 3 | Fusiform gyrus | 86 | R | 21.5 | 28 | -52 | -14 |
| 3 | Fusiform gyrus | 86 | R | 20.4 | 32 | -62 | -18 |
| 3 | Fusiform gyrus | 86 | R | 17.9 | 30 | -62 | -14 |
| 2 | Fusiform gyrus | 62 | L | 24.7 | -30 | -64 | -16 |
| 2 | Fusiform gyrus | 62 | L | 22.8 | -34 | -60 | -18 |
| 2 | Fusiform gyrus | 62 | L | 20.4 | -34 | -54 | -18 |
| 2 | Fusiform gyrus | 62 | L | 17.9 | -34 | -54 | -22 |
| 1 | Precuneus | 2 | R | 13.2 | 14 | -74 | 48 |

# Neural adaptation  
  
read\_csv(file.path("results\_sig", 'smp\_adapt\_neg\_ROI\_tstat1.csv'), show\_col\_types = F) %>%  
 kable(., caption = 'ALL: repetition suppression')

ALL: repetition suppression

| Cluster Index | Region | Cluster size | H | t-value | x | y | z |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | Fusiform gyrus | 55 | R | 4.36 | 28 | -80 | -16 |
| 3 | Fusiform gyrus | 55 | R | 4.24 | 36 | -76 | -16 |
| 2 | Fusiform gyrus | 27 | R | 4.62 | 38 | -56 | -22 |
| 1 | Fusiform gyrus | 12 | R | 4.16 | 32 | -56 | -14 |

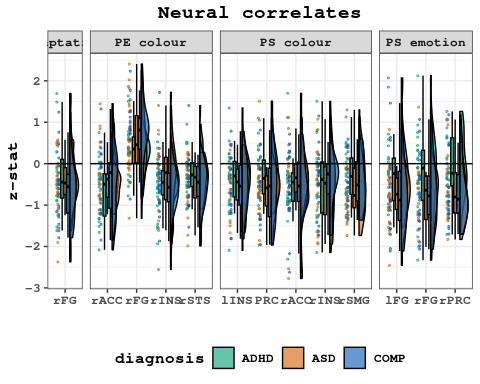
## Plotting

Plot the participants’ activation in clusters larger than 100 voxels to visualise the effects.

# custom colour palette  
custom.col = c("#009E73", "#D55E00", "#0058b2", "#CC79A7")  
  
# load in the extracted activation  
df.act = read\_csv(file.path("fMRI\_data", "grp\_use-sorted.csv"),   
 show\_col\_types = F) %>%  
 mutate(  
 diagnosis = fct\_recode(diagnosis,   
 "COMP" = "CTR")  
 ) %>%  
 select(diagnosis) %>%  
 mutate(  
 # load zstats for eps-c  
 `PE colour-rFG` = scan(file.path("fMRI\_data", "eps\_c\_C7\_meants.txt")),  
 `PE colour-rSTS` = scan(file.path("fMRI\_data", "eps\_c\_C6\_meants.txt")),  
 `PE colour-rINS` = scan(file.path("fMRI\_data", "eps\_c\_C5\_meants.txt")),  
 `PE colour-rACC` = scan(file.path("fMRI\_data", "eps\_c\_C4\_meants.txt")),  
 # load zstats for mu-z  
 `PS colour-rINS` = scan(file.path("fMRI\_data", "mu\_c\_C3\_meants.txt")),  
 `PS colour-lINS` = scan(file.path("fMRI\_data", "mu\_c\_C4\_meants.txt")),  
 `PS colour-rACC` = scan(file.path("fMRI\_data", "mu\_c\_C5\_meants.txt")),  
 `PS colour-rSMG` = scan(file.path("fMRI\_data", "mu\_c\_C6\_meants.txt")),  
 `PS colour-PRC` = scan(file.path("fMRI\_data", "mu\_c\_C7\_meants.txt")),  
 # load zstats for mu-e  
 `PS emotion-rPRC` = scan(file.path("fMRI\_data", "mu\_e\_C4\_meants.txt")),  
 `PS emotion-rFG` = scan(file.path("fMRI\_data", "mu\_e\_C3\_meants.txt")),  
 `PS emotion-lFG` = scan(file.path("fMRI\_data", "mu\_e\_C2\_meants.txt")),  
 # load zstat for neural adaptation  
 `adaptation-rFG` = scan(file.path("fMRI\_data", "adapt\_meants.txt"))  
 ) %>%  
 pivot\_longer(cols = -diagnosis, names\_to = c("parameter", "region"),   
 names\_sep = "-", values\_to = "activation")  
  
# plot   
df.act %>%  
 ggplot(aes(region, activation, fill = diagnosis, colour = diagnosis)) + #  
 geom\_rain(rain.side = 'r',  
boxplot.args = list(color = "black", outlier.shape = NA, show.legend = FALSE, alpha = .8),  
violin.args = list(color = "black", outlier.shape = NA, alpha = .6),  
boxplot.args.pos = list(  
 position = ggpp::position\_dodgenudge(x = 0, width = 0.3), width = 0.3  
),  
point.args = list(show\_guide = FALSE, alpha = .5, size = 0.5),  
violin.args.pos = list(  
 width = 0.6, position = position\_nudge(x = 0.16)),  
point.args.pos = list(position = ggpp::position\_dodgenudge(x = -0.25, width = 0.1))) +  
 scale\_fill\_manual(values = custom.col) +  
 scale\_color\_manual(values = custom.col) +  
 labs(title = "Neural correlates", x = "", y = "z-stat") +   
 facet\_grid(. ~ parameter, scales = "free", space = "free") +  
 geom\_hline(yintercept = 0) +  
 theme\_bw() +   
 theme(legend.position = "bottom",   
 plot.title = element\_text(hjust = 0.5),   
 legend.direction = "horizontal",   
 text = element\_text(size = 12, family = "mono", face = "bold")  
 )

## Warning: The `show\_guide` argument of `layer()` is deprecated as of ggplot2 2.0.0.  
## ℹ Please use the `show.legend` argument instead.  
## ℹ The deprecated feature was likely used in the ggrain package.  
## Please report the issue at <https://github.com/njudd/ggrain/issues>.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was  
## generated.

## Warning in (function (mapping = NULL, data = NULL, stat = "half\_ydensity", :  
## Ignoring unknown parameters: `outlier.shape`



ggsave("neural\_zstat.pdf",  
 units = "mm", width = 270, height = 100, dpi = 300)