

# Smith Replication Data Analysis

Laura Marusich, Jon Bakdash, Emilie Caron

2022-05-05

## Save References, R Environment, and Session Information

```
# References for R packages
#install.packages(devtools)
#require(devtools)
#devtools::install_github("crsh/papaja")
#require(papaja)

#papaja::r_refs(file = "output/r-package-refs.bib") #<-- writes bib file w/refs

#Save package versions
#renv::snapshot()

sessionInfo()
```

```
## R version 4.1.2 (2021-11-01)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 10 x64 (build 19044)
##
## Matrix products: default
##
## locale:
## [1] LC_COLLATE=English_United States.1252 LC_CTYPE=English_United States.1252
## [3] LC_MONETARY=English_United States.1252 LC_NUMERIC=C
## [5] LC_TIME=English_United States.1252
##
## attached base packages:
## [1] stats      graphics  grDevices datasets  utils      methods    base
##
## other attached packages:
## [1] renv_0.15.4      ggstance_0.3.5      scales_1.2.0      rlang_1.0.2
## [5] cowplot_1.1.1    readxl_1.4.0        reshape2_1.4.4    superb_0.9.7.8
## [9] psychReport_3.0.1 apaTables_2.0.8      psych_2.2.3       BayesFactor_0.9.12-4.3
## [13] coda_0.19-4      ez_4.4-0            afex_1.1-1        lme4_1.1-29
## [17] Matrix_1.3-4     forcats_0.5.1       stringr_1.4.0     dplyr_1.0.9
## [21] purrr_0.3.4      readr_2.1.2         tidyverse_1.3.1   tidyverse_1.3.1
## [25] ggplot2_3.3.6    tidyverse_1.3.1     plyr_1.8.7        rmarkdown_2.14
## [29] knitr_1.39       pacman_0.5.1
##
## loaded via a namespace (and not attached):
```

```
## [1] minqa_1.2.4           colorspace_2.0-3      ellipsis_0.3.2        fs_1.5.2
## [5] rstudioapi_0.13        MatrixModels_0.5-0    fansi_1.0.3           mvtnorm_1.1-3
## [9] lubridate_1.8.0        xml2_1.3.3            splines_4.1.2         mnormt_2.0.2
## [13] jsonlite_1.8.0         nloptr_2.0.0          lsr_0.5.2             broom_0.8.0
## [17] dbplyr_2.1.1           shiny_1.7.1           compiler_4.1.2         httr_1.4.3
## [21] backports_1.4.1        assertthat_0.2.1      fastmap_1.1.0         cli_3.3.0
## [25] later_1.3.0            htmltools_0.5.2       tools_4.1.2           lmerTest_3.1-3
## [29] gtable_0.3.0           glue_1.6.2            Rcpp_1.0.8.3          carData_3.0-5
## [33] cellranger_1.1.0       vctrs_0.4.1           nlme_3.1-153          xfun_0.30
## [37] rbibutils_2.2.8        rvest_1.0.2           mime_0.12             lifecycle_1.0.1
## [41] gtools_3.9.2           MASS_7.3-54           hms_1.1.1             promises_1.2.0.1
## [45] shinyBS_0.61.1         parallel_4.1.2        yaml_2.3.5            pbapply_1.5-0
## [49] stringi_1.7.6          boot_1.3-28           Rdpack_2.3            pkgconfig_2.0.3
## [53] evaluate_0.15          lattice_0.20-45       tidyselect_1.1.2      magrittr_2.0.3
## [57] R6_2.5.1              generics_0.1.2        DBI_1.1.2             pillar_1.7.0
## [61] haven_2.5.0           foreign_0.8-81        withr_2.5.0           mgcv_1.8-38
## [65] abind_1.4-5           modelr_0.1.8          crayon_1.5.1          car_3.0-13
## [69] utf8_1.2.2            tmvnsim_1.0-2         tzdb_0.3.0            grid_4.1.2
## [73] reprex_2.0.1          digest_0.6.29         xtable_1.8-4          httpuv_1.6.5
## [77] numDeriv_2016.8-1.1  munsell_0.5.0
```

## Experiment 1 - Stroop

### Import and clean data

```
stroop_files = list.files(path = "Experiment 1 Data/", full.names = T)
stroop_files = stroop_files[str_detect(stroop_files, pattern="(?.*SJ)(?.*.txt)")]

mergedStroopData <- ldply(stroop_files,
  read.delim,
  header=FALSE,
  stringsAsFactors = FALSE,
  sep = "") #for each item in the list apply the function read.delim

names(mergedStroopData) = c("sj",
  "cb",
  "blockNumber",
  "blockType",
  "trialNum",
  "congruency",
  "posture",
  "wordStim",
  "inkColour",
  "rt",
  "cResp",
  "resp",
  "ac")

#...remove problem subjects
#.. No subjects pre-identified as needing to be removed (see ethics protocol)
```

```
#...check number of observations per condition
ftable(posture+congruency~sj, mergedStroopData)
```

##	posture	SITTING			STANDING		
##	congruency	congruent	incongruent	neutral	congruent	incongruent	neutral
## sj							
## 1		60	60	60	60	60	60
## 2		60	60	60	60	60	60
## 3		60	60	60	60	60	60
## 4		60	60	60	60	60	60
## 5		60	60	60	60	60	60
## 6		60	60	60	60	60	60
## 7		60	60	60	60	60	60
## 8		60	60	60	60	60	60
## 9		60	60	60	60	60	60
## 10		60	60	60	60	60	60
## 11		60	60	60	60	60	60
## 12		60	60	60	60	60	60
## 13		60	60	60	60	60	60
## 14		60	60	60	60	60	60
## 15		60	60	60	60	60	60
## 16		60	60	60	60	60	60
## 17		60	60	60	60	60	60
## 18		60	60	60	60	60	60
## 19		60	60	60	60	60	60
## 20		60	60	60	60	60	60
## 21		60	60	60	60	60	60
## 22		120	120	120	120	120	120
## 24		60	60	60	60	60	60
## 25		60	60	60	60	60	60
## 26		60	60	60	60	60	60
## 27		60	60	60	60	60	60
## 28		60	60	60	60	60	60
## 29		60	60	60	60	60	60
## 30		60	60	60	60	60	60
## 31		60	60	60	60	60	60
## 32		60	60	60	60	60	60
## 33		60	60	60	60	60	60
## 34		60	60	60	60	60	60
## 35		60	60	60	60	60	60
## 36		60	60	60	60	60	60
## 37		60	60	60	60	60	60
## 38		60	60	60	60	60	60
## 39		60	60	60	60	60	60
## 40		60	60	60	60	60	60
## 41		60	60	60	60	60	60
## 42		60	60	60	60	60	60
## 43		60	60	60	60	60	60
## 44		60	60	60	60	60	60
## 45		60	60	60	60	60	60
## 46		60	60	60	60	60	60
## 47		60	60	60	60	60	60
## 48		60	60	60	60	60	60

## 49	60	60	60	60	60	60
## 50	60	60	60	60	60	60

```
ftable(blockType~sj, mergedStroopData)
```

##	blockType	experimental	practice
##	sj		
##	1	288	72
##	2	288	72
##	3	288	72
##	4	288	72
##	5	288	72
##	6	288	72
##	7	288	72
##	8	288	72
##	9	288	72
##	10	288	72
##	11	288	72
##	12	288	72
##	13	288	72
##	14	288	72
##	15	288	72
##	16	288	72
##	17	288	72
##	18	288	72
##	19	288	72
##	20	288	72
##	21	288	72
##	22	576	144
##	24	288	72
##	25	288	72
##	26	288	72
##	27	288	72
##	28	288	72
##	29	288	72
##	30	288	72
##	31	288	72
##	32	288	72
##	33	288	72
##	34	288	72
##	35	288	72
##	36	288	72
##	37	288	72
##	38	288	72
##	39	288	72
##	40	288	72
##	41	288	72
##	42	288	72
##	43	288	72
##	44	288	72
##	45	288	72
##	46	288	72
##	47	288	72
##	48	288	72

```
## 49          288      72
## 50          288      72
```

```
##...need to fix SJ - same one was used with two counterbalances
```

```
mergedStroopData$sj = paste(mergedStroopData$sj,"_",mergedStroopData$cb,sep="")
```

```
##...check for missing data
```

```
mergedStroopData[!complete.cases(mergedStroopData),]
```

##	sj	cb	blockNumber	blockType	trialNum	congruency	posture	wordStim	inkColour	rt	cResp
## 646	10_2	2	8	experimental	34	incongruent	STANDING	RED	green	0	2
## 1081	12_2	2	1	practice	1	neutral	SITTING	XXXXX	green	0	2
## 1117	12_2	2	2	experimental	1	incongruent	SITTING	GREEN	red	0	1
## 1445	13_1	1	1	practice	5	incongruent	STANDING	GREEN	red	0	1
## 1801	14_2	2	1	practice	1	neutral	SITTING	XXX	green	0	2
## 2162	15_1	1	1	practice	2	congruent	STANDING	GREEN	green	0	2
## 2163	15_1	1	1	practice	3	neutral	STANDING	XXXXX	green	0	2
## 2615	16_2	2	3	experimental	23	incongruent	SITTING	RED	green	0	2
## 2720	16_2	2	6	practice	20	neutral	STANDING	XXX	red	0	1
## 2737	16_2	2	7	experimental	1	incongruent	STANDING	GREEN	red	0	1
## 2885	17_1	1	1	practice	5	incongruent	STANDING	RED	green	0	2
## 3360	18_2	2	4	experimental	12	incongruent	SITTING	GREEN	red	0	1
## 3457	18_2	2	7	experimental	1	incongruent	STANDING	RED	green	0	2
## 3601	19_1	1	1	practice	1	congruent	STANDING	RED	red	0	1
## 4370	20_2	2	2	experimental	14	neutral	SITTING	XXXXX	red	0	1
## 4505	20_2	2	6	practice	5	incongruent	STANDING	GREEN	red	0	1
## 4681	21_1	1	1	practice	1	congruent	STANDING	RED	red	0	1
## 4682	21_1	1	1	practice	2	neutral	STANDING	XXX	red	0	1
## 4692	21_1	1	1	practice	12	incongruent	STANDING	RED	green	0	2
## 5041	22_1	1	1	practice	1	incongruent	STANDING	GREEN	red	0	1
## 5042	22_1	1	1	practice	2	incongruent	STANDING	RED	green	0	2
## 5043	22_1	1	1	practice	3	neutral	STANDING	XXX	red	0	1
## 5422	22_2	2	1	practice	22	incongruent	SITTING	GREEN	red	0	1
## 5428	22_2	2	1	practice	28	incongruent	SITTING	RED	green	0	2
## 5501	22_2	2	3	experimental	29	neutral	SITTING	XXXXX	red	0	1
## 5530	22_2	2	4	experimental	22	incongruent	SITTING	RED	green	0	2
## 5533	22_2	2	4	experimental	25	incongruent	SITTING	RED	green	0	2
## 5608	22_2	2	6	practice	28	incongruent	STANDING	GREEN	red	0	1
## 5621	22_2	2	7	experimental	5	neutral	STANDING	XXXXX	green	0	2
## 5644	22_2	2	7	experimental	28	neutral	STANDING	XXX	green	0	2
## 5668	22_2	2	8	experimental	16	incongruent	STANDING	GREEN	red	0	1
## 5684	22_2	2	8	experimental	32	neutral	STANDING	XXXXX	red	0	1
## 5741	22_2	2	10	experimental	17	neutral	STANDING	XXX	green	0	2
## 5761	24_2	2	1	practice	1	congruent	SITTING	RED	red	0	1
## 5763	24_2	2	1	practice	3	congruent	SITTING	GREEN	green	0	2
## 5768	24_2	2	1	practice	8	neutral	SITTING	XXX	green	0	2
## 5770	24_2	2	1	practice	10	incongruent	SITTING	RED	green	0	2
## 5772	24_2	2	1	practice	12	congruent	SITTING	GREEN	green	0	2
## 5773	24_2	2	1	practice	13	neutral	SITTING	XXX	red	0	1
## 5775	24_2	2	1	practice	15	incongruent	SITTING	GREEN	red	0	1
## 5776	24_2	2	1	practice	16	neutral	SITTING	XXXXX	green	0	2
## 5797	24_2	2	2	experimental	1	neutral	SITTING	XXXXX	green	0	2
## 5798	24_2	2	2	experimental	2	incongruent	SITTING	RED	green	0	2
## 6018	24_2	2	8	experimental	6	congruent	STANDING	RED	red	0	1

## 6121	25_1	1	1	practice	1	neutral	STANDING	XXX	red	0	1
## 6482	26_2	2	1	practice	2	neutral	SITTING	XXXXX	red	0	1
## 6518	26_2	2	2	experimental	2	incongruent	SITTING	RED	green	0	2
## 6841	27_1	1	1	practice	1	congruent	STANDING	RED	red	0	1
## 6842	27_1	1	1	practice	2	neutral	STANDING	XXXXX	green	0	2
## 6843	27_1	1	1	practice	3	neutral	STANDING	XXXXX	red	0	1
## 7202	28_2	2	1	practice	2	incongruent	SITTING	GREEN	red	0	1
## 7921	3_1	1	1	practice	1	congruent	STANDING	GREEN	green	0	2
## 7957	3_1	1	2	experimental	1	neutral	STANDING	XXXXX	red	0	1
## 8858	31_1	1	7	experimental	2	congruent	SITTING	RED	red	0	1
## 9253	32_2	2	8	experimental	1	neutral	STANDING	XXX	green	0	2
## 9361	33_1	1	1	practice	1	congruent	STANDING	RED	red	0	1
## 9364	33_1	1	1	practice	4	incongruent	STANDING	GREEN	red	0	1
## 9386	33_1	1	1	practice	26	congruent	STANDING	GREEN	green	0	2
## 9390	33_1	1	1	practice	30	neutral	STANDING	XXX	red	0	1
## 9505	33_1	1	5	experimental	1	neutral	STANDING	XXXXX	red	0	1
## 10441	36_2	2	1	practice	1	congruent	SITTING	GREEN	green	0	2
## 10444	36_2	2	1	practice	4	incongruent	SITTING	GREEN	red	0	1
## 10447	36_2	2	1	practice	7	incongruent	SITTING	RED	green	0	2
## 10448	36_2	2	1	practice	8	neutral	SITTING	XXX	green	0	2
## 10535	36_2	2	3	experimental	23	incongruent	SITTING	GREEN	red	0	1
## 10639	36_2	2	6	practice	19	neutral	STANDING	XXXXX	green	0	2
## 10785	36_2	2	10	experimental	21	congruent	STANDING	GREEN	green	0	2
## 11294	38_2	2	4	experimental	26	incongruent	SITTING	RED	green	0	2
## 11387	38_2	2	7	experimental	11	neutral	STANDING	XXX	green	0	2
## 11418	38_2	2	8	experimental	6	incongruent	STANDING	RED	green	0	2
## 11421	38_2	2	8	experimental	9	incongruent	STANDING	GREEN	red	0	1
## 12202	4_2	2	9	experimental	34	incongruent	STANDING	GREEN	red	0	1
## 12241	40_2	2	1	practice	1	incongruent	SITTING	RED	green	0	2
## 13603	43_1	1	8	experimental	31	incongruent	SITTING	RED	green	0	2
## 13688	44_2	2	1	practice	8	incongruent	SITTING	RED	green	0	2
## 13689	44_2	2	1	practice	9	incongruent	SITTING	GREEN	red	0	1
## 13694	44_2	2	1	practice	14	incongruent	SITTING	GREEN	red	0	1
## 13695	44_2	2	1	practice	15	neutral	SITTING	XXXXX	red	0	1
## 13696	44_2	2	1	practice	16	incongruent	SITTING	RED	green	0	2
## 13702	44_2	2	1	practice	22	congruent	SITTING	GREEN	green	0	2
## 13709	44_2	2	1	practice	29	incongruent	SITTING	GREEN	red	0	1
## 13713	44_2	2	1	practice	33	incongruent	SITTING	RED	green	0	2
## 13715	44_2	2	1	practice	35	incongruent	SITTING	GREEN	red	0	1
## 13716	44_2	2	1	practice	36	congruent	SITTING	GREEN	green	0	2
## 13717	44_2	2	2	experimental	1	congruent	SITTING	RED	red	0	1
## 13721	44_2	2	2	experimental	5	incongruent	SITTING	GREEN	red	0	1
## 14041	45_1	1	1	practice	1	congruent	STANDING	GREEN	green	0	2
## 14379	45_1	1	10	experimental	15	neutral	SITTING	XXXXX	green	0	2
## 14864	47_1	1	3	experimental	32	congruent	STANDING	RED	red	0	1
## 14901	47_1	1	4	experimental	33	neutral	STANDING	XXX	green	0	2
## 14958	47_1	1	6	practice	18	incongruent	SITTING	RED	green	0	2
## 15121	48_2	2	1	practice	1	congruent	SITTING	GREEN	green	0	2
## 15842	5_1	1	1	practice	2	incongruent	STANDING	GREEN	red	0	1
## 15843	5_1	1	1	practice	3	congruent	STANDING	RED	red	0	1
## 15845	5_1	1	1	practice	5	congruent	STANDING	GREEN	green	0	2
## 15846	5_1	1	1	practice	6	incongruent	STANDING	RED	green	0	2
## 15847	5_1	1	1	practice	7	neutral	STANDING	XXX	green	0	2
## 16107	5_1	1	8	experimental	15	neutral	SITTING	XXX	red	0	1

## 16201	50_2	2	1	practice	1	incongruent	SITTING	GREEN	red	0	1
## 16565	6_2	2	1	practice	5	congruent	SITTING	RED	red	0	1
## 16957	7_1	1	2	experimental	1	neutral	STANDING	XXX	green	0	2
## 17282	8_2	2	1	practice	2	incongruent	SITTING	GREEN	red	0	1
## 17643	9_1	1	1	practice	3	congruent	STANDING	GREEN	green	0	2
## 17644	9_1	1	1	practice	4	incongruent	STANDING	RED	green	0	2
##	resp	ac									
## 646	0	NA									
## 1081	0	NA									
## 1117	0	NA									
## 1445	0	NA									
## 1801	0	NA									
## 2162	0	NA									
## 2163	0	NA									
## 2615	0	NA									
## 2720	0	NA									
## 2737	0	NA									
## 2885	0	NA									
## 3360	0	NA									
## 3457	0	NA									
## 3601	0	NA									
## 4370	0	NA									
## 4505	0	NA									
## 4681	0	NA									
## 4682	0	NA									
## 4692	0	NA									
## 5041	0	NA									
## 5042	0	NA									
## 5043	0	NA									
## 5422	0	NA									
## 5428	0	NA									
## 5501	0	NA									
## 5530	0	NA									
## 5533	0	NA									
## 5608	0	NA									
## 5621	0	NA									
## 5644	0	NA									
## 5668	0	NA									
## 5684	0	NA									
## 5741	0	NA									
## 5761	0	NA									
## 5763	0	NA									
## 5768	0	NA									
## 5770	0	NA									
## 5772	0	NA									
## 5773	0	NA									
## 5775	0	NA									
## 5776	0	NA									
## 5797	0	NA									
## 5798	0	NA									
## 6018	0	NA									
## 6121	0	NA									
## 6482	0	NA									
## 6518	0	NA									

## 6841	0 NA
## 6842	0 NA
## 6843	0 NA
## 7202	0 NA
## 7921	0 NA
## 7957	0 NA
## 8858	0 NA
## 9253	0 NA
## 9361	0 NA
## 9364	0 NA
## 9386	0 NA
## 9390	0 NA
## 9505	0 NA
## 10441	0 NA
## 10444	0 NA
## 10447	0 NA
## 10448	0 NA
## 10535	0 NA
## 10639	0 NA
## 10785	0 NA
## 11294	0 NA
## 11387	0 NA
## 11418	0 NA
## 11421	0 NA
## 12202	0 NA
## 12241	0 NA
## 13603	0 NA
## 13688	0 NA
## 13689	0 NA
## 13694	0 NA
## 13695	0 NA
## 13696	0 NA
## 13702	0 NA
## 13709	0 NA
## 13713	0 NA
## 13715	0 NA
## 13716	0 NA
## 13717	0 NA
## 13721	0 NA
## 14041	0 NA
## 14379	0 NA
## 14864	0 NA
## 14901	0 NA
## 14958	0 NA
## 15121	0 NA
## 15842	0 NA
## 15843	0 NA
## 15845	0 NA
## 15846	0 NA
## 15847	0 NA
## 16107	0 NA
## 16201	0 NA
## 16565	0 NA
## 16957	0 NA



```
## 17282    0 NA
## 17643    0 NA
## 17644    0 NA
```

```
#...THERE IS MISSING DATA, BUT IT IS EXPECTED:
#...There are trials where the the experiment times out
#...can be identified as RT == 0
#...trials where a response was not made have an RT =0, resp=0 and ac = NA

#...get the number of time outs
dim(mergedStroopData[!complete.cases(mergedStroopData),])[1]
```

```
## [1] 104
```

```
#...how are the missing trials distributed???
timeOutStroopData = mergedStroopData[!complete.cases(mergedStroopData),]

ftable(posture~congruency, timeOutStroopData)
```

```
##           posture SITTING STANDING
## congruency
## congruent           10          14
## incongruent         29          18
## neutral             13          20
```

```
ftable(blockType~sj, timeOutStroopData)
```

```
##           blockType experimental practice
## sj
## 10_2           1           0
## 12_2           1           1
## 13_1           0           1
## 14_2           0           1
## 15_1           0           2
## 16_2           2           1
## 17_1           0           1
## 18_2           2           0
## 19_1           0           1
## 20_2           1           1
## 21_1           0           3
## 22_1           0           3
## 22_2           8           3
## 24_2           3           8
## 25_1           0           1
## 26_2           1           1
## 27_1           0           3
## 28_2           0           1
## 3_1            1           1
## 31_1           1           0
## 32_2           1           0
## 33_1           1           4
## 36_2           2           5
```

```
## 38_2          4          0
## 4_2           1          0
## 40_2          0          1
## 43_1          1          0
## 44_2          2         10
## 45_1          1          1
## 47_1          2          1
## 48_2          0          1
## 5_1           1          5
## 50_2          0          1
## 6_2           0          1
## 7_1           1          0
## 8_2           0          1
## 9_1           0          2
```

```
##...this code changes the "time-out" trials as errors
##...see Davoli et al.
```

```
mergedStroopData$sac[mergedStroopData$rt==0] = 0
```

```
##...remove practice trials
```

```
mergedStroopData <- mergedStroopData[!mergedStroopData$blockType=="practice",]
```

```
##...check that only experimental trials are left
```

```
unique(mergedStroopData$blockType)
```

```
## [1] "experimental"
```

```
totalStroopTrials = dim(mergedStroopData)[1]
```

```
observationDataStroop = data.frame(ftable(blockType~sj, mergedStroopData))[,c(1,3)]
```

```
##...remove trials faster than 100ms
```

```
# mergedStroopData= mergedStroopData[!mergedStroopData$rt==0,] #...greater than 1500ms
```

```
mergedStroopData= mergedStroopData[!(mergedStroopData$rt<=100 & mergedStroopData$rt > 0),]
```

```
validStroopRTTrials = dim(mergedStroopData)[1]
```

```
observationDataStroop$validTrials = data.frame(ftable(blockType~sj, mergedStroopData))[,c(3)]
```

```
print(paste("percent invalid trials = ",
            ((totalStroopTrials-validStroopRTTrials)/totalStroopTrials)*100))
```

```
## [1] "percent invalid trials = 0.006944444444444444"
```

```
write.table(mergedStroopData, file = "Experiment 1 Data/merged_stroop_data.txt",
            row.names = F)
```

```
stroopCorrect = mergedStroopData[mergedStroopData$sac == 1, ]
```

```
# mergedDataSet = mergedDataSet[mergedDataSet$sac ==1,]
```

```
errorsRemoved = dim(stroopCorrect)[1] ##...total remaining trials
```

```
observationDataStroop$correctTrials = data.frame(ftable(blockType~sj, stroopCorrect))[,c(3)]
```

```
trimInfo = data.frame(totalStroopTrials, validStroopRTTrials,errorsRemoved)
```

```
head(trimInfo)
```

```
## totalStroopTrials validStroopRTTrials errorsRemoved
## 1 14400 14399 13852
```

```
#...percent of error trials lost
print(paste("percent errors removed = ",
            (((validStroopRTTrials-errorsRemoved)/totalStroopTrials)*100)))
```

```
## [1] "percent errors removed = 3.79861111111111"
```

```
#####
#...CHECK 20% CRITERION
#####
observationDataStroop$percentLoss =
  ((observationDataStroop$Freq-observationDataStroop$correctTrials)/
   observationDataStroop$Freq)*100

observationDataStroop$percentLoss
```

```
## [1] 3.472222 1.736111 0.347222 6.944444 1.736111 4.166667 4.513889 1.736111
## [9] 1.041667 1.736111 1.736111 3.125000 2.083333 4.513889 1.736111 10.069444
## [17] 8.680556 0.347222 2.083333 4.513889 4.861111 1.388889 1.388889 3.472222
## [25] 16.666667 1.736111 15.972222 1.041667 0.000000 5.555556 2.083333 8.680556
## [33] 0.347222 3.125000 1.736111 2.083333 4.166667 2.777778 2.430556 7.638889
## [41] 1.041667 4.166667 2.777778 1.041667 5.555556 3.125000 10.069444 1.736111
## [49] 3.472222 3.819444
```

```
sum(observationDataStroop$percentLoss>20)
```

```
## [1] 0
```

```
#...None!

#...RUN TRIMMING PROCEDURE
tempList = pjRecursiveTrim2(stroopCorrect, #...dataset
                           "rt", #...dependent variables
                           c("sj",
                             "cb",
                             "congruency",
                             "posture")) #.independent variables

trimmedStroopData=tempList[[1]]
totalStroopN = tempList[[2]]
rejectedStroop = tempList[[3]]
percentTrimmedStroop = tempList[[4]]
NcellsStroop = tempList[[5]]

#...get the trimming info
trimOutputStroop= data.frame(totalStroopN, rejectedStroop,percentTrimmedStroop,NcellsStroop)
head(trimOutputStroop)
```

```
## totalStroopN rejectedStroop percentTrimmedStroop NcellsStroop
## 1 13852 292 2.107999 300
```

```
stroopRT = plyr::ddply(trimmedStroopData,
                      .(sj, cb, congruency, posture),
                      summarise,
                      meanRT = mean(rt))

head(stroopRT)
```

```
## sj cb congruency posture meanRT
## 1 1_1 1 congruent SITTING 471.6458
## 2 1_1 1 congruent STANDING 400.0638
## 3 1_1 1 incongruent SITTING 430.0455
## 4 1_1 1 incongruent STANDING 439.8444
## 5 1_1 1 neutral SITTING 454.5455
## 6 1_1 1 neutral STANDING 408.4565
```

```
#...get error data
stroopPE = plyr::ddply(mergedStroopData,
                      .(sj, cb, congruency, posture),
                      summarise,
                      meanPE = 100 - (mean(ac)*100))

head(stroopPE)
```

```
## sj cb congruency posture meanPE
## 1 1_1 1 congruent SITTING 0.000000
## 2 1_1 1 congruent STANDING 0.000000
## 3 1_1 1 incongruent SITTING 4.166667
## 4 1_1 1 incongruent STANDING 6.250000
## 5 1_1 1 neutral SITTING 6.250000
## 6 1_1 1 neutral STANDING 4.166667
```

```
#...combine the RT and error data
stroopCombined = cbind(stroopRT, meanPE = stroopPE$meanPE)

head(stroopCombined)
```

```
## sj cb congruency posture meanRT meanPE
## 1 1_1 1 congruent SITTING 471.6458 0.000000
## 2 1_1 1 congruent STANDING 400.0638 0.000000
## 3 1_1 1 incongruent SITTING 430.0455 4.166667
## 4 1_1 1 incongruent STANDING 439.8444 6.250000
## 5 1_1 1 neutral SITTING 454.5455 6.250000
## 6 1_1 1 neutral STANDING 408.4565 4.166667
```

```
#...set as factors
stroopCombined$sj = factor(stroopCombined$sj)
stroopCombined$cb = factor(stroopCombined$cb)
```

## Reaction time results

```
rtModelStroop <- ezANOVA(stroopCombined,
  dv = .(meanRT),
  wid=.(sj),
  within=.(posture,congruency),
  detailed=TRUE,
  type=3,
  return_aov=TRUE)
```

```
## Warning: Converting "posture" to factor for ANOVA.
```

```
## Warning: Converting "congruency" to factor for ANOVA.
```

```
rtModelStroop$ANOVA
```

##	Effect	DFn	DFd	SSn	SSd	F	p	p<.05	ges
## 1	(Intercept)	1	49	6.530862e+07	1322013.63	2.420643e+03	2.233955e-43	*	0.9748634585
## 2	posture	1	49	8.221421e+02	156217.37	2.578776e-01	6.138604e-01		0.0004879807
## 3	congruency	2	98	7.093105e+04	154676.49	2.247026e+01	9.278220e-09	*	0.0404190166
## 4	posture:congruency	2	98	8.430066e+01	51054.35	8.090852e-02	9.223396e-01		0.0000500584

```
rtStroopMSE = rtModelStroop$ANOVA$SSd/rtModelStroop$ANOVA$DFd
```

```
##...print ANOVA in nice format
```

```
paste(rtModelStroop$ANOVA$Effect,": F(",
  rtModelStroop$ANOVA$DFn,
  ", ",
  rtModelStroop$ANOVA$DFd,
  ") = ",
  round(rtModelStroop$ANOVA$F,3),
  ", MSE = ",
  round(rtStroopMSE,3),
  ", p = ",
  round(rtModelStroop$ANOVA$p,3),
  ", partialEtaSq = ",
  round(rtModelStroop$ANOVA$SSn/(rtModelStroop$ANOVA$SSn+rtModelStroop$ANOVA$SSd),4),
  sep="")
```

```
## [1] "(Intercept): F(1, 49) = 2420.643, MSE = 26979.87, p = 0, partialEtaSq = 0.9802"
## [2] "posture: F(1, 49) = 0.258, MSE = 3188.11, p = 0.614, partialEtaSq = 0.0052"
## [3] "congruency: F(2, 98) = 22.47, MSE = 1578.332, p = 0, partialEtaSq = 0.3144"
## [4] "posture:congruency: F(2, 98) = 0.081, MSE = 520.963, p = 0.922, partialEtaSq = 0.0016"
```

```
##...CALCULATE THE BAYES FACTORS FOR THE RT ANALYSIS
```

```
stroopBF = stroopCombined
stroopBF$posture = factor(stroopBF$posture)
stroopBF$congruency = factor(stroopBF$congruency)
bfValues1 = anovaBF(meanRT~congruency*posture+sj,
  data = stroopBF,
```

```

        whichRandom = "sj",
        method="laplace")
bfValues1

```

```

## Bayes factor analysis
## -----
## [1] congruency + sj : 35335703 ±NA%
## [2] posture + sj : 0.1461731 ±NA%
## [3] congruency + posture + sj : 5410998 ±NA%
## [4] congruency + posture + congruency:posture + sj : 346149.8 ±NA%
##
## Against denominator:
## meanRT ~ sj
## ---
## Bayes factor type: BFlinearModel, JZS

```

```

#...get the Bayes factor for the Null Interaction
bfValues1[3]/bfValues1[4]

```

```

## Bayes factor analysis
## -----
## [1] congruency + posture + sj : 15.63195 ±NA%
##
## Against denominator:
## meanRT ~ congruency + posture + congruency:posture + sj
## ---
## Bayes factor type: BFlinearModel, JZS

```

```

1/(bfValues1[3]/bfValues1[4])

```

```

## Bayes factor analysis
## -----
## [1] congruency + posture + congruency:posture + sj : 0.06397154 ±NA%
##
## Against denominator:
## meanRT ~ congruency + posture + sj
## ---
## Bayes factor type: BFlinearModel, JZS

```

```

# Difference scores and paired t-tests
#... stroop effect (incongruent - congruent) FOR Standing
standingStroop = stroopCombined[stroopCombined$posture=="STANDING", ]
standingStroop = standingStroop[standingStroop$congruency!="neutral", ]
t.test(standingStroop$meanRT[standingStroop$congruency=="congruent"],
       standingStroop$meanRT[standingStroop$congruency=="incongruent"],
       paired=TRUE )

```

```

##
## Paired t-test
##
## data: standingStroop$meanRT[standingStroop$congruency == "congruent"] and standingStroop$meanRT[stan

```

```
## t = -4.3805, df = 49, p-value = 6.226e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -53.81756 -19.96796
## sample estimates:
## mean of the differences
## -36.89276
```

```
#... stroop effect (incongruent - congruent) FOR SITTING
sittingStroop = stroopCombined[stroopCombined$posture=="SITTING", ]
sittingStroop = sittingStroop[sittingStroop$congruency!="neutral", ]
t.test(sittingStroop$meanRT[sittingStroop$congruency=="congruent"],
       sittingStroop$meanRT[sittingStroop$congruency=="incongruent"],
       paired=TRUE )
```

```
##
## Paired t-test
##
## data: sittingStroop$meanRT[sittingStroop$congruency == "congruent"] and sittingStroop$meanRT[sittingStroop$congruency == "incongruent"]
## t = -5.1209, df = 49, p-value = 5.104e-06
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -52.27703 -22.81052
## sample estimates:
## mean of the differences
## -37.54377
```

## Percent error results

```
errModelStroop <- ezANOVA(stroopCombined,
                          dv = .(meanPE),
                          wid=.(sj),
                          within=.(posture,congruency),
                          detailed=TRUE,
                          type=3,
                          return_aov = TRUE)
```

```
## Warning: Converting "posture" to factor for ANOVA.
```

```
## Warning: Converting "congruency" to factor for ANOVA.
```

```
errStroopMSE = errModelStroop$ANOVA$SSd/errModelStroop$ANOVA$DFd

paste(errModelStroop$ANOVA$Effect,": F(",
      errModelStroop$ANOVA$DFn,
      ", ",
      errModelStroop$ANOVA$DFd,
      ") = ",
      round(errModelStroop$ANOVA$F,3),
      ", MSE = ",
```

```

round(errStroopMSE,3),
", p = ",
round(errModelStroop$ANOVA$p,3),
", partialEtaSq = ",
round(errModelStroop$ANOVA$SSn/(errModelStroop$ANOVA$SSn+errModelStroop$ANOVA$SSd),4),
sep="")

```

```

## [1] "(Intercept): F(1, 49) = 57.526, MSE = 75.297, p = 0, partialEtaSq = 0.54"
## [2] "posture: F(1, 49) = 0.007, MSE = 16.562, p = 0.934, partialEtaSq = 1e-04"
## [3] "congruency: F(2, 98) = 11.598, MSE = 9.222, p = 0, partialEtaSq = 0.1914"
## [4] "posture:congruency: F(2, 98) = 1.59, MSE = 6.228, p = 0.209, partialEtaSq = 0.0314"

```

```

#...ERRORS

```

```

#... stroop effect (incongruent - congruent) FOR Standing

```

```

t.test(standingStroop$meanPE[standingStroop$congruency=="congruent"],
       standingStroop$meanPE[standingStroop$congruency=="incongruent"],
       paired=TRUE )

```

```

##
## Paired t-test
##
## data: standingStroop$meanPE[standingStroop$congruency == "congruent"] and standingStroop$meanPE[stan
## t = -2.0681, df = 49, p-value = 0.04393
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -2.79325655 -0.04007678
## sample estimates:
## mean of the differences
## -1.416667

```

```

#... stroop effect (incongruent - congruent) FOR SITTING

```

```

t.test(sittingStroop$meanPE[sittingStroop$congruency=="congruent"],
       sittingStroop$meanPE[sittingStroop$congruency=="incongruent"],
       paired=TRUE )

```

```

##
## Paired t-test
##
## data: sittingStroop$meanPE[sittingStroop$congruency == "congruent"] and sittingStroop$meanPE[sitting
## t = -4.6535, df = 49, p-value = 2.51e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -3.758593 -1.491407
## sample estimates:
## mean of the differences
## -2.625

```

Make plots for Stroop



```

#...pull out summary statistics per condition averaged across subjects for graph
graphRT = describeBy(stroopCombined$meanRT,
                      list(stroopCombined$posture, stroopCombined$congruency),
                      mat=TRUE,
                      digits = 1)

graphPE = describeBy(stroopCombined$meanPE,
                      list(stroopCombined$posture, stroopCombined$congruency),
                      mat=TRUE,
                      digits = 1)

head(graphRT)

```

```

##      item  group1      group2 vars  n mean    sd median trimmed mad   min   max range skew
## X11     1  SITTING  congruent   1 50 450.8  56.3  443.0   446.5 45.5 348.3 598.3 250.0  0.7
## X12     2  STANDING  congruent   1 50 448.5  60.6  440.3   442.2 48.6 341.3 624.4 283.0  1.0
## X13     3  SITTING  incongruent  1 50 488.3  91.9  471.8   476.7 74.4 351.1 803.1 452.0  1.2
## X14     4  STANDING  incongruent  1 50 485.4 100.6  458.7   470.5 79.0 358.3 861.5 503.2  1.8
## X15     5  SITTING    neutral   1 50 465.6  66.3  456.6   460.1 49.7 357.8 702.6 344.7  1.0
## X16     6  STANDING    neutral   1 50 460.9  67.6  452.7   453.6 51.5 346.2 695.4 349.2  1.4
##      kurtosis  se
## X11         0.2 8.0
## X12         0.9 8.6
## X13         1.7 13.0
## X14         3.8 14.2
## X15         1.9 9.4
## X16         2.7 9.6

```

```

#...get rid of irrelevant columns
graphRT = graphRT[,c("group1", "group2", "mean", "se")]
graphPE = graphPE[,c("group1", "group2", "mean", "se")]

#...rename the variables
names(graphRT) = c("posture", "congruency", "mean", "se")
names(graphPE) = c("posture", "congruency", "mean", "se")

#...make sure posture is in UPPERCASE
graphRT$posture = str_to_upper(graphRT$posture)

#..calculate the within subjects confidence intervals based on loftus and masson
#..the confidence intervals are based on the interaction term.

inxn.rt.MSE = rtStroopMSE[4]
inxn.err.MSE = errStroopMSE[4]

graphRT$se = sqrt((inxn.rt.MSE)/length(unique(stroopCombined$sj)))
graphPE$se = sqrt((inxn.err.MSE)/length(unique(stroopCombined$sj)))

critT = qt(p=.025, df=length(unique(stroopCombined$sj))-2, lower.tail =FALSE)

#---add the min and max for the confidence intervals
graphRT$min = graphRT$mean - (graphRT$se*critT)
graphRT$max = graphRT$mean + (graphRT$se*critT)

```

```
####GET AC DATA FROM twoAnimalWordsPRPac.R
```

```
graphRT$ac = paste("(",format(round(graphPE$mean,digits=1),nsmall = 1),")",sep="")
head(graphRT)
```

```
##      posture congruency mean      se      min      max      ac
## X11 SITTING   congruent 450.8 3.227887 444.3099 457.2901 (2.6)
## X12 STANDING   congruent 448.5 3.227887 442.0099 454.9901 (3.3)
## X13 SITTING   incongruent 488.3 3.227887 481.8099 494.7901 (5.2)
## X14 STANDING   incongruent 485.4 3.227887 478.9099 491.8901 (4.7)
## X15 SITTING      neutral 465.6 3.227887 459.1099 472.0901 (3.7)
## X16 STANDING      neutral 460.9 3.227887 454.4099 467.3901 (3.4)
```

```
#...used for positioning the accuracy data on the graph
```

```
graphRT$vAdj = 25 #down
```

```
graphRT$vAdj[graphRT$congruency=="incongruent"]=25 #up
```

```
graphRT$hAdj = 0 #right
```

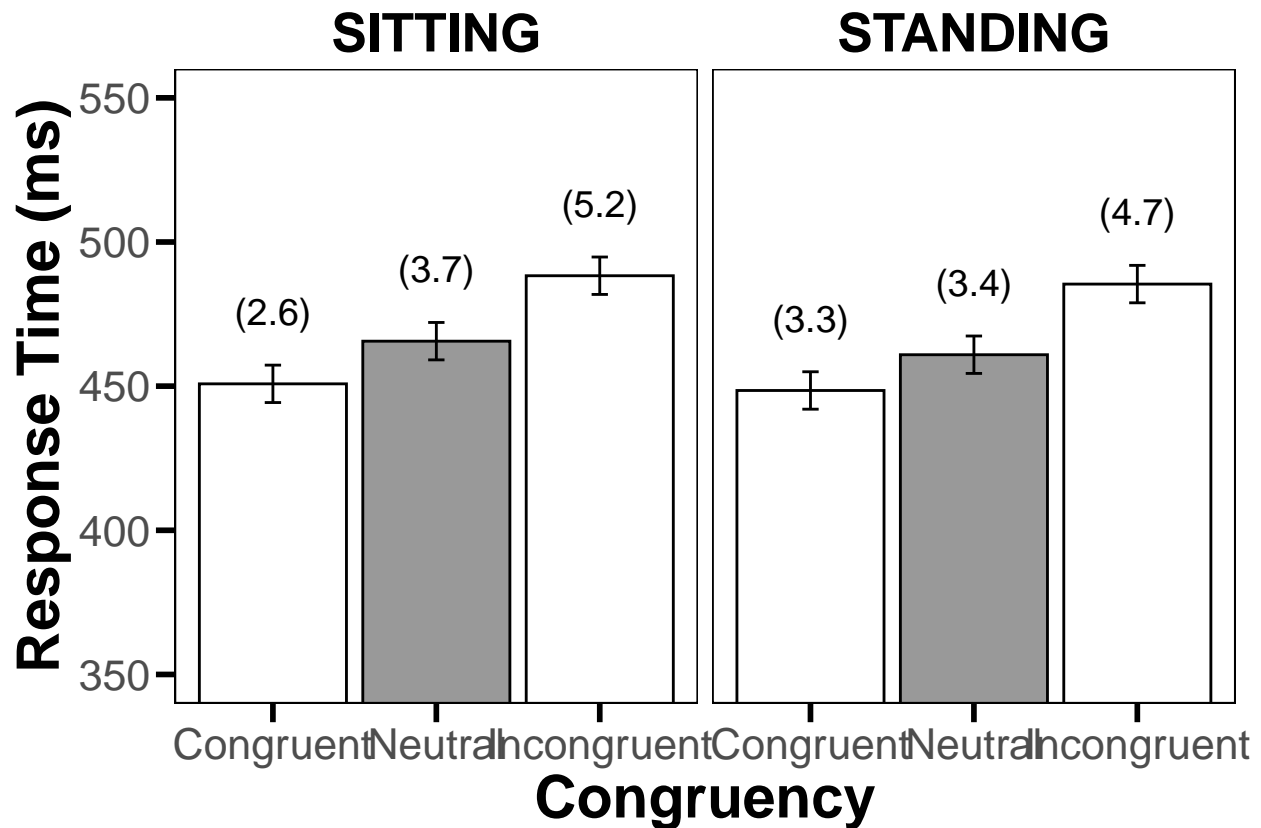
```
#graphRT$hAdj[graphRT$posture=="SITTING"]=-60 #left
```

```
graphRT$congruency = factor(graphRT$congruency,labels = c("Congruent","Incongruent","Neutral"))
```

```
graphRT$congruency = factor(graphRT$congruency,levels=c("Congruent","Neutral","Incongruent"))
```

```
interactionPlot <- ggplot(graphRT, aes(congruency, mean, group=posture)) +
  theme(legend.position = "none")+
  scale_fill_manual(values=c("#FFFFFF","999999","FFFFFF","999999")) +
  coord_cartesian(ylim=c(350,550),expand=TRUE) +
  scale_y_continuous(breaks = round(seq(350, 550, by = 50),0)) +
  geom_text(aes(label=ac),nudge_x=graphRT$hAdj,nudge_y =graphRT$vAdj, size=5) +
  geom_bar(stat="identity", aes(fill=interaction(congruency)),colour="black")+
  geom_errorbar(aes(ymin=min,ymax=max,group=interaction(posture,congruency)), width=.1)+
  labs(x = "Congruency", y = "Response Time (ms)") +
  theme(axis.ticks = element_line(size = 1, colour = "black", linetype = "solid"),
        axis.ticks.length = unit(.25,"cm"),
        #axis.line = element_line(size = 1, colour = "black", linetype = "solid"),
        panel.background = element_rect(fill = "white", colour = "white", size = 1),
        axis.text=element_text(size=16),
        axis.title=element_text(size=22,face="bold"),
        strip.text = element_text(size = 20, face = "bold",colour = "black", angle = 0),
        panel.border = element_rect(colour = "black", fill = NA, size = 0.50),
        strip.background = element_rect(fill=NA,colour="NA",size = 2))+
  facet_grid(~posture)
```

```
interactionPlot
```



```
ggsave(interactionPlot,
  file = "plots/exp1_stroop_interaction_plot.pdf",
  units = "in",
  width = 8.5,
  height = 5,
  dpi = 600)
```

```
exp1.table <-
apa.2way.table(congruency,
  posture,
  meanRT,
  stroopCombined,
  show.conf.interval = TRUE,
  landscape=TRUE,
  filename = "Output/exp1_table.doc")
```

```
exp1.table
```

```
##
##
## Means and standard deviations for meanRT as a function of a 3(congruency) X 2(posture) design
##
##           M           M_95%_CI      SD
## posture:SITTING
```

```
##      congruency
##      congruent 450.77 [434.78, 466.76] 56.26
##      incongruent 488.31 [462.20, 514.42] 91.87
##      neutral 465.62 [446.78, 484.47] 66.31
##
## posture:STANDING
##      congruency
##      congruent 448.51 [431.30, 465.72] 60.56
##      incongruent 485.40 [456.81, 513.99] 100.61
##      neutral 460.86 [441.64, 480.08] 67.64
##
## Note. M and SD represent mean and standard deviation, respectively.
## LL and UL indicate the lower and upper limits of the
## 95% confidence interval for the mean, respectively.
## The confidence interval is a plausible range of population means
## that could have created a sample mean (Cumming, 2014).
```

## Experiment 2 - Task-switching

### Import and clean data

```
###read in data

ts_path <- "/Experiment 2 Data/task-switching-replication-recoded-2.csv"
task_switching_raw <- read.csv(paste0(workingdir, ts_path))
head(task_switching_raw)
```

```
## participant session condition trialType posture blockNum trialNum switchTrialType
## 1 1 1 1 experiment standing 1 1 buffer
## 2 1 1 1 experiment standing 1 2 noswitch
## 3 1 1 1 experiment standing 1 3 switch
## 4 1 1 1 experiment standing 1 4 noswitch
## 5 1 1 1 experiment standing 1 5 noswitch
## 6 1 1 1 experiment standing 1 6 noswitch
## congruentTrialType cueType shapeType shapeColor response correctResponse correct reactionTime
## 1 incongruent solid square blue right left no 0.9088130
## 2 incongruent solid square blue left left yes 0.5947349
## 3 incongruent dashed square blue right right yes 0.7084870
## 4 incongruent dashed square blue right right yes 0.5995200
## 5 congruent dashed square yellow right right yes 0.4399409
## 6 congruent dashed square yellow right right yes 0.3847258
## date utcTime
## 1 2021-11-10 10:22:00 1636561737
## 2 2021-11-10 10:22:00 1636561744
## 3 2021-11-10 10:22:00 1636561746
## 4 2021-11-10 10:22:00 1636561748
## 5 2021-11-10 10:22:00 1636561750
## 6 2021-11-10 10:22:00 1636561752
```

```
### check data
```

```
#does every person have 392 trials?  
ntrials_sub <- task_switching_raw %>%  
  group_by(participant) %>%  
  summarize(ntrials = n()) %>%  
  pull(ntrials)  
  
all(ntrials_sub == 392)
```

```
## [1] TRUE
```

```
#does every block start with a buffer and have 49 trials?  
task_switching_raw <- task_switching_raw %>%  
  mutate(condblock = paste0(posture, blockNum))  
  
blocktrials <- task_switching_raw %>%  
  group_by(participant, condblock) %>%  
  summarize(ntrials = n(), firsttrial = first(switchTrialType))
```

## 'summarise()' has grouped output by 'participant'. You can override using the '.groups' argument.

```
all(blocktrials$ntrials == 49)
```

```
## [1] TRUE
```

```
all(blocktrials$firsttrial == "buffer")
```

```
## [1] TRUE
```

```
### clean data
```

```
#Drop buffer trials  
task_switching_raw2 <- task_switching_raw %>%  
  filter(switchTrialType != "buffer")  
  
#Recode Correct to 1 and Incorrect to 0  
task_switching_raw2$correct_bin <- recode(task_switching_raw2$correct,  
                                           "no" = 0,  
                                           "yes" = 1)  
  
#Calc overall acc by participant  
ts_overall_acc <- task_switching_raw2 %>%  
  group_by(participant) %>%  
  summarize(Accuracy = mean(correct_bin))  
  
#find participants with less than 80% accuracy  
#2, 8, 15, 44, 49, 51  
#First exclusion criteria  
low_acc_subs <- ts_overall_acc %>% filter(Accuracy < 0.80) %>%  
  pull(participant)
```

```

task_switching_raw3 <- task_switching_raw2 %>%
  filter(!(participant %in% low_acc_subs))

#Calc mean Acc by participant and conditions (posture, con, switch)
#Narrow format
ts_acc_mean <- task_switching_raw3 %>%
  group_by(participant,
            posture,
            congruentTrialType,
            switchTrialType) %>%
  summarize(Accuracy = mean(correct_bin))

## 'summarise()' has grouped output by 'participant', 'posture', 'congruentTrialType'. You can
## override using the '.groups' argument.

#Convert data to wide format (for statview/SPSS/etc)
ts_acc_mean_wide <- ts_acc_mean %>%
  pivot_wider(names_from = c(posture,
                              congruentTrialType,
                              switchTrialType),
              values_from = Accuracy)

# ts_acc_mean <- data.frame(ts_acc_mean)
ts_acc_mean <- ts_acc_mean %>%
  ungroup() %>%
  mutate(across(posture:switchTrialType, as.factor))

str(ts_acc_mean)

## tibble [408 x 5] (S3: tbl_df/tbl/data.frame)
## $ participant      : int [1:408] 1 1 1 1 1 1 1 1 3 3 ...
## $ posture          : Factor w/ 2 levels "sitting","standing": 1 1 1 1 2 2 2 2 1 1 ...
## $ congruentTrialType: Factor w/ 2 levels "congruent","incongruent": 1 1 2 2 1 1 2 2 1 1 ...
## $ switchTrialType  : Factor w/ 2 levels "noswitch","switch": 1 2 1 2 1 2 1 2 1 2 ...
## $ Accuracy         : num [1:408] 0.96 0.978 0.957 0.88 0.981 ...

```

```

#Total N = 51 (6 dropped for total acc < 80%)
length(unique(ts_acc_mean$participant))

```

```
## [1] 51
```

## Summarize Demographics

```

demo_raw <- read.csv(paste0(workingdir,
                             "/Experiment 2 Data/Task Switching_February 24, 2022_13.05.csv"),
                    skip = 1) %>%
  slice(-1) %>%
  select(-c(Response.Type, IP.Address, Recipient.Last.Name:Distribution.Channel))
colnames(demo_raw)[10:15] <- c("Gender.Pick", "Gender.Text", "Age", "Race.Pick", "Race.Text", "Eng.First")

dim(demo_raw)

```

```
## [1] 59 15
```

```
#59 records  
#first two are test data  
# need to match up the 6 dropped participants from behavioral data  
demo_df <- demo_raw %>%  
  filter(!(X %in% c("test", low_acc_subs)))  
dim(demo_df)
```

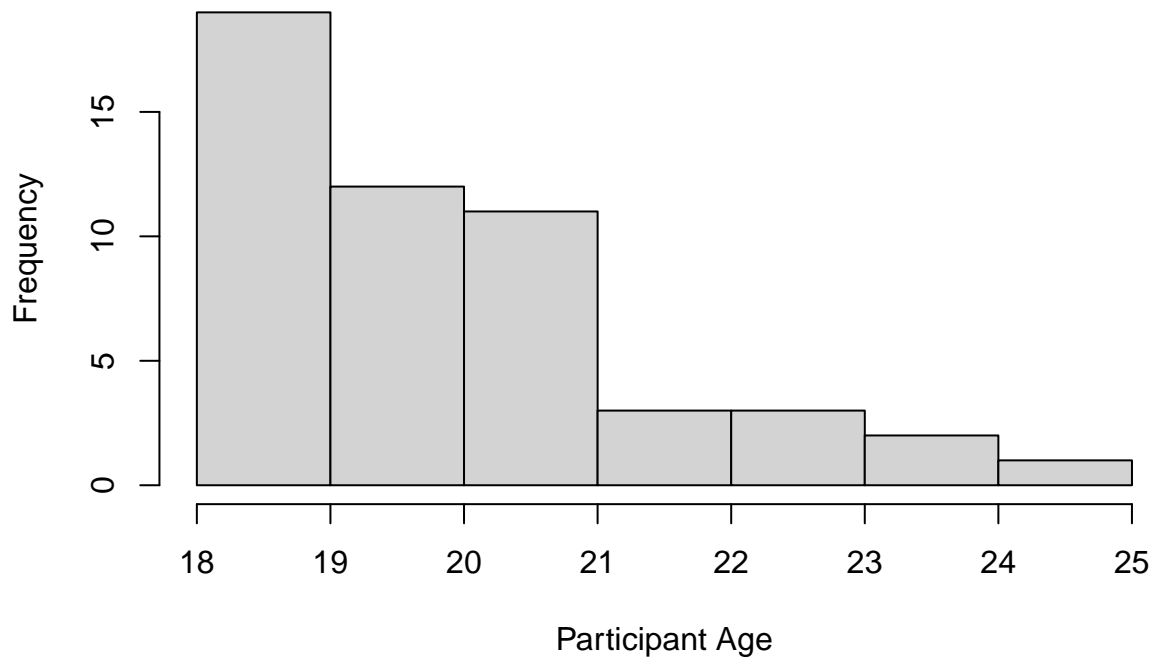
```
## [1] 51 15
```

```
demo_df <- demo_df %>%  
  mutate(Gender.New = ifelse(Gender.Pick %in% c("Man","Woman"), Gender.Pick, Gender.Text),  
         Eng.First = toupper(Eng.First))  
  
#gender breakdown  
gender_table <- demo_df %>%  
  group_by(Gender.New) %>%  
  summarize(n = n())  
gender_table
```

```
## # A tibble: 3 x 2  
##   Gender.New      n  
##   <chr>        <int>  
## 1 Man          23  
## 2 non binaary   1  
## 3 Woman        27
```

```
#age breakdown  
hist(as.numeric(demo_df$Age),  
     main = "Histogram of Participant Ages",  
     xlab = "Participant Age")
```

## Histogram of Participant Ages



```
age_table <- demo_df %>%  
  group_by(Age) %>%  
  summarize(n = n())  
age_table
```

```
## # A tibble: 8 x 2  
##   Age      n  
##   <chr> <int>  
## 1 18      9  
## 2 19     10  
## 3 20     12  
## 4 21     11  
## 5 22      3  
## 6 23      3  
## 7 24      2  
## 8 25      1
```

```
#age mean and sd  
mean_age <- mean(as.numeric(demo_df$Age))  
sd_age <- sd(as.numeric(demo_df$Age))  
  
kable(matrix(c(mean_age, sd_age), nrow = 1), col.names = c("Mean of Age", "SD of Age"))
```



Mean of Age	SD of Age
20.21569	1.73567

```
#race breakdown
```

```
race_table <- demo_df %>%
  group_by(Race.Pick) %>%
  summarize(n = n()) %>%
  arrange(desc(n))
race_table
```

```
## # A tibble: 6 x 2
##   Race.Pick          n
##   <chr>          <int>
## 1 White /European American    22
## 2 Black / African American    11
## 3 Hispanic/Latino/Latina/Latinx 11
## 4 Asian /South Pacific Islander   3
## 5 Central Asian /Indian /Pakistani 3
## 6 Native American / American Indian 1
```

```
#language breakdown
```

```
lang_table <- demo_df %>%
  group_by(Eng.First) %>%
  summarize(n=n())
lang_table
```

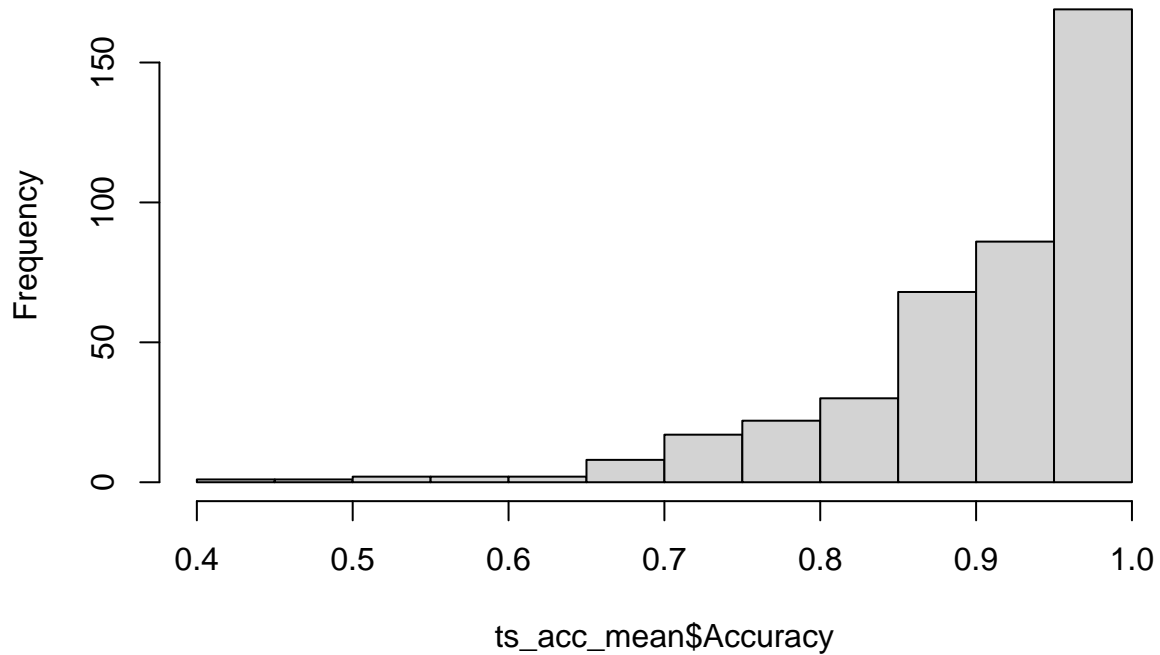
```
## # A tibble: 2 x 2
##   Eng.First    n
##   <chr>    <int>
## 1 NO         8
## 2 YES        43
```

## Accuracy results

```
#Accuracy for all cells
```

```
hist(ts_acc_mean$Accuracy)
```

## Histogram of ts\_acc\_mean\$Accuracy



```
accModelTS <- aov_ez(data = ts_acc_mean,  
  dv = "Accuracy",  
  id = "participant",  
  within = c("posture", "congruentTrialType", "switchTrialType"),  
  type = 3,  
  anova_table = list(es = "pes")  
)
```

```
acc.stats.TS <- ezStats(ts_acc_mean,  
  dv = Accuracy,  
  wid = participant,  
  within = .(posture, congruentTrialType, switchTrialType),  
  type = 3  
)
```

## Warning: Converting "participant" to factor for ANOVA.

```
write.csv(acc.stats.TS[, -7], file = "output/exp2_Descriptives_ACC.csv",  
  row.names = F)
```

```
write.csv(accModelTS$anova_table, "output/exp2_ANOVA_acc.csv")  
accModelTS
```

## Anova Table (Type 3 tests)

```
##
## Response: Accuracy
##
##          Effect    df  MSE      F    pes p.value
## 1          posture  1, 50 0.01    1.06 .021   .308
## 2      congruentTrialType 1, 50 0.01 99.66 *** .666 <.001
## 3      switchTrialType 1, 50 0.00 92.04 *** .648 <.001
## 4 posture:congruentTrialType 1, 50 0.00    0.02 <.001   .875
## 5 posture:switchTrialType 1, 50 0.00    0.74 .015   .395
## 6 congruentTrialType:switchTrialType 1, 50 0.00 58.43 *** .539 <.001
## 7 posture:congruentTrialType:switchTrialType 1, 50 0.00    1.26 .024   .268
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#Calculate confidence interval: PES for posture x switch/condition interaction
#using ANOVA results (partial eta-squared)
interaction_effect_CI <- get.ci.partial.eta.squared(accModelTS$anova_table$F[5],
                                                    accModelTS$anova_table$num Df[5],
                                                    accModelTS$anova_table$den Df[5],
                                                    conf.level = 0.90)
#90% CI is the convention for PES

interaction_effect_CI
```

```
## $LL
## [1] 0
##
## $UL
## [1] 0.1073579
```

```
congruent.labs <- c("Congruent", "Incongruent")
names(congruent.labs) <- c("1", "2")

#make plot like Smith et al's
acc_plot <-
  superbPlot(ts_acc_mean_wide,
             WSFactors = c("Condition(2)", "Congruent(2)", "Posture(2)"),
             variables = colnames(ts_acc_mean_wide)[2:9],
             errorbar = "SE", #Tempted to change to CI, should stay SE to be consistent with SMith
             plotStyle = "line",
             factorOrder = c("Condition", "Posture", "Congruent"),
             adjustments = list(purpose = "difference"))+
  theme_classic() +
  ylim(0.77, 1) + #Trying to make ylim same as the Smith w/o cutting off error bars
  facet_wrap(vars(Congruent), labeller = labeller(Congruent = congruent.labs)) +
  scale_x_discrete(labels=c("1" = "No Switch", "2" = "Switch"))+
  scale_color_manual(values=c("#E69F00", "#0072B2"),
                    labels = c("Sitting", "Standing")) +
  labs(y = "Accuracy")
```

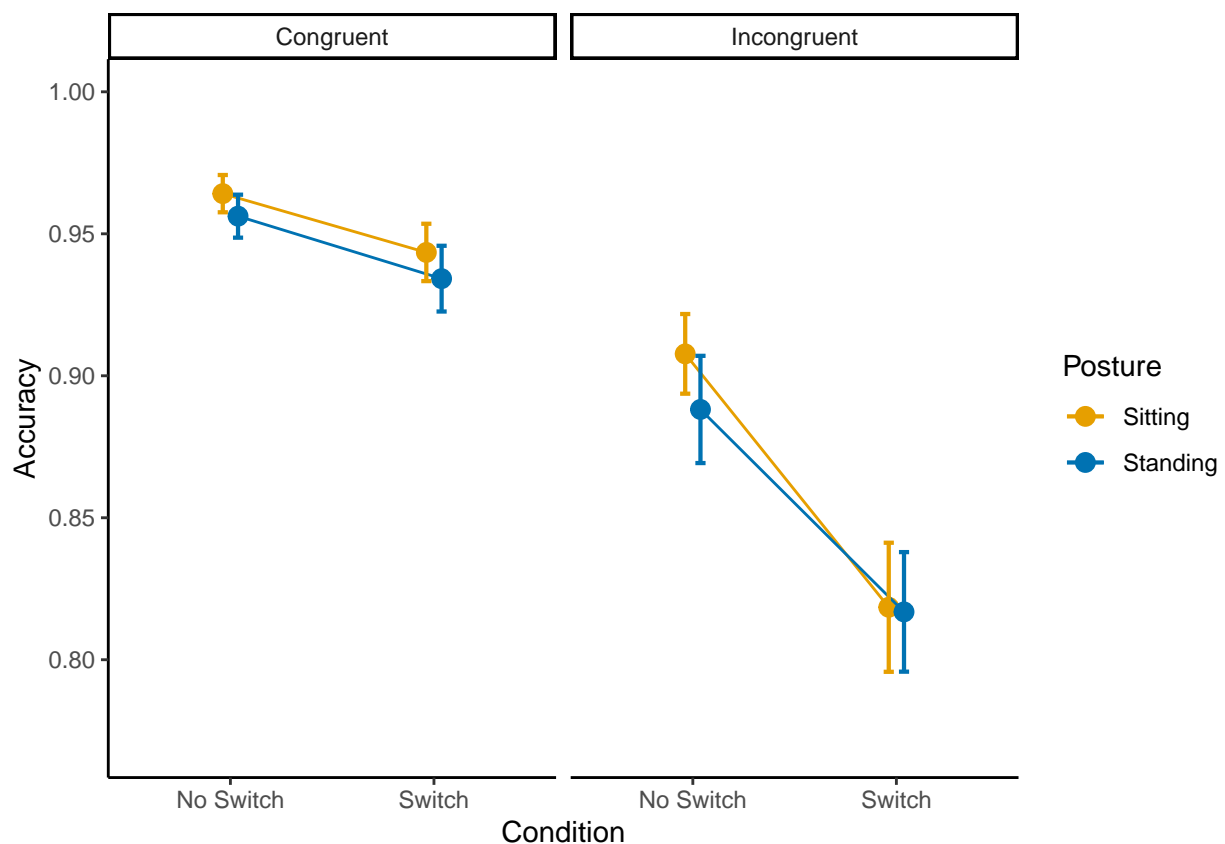
```
## superb::FYI: Here is how the within-subject variables are understood:
```

```
## Condition Congruent Posture          variable
##          1          1          1 sitting_congruent_noswitch
```

```
##      2      1      1      sitting_congruent_switch
##      1      2      1 sitting_incongruent_noswitch
##      2      2      1 sitting_incongruent_switch
##      1      1      2 standing_congruent_noswitch
##      2      1      2 standing_congruent_switch
##      1      2      2 standing_incongruent_noswitch
##      2      2      2 standing_incongruent_switch
```

```
ggsave(acc_plot,
       file = "plots/exp2_ts_acc_plot.pdf",
       units = "in",
       width = 6.62,
       height = 5.50,
       dpi = 600)
```

acc\_plot



*#...CALCULATE THE BAYES FACTORS FOR THE ACC ANALYSIS*

```
taskswitchBF = data.frame(ts_acc_mean)
```

```
taskswitchBF$participant = factor(ts_acc_mean$participant)
```

```
taskswitchBF$posture = factor(ts_acc_mean$posture)
```

```
taskswitchBF$congruentTrialType = factor(taskswitchBF$congruentTrialType)
```

```
taskswitchBF$switchTrialType = factor(taskswitchBF$switchTrialType)
```

```
#str(taskswitchBF)
```

```

bfValues2 = anovaBF(Accuracy~ posture*switchTrialType+participant,
                    data = taskswitchBF,
                    whichRandom = "participant",
                    method="laplace")

bfValues2

## Bayes factor analysis
## -----
## [1] posture + participant : 0.1836549 ±NA%
## [2] switchTrialType + participant : 5429475 ±NA%
## [3] posture + switchTrialType + participant : 1064550 ±NA%
## [4] posture + switchTrialType + posture:switchTrialType + participant : 168897.1 ±NA%
##
## Against denominator:
## Accuracy ~ participant
## ---
## Bayes factor type: BFlinearModel, JZS

#...get the Bayes factor for the Null Interaction (vs. model w/no interaction)
bfValues2[3]/bfValues2[4]

## Bayes factor analysis
## -----
## [1] posture + switchTrialType + participant : 6.302952 ±NA%
##
## Against denominator:
## Accuracy ~ posture + switchTrialType + posture:switchTrialType + participant
## ---
## Bayes factor type: BFlinearModel, JZS

1/(bfValues2[3]/bfValues2[4])

## Bayes factor analysis
## -----
## [1] posture + switchTrialType + posture:switchTrialType + participant : 0.1586558 ±NA%
##
## Against denominator:
## Accuracy ~ posture + switchTrialType + participant
## ---
## Bayes factor type: BFlinearModel, JZS

```

## Reaction time results

```

#look at reaction time for correct trials
ts_correct_only <- task_switching_raw3 %>%
  filter(correct_bin == 1)

#Second exclusion criteria
#How many trials faster than 100 ms? Only a single one
sum(ts_correct_only$reactionTime < 0.100)

```

```
## [1] 1
```

```
dim(ts_correct_only)
```

```
## [1] 17699 20
```

```
ts_correct_only2 <- ts_correct_only %>% filter(reactionTime >= 0.100)
#Sanity check, one trial is dropped. Now have 17,698 trials
dim(ts_correct_only2)
```

```
## [1] 17698 20
```

```
trimOutputTS = pjRecursiveTrim2(dataSet = ts_correct_only2,
                                dv = "reactionTime",
                                splitvars = c("participant",
                                                "posture",
                                                "switchTrialType",
                                                "congruentTrialType"))

trimmedTSData=trimOutputTS[[1]]
totalN.TS = trimOutputTS[[2]]
rejectedTS = trimOutputTS[[3]]
percentTrimmedTS = trimOutputTS[[4]] #this is very close to the percentage trimmed for stroop
#2.14% of trials
percentTrimmedTS
```

```
## [1] 2.141485
```

```
NcellsTS = trimOutputTS[[5]] # 51 participants * 8 conditions
```

```
trimmed_rt_mean_TS <- trimmedTSData %>%
  group_by(participant,
            posture,
            congruentTrialType,
            switchTrialType) %>%
  summarize(mean_rt = mean(reactionTime)*1000)
```

```
## 'summarise()' has grouped output by 'participant', 'posture', 'congruentTrialType'. You can
## override using the '.groups' argument.
```

```
#Convert data to wide format
trimmed_rt_mean_TS_wide <- trimmed_rt_mean_TS %>%
  pivot_wider(names_from = c(posture,
                              congruentTrialType,
                              switchTrialType),
              values_from = mean_rt)

trimmed_RT_plot <-
  superbPlot(trimmed_rt_mean_TS_wide,
             WSFactors = c("Condition(2)", "Congruent(2)", "Posture(2)"),
             variables = colnames(trimmed_rt_mean_TS_wide)[2:9],
```

```

    errorbar = "SE",
    plotStyle = "line",
    factorOrder = c("Condition", "Posture", "Congruent"),
    adjustments = list(purpose = "difference"))+
theme_classic()+
facet_wrap(vars(Congruent), labeller = labeller(Congruent = congruent.labs)) +
scale_x_discrete(labels=c("1" = "No Switch", "2" = "Switch"))+
scale_color_manual(values=c("#E69F00", "#0072B2"), labels = c("Sitting", "Standing")) +
ylim(500, 700) +
labs(y = "Response Time (ms)")

```

## superb::FYI: Here is how the within-subject variables are understood:

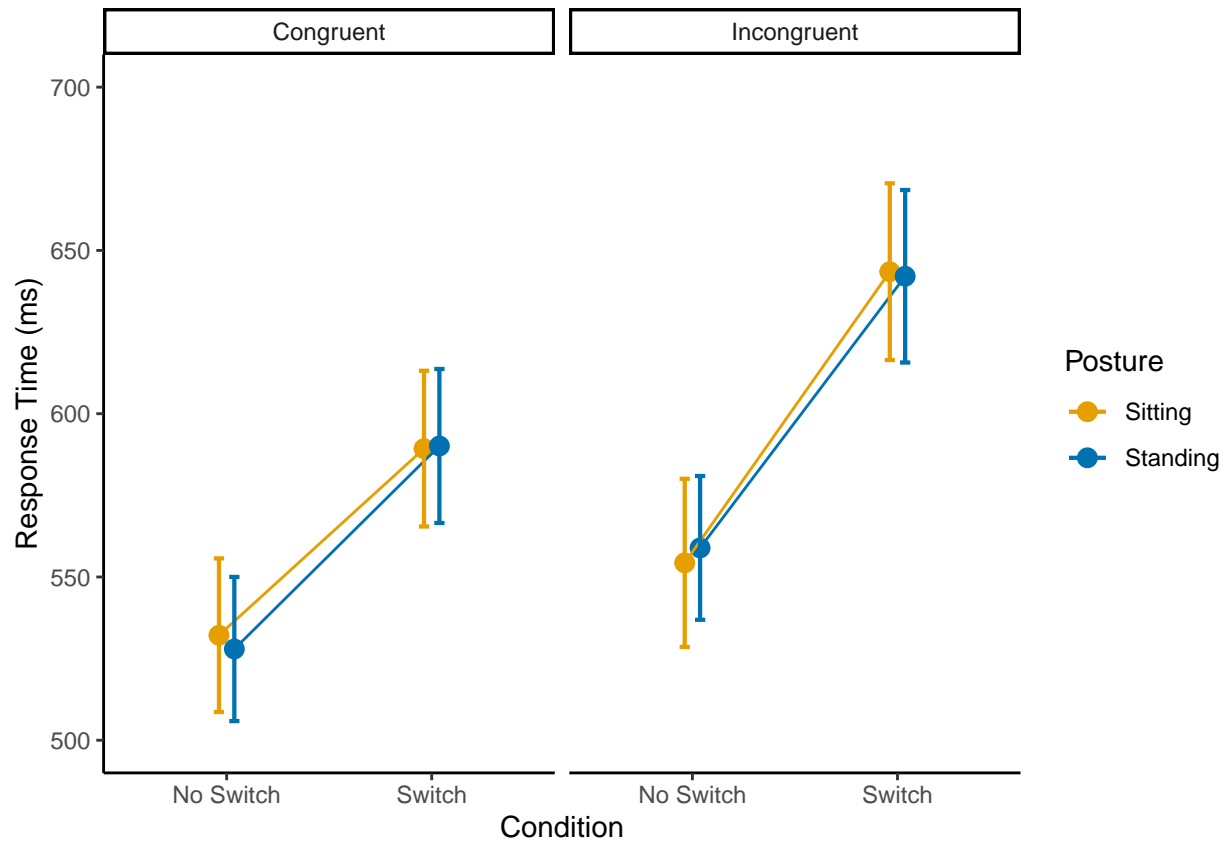
##	Condition	Congruent	Posture	variable
##	1	1	1	sitting_congruent_noswitch
##	2	1	1	sitting_congruent_switch
##	1	2	1	sitting_incongruent_noswitch
##	2	2	1	sitting_incongruent_switch
##	1	1	2	standing_congruent_noswitch
##	2	1	2	standing_congruent_switch
##	1	2	2	standing_incongruent_noswitch
##	2	2	2	standing_incongruent_switch

```

ggsave(trimmed_RT_plot,
    file = "plots/exp2_ts_trimmed_RT_plot.pdf",
    units = "in",
    width = 6.62,
    height = 5.50,
    dpi = 600)

```

trimmed\_RT\_plot



```
rtModelTS <- aov_ez(data = trimmed_rt_mean_TS,
  dv = 'mean_rt',
  id = 'participant',
  within = c('posture',
    'congruentTrialType',
    'switchTrialType'),
  type = 3,
  anova_table = list(es = "pes"))

rt.stats.TS <- ezStats(trimmed_rt_mean_TS,
  dv = mean_rt,
  wid = participant,
  within = .(posture, congruentTrialType, switchTrialType),
  type = 3
)
```

```
## Warning: Converting "participant" to factor for ANOVA.
```

```
## Warning: Converting "posture" to factor for ANOVA.
```

```
## Warning: Converting "congruentTrialType" to factor for ANOVA.
```

```
## Warning: Converting "switchTrialType" to factor for ANOVA.
```



```
write.csv(rt.stats.TS[, -7],
          file = "output/exp2_Descriptives_trimmed_RT.csv",
          row.names = F)

write.csv(rtModelTS$anova_table, file = "output/exp2_ANOVA_trimmed_RT.csv")
rtModelTS
```

```
## Anova Table (Type 3 tests)
##
## Response: mean_rt
##
```

	Effect	df	MSE	F	pes	p.value
## 1	posture	1, 50	9922.05	0.00	<.001	.995
## 2	congruentTrialType	1, 50	3302.21	48.98 ***	.495	<.001
## 3	switchTrialType	1, 50	4166.22	130.17 ***	.722	<.001
## 4	posture:congruentTrialType	1, 50	1592.27	0.17	.003	.679
## 5	posture:switchTrialType	1, 50	1519.08	0.00	<.001	.951
## 6	congruentTrialType:switchTrialType	1, 50	1252.33	14.32 ***	.223	<.001
## 7	posture:congruentTrialType:switchTrialType	1, 50	1552.36	0.50	.010	.483

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## Experiment 3 - Visual search

### Import and clean data

```
vs_files = list.files(path = "Experiment 3 Data/", full.names = T)
vs_files = vs_files[str_detect(vs_files, pattern="(?!.*SJ)(?!.*.txt)")]

merged.VS.data <- ldply(vs_files,
                        read.delim,
                        header=FALSE,
                        stringsAsFactors = FALSE,
                        sep = "") #for each item in the list apply the function read.delim

#..ADD HEADERS
names(merged.VS.data) = c("sj",
                          "cb",
                          "blockNumber",
                          "blockType",
                          "trialNum",
                          "target",
                          "targetImage",
                          "distractor",
                          "distractorImage",
                          "posture",
                          "setSize",
                          "rt",
                          "resp",
                          "cresp",
                          "ac")
```

```
#...look at unique values from both columns  
unique(merged.VS.data[c('sj')])
```

```
##      sj  
## 1      1  
## 265    10  
## 529    11  
## 793    12  
## 1057   13  
## 1321   14  
## 1585   15  
## 1849   16  
## 2113   17  
## 2377   18  
## 2641   19  
## 2905    2  
## 3169   20  
## 3433   21  
## 3697   22  
## 3961   23  
## 4225   24  
## 4489   25  
## 4753   26  
## 5017   27  
## 5281   28  
## 5545   29  
## 5809    3  
## 6073   30  
## 6337   31  
## 6601   32  
## 6865   33  
## 7129   34  
## 7393   35  
## 7657   36  
## 7921   37  
## 8185   38  
## 8449   39  
## 8713    4  
## 8977   40  
## 9241   41  
## 9505   42  
## 9769   43  
## 10033  44  
## 10297  45  
## 10561  46  
## 10825  47  
## 11089  48  
## 11353  49  
## 11617   5  
## 11881  50  
## 12145   6  
## 12409   7  
## 12673   8
```

```
## 12937 9
```

```
unique(merged.VS.data[c('blockType')])
```

```
##      blockType
## 1      practice
## 9 experimental
```

```
##..DOES EACH SUBJECT HAVE THE SAME NUMBER OF TRIALS
ftable(blockType~sj, merged.VS.data)
```

```
##      blockType experimental practice
## sj
## 1              256           8
## 2              256           8
## 3              256           8
## 4              256           8
## 5              256           8
## 6              256           8
## 7              256           8
## 8              256           8
## 9              256           8
## 10             256           8
## 11             256           8
## 12             256           8
## 13             256           8
## 14             256           8
## 15             256           8
## 16             256           8
## 17             256           8
## 18             256           8
## 19             256           8
## 20             256           8
## 21             256           8
## 22             256           8
## 23             256           8
## 24             256           8
## 25             256           8
## 26             256           8
## 27             256           8
## 28             256           8
## 29             256           8
## 30             256           8
## 31             256           8
## 32             256           8
## 33             256           8
## 34             256           8
## 35             256           8
## 36             256           8
## 37             256           8
## 38             256           8
## 39             256           8
## 40             256           8
```

```
## 41          256      8
## 42          256      8
## 43          256      8
## 44          256      8
## 45          256      8
## 46          256      8
## 47          256      8
## 48          256      8
## 49          256      8
## 50          256      8
```

*...DO WE HAVE EQUAL OBSERVATIONS FOR EACH COUNTERBALANCE*

```
fable(blockType~cb, merged.VS.data)
```

```
##    blockType experimental practice
## cb
## 1          6400      200
## 2          6400      200
```

*...LOOK FOR MISSING DATA*

```
merged.VS.data[!complete.cases(merged.VS.data),]
```

```
## [1] sj          cb          blockNumber    blockType      trialNum      target
## [7] targetImage    distractor     distractorImage posture      setSize      rt
## [13] resp          cresp         ac
## <0 rows> (or 0-length row.names)
```

*... GET RID OF PRACTICE TRIALS*

```
merged.VS.data <- merged.VS.data[!merged.VS.data$blockType=="practice",]
```

*.... CHECK TRIALS PER CONDITION*

```
fable(posture+target+distractor+setSize~sj, merged.VS.data)
```

```
##    posture    SITTING                                STANDING
##    target      h          s          h          s
##    distractor  e    u    e    u    e    u    e    u
##    setSize    4  8  4  8  4  8  4  8    4  8  4  8  4  8  4  8
## sj
## 1          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 2          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 3          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 4          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 5          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 6          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 7          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 8          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 9          16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 10         16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 11         16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 12         16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 13         16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
## 14         16 16 16 16 16 16 16 16    16 16 16 16 16 16 16 16
```

```
## 15      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 16      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 17      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 18      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 19      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 20      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 21      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 22      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 23      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 24      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 25      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 26      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 27      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 28      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 29      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 30      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 31      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 32      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 33      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 34      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 35      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 36      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 37      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 38      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 39      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 40      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 41      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 42      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 43      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 44      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 45      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 46      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 47      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 48      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 49      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
## 50      16 16 16 16 16 16 16 16      16 16 16 16 16 16 16 16
```

```
#... UNLIKE THE STROOP, PARTICIPANTS WERE ALLOWED TO TAKE LONGER THAN 1500MS BUT WERE GIVEN A WARNING
#... TRIALS LONGER THAN 1500 MS will be considered errors (i.e., they will be dropped in RT but kept in
#... Set values in the ac column to 0 on trials where a response is > = 1500
```

```
#...check that only experimental trials are left
unique(merged.VS.data$blockType)
```

```
## [1] "experimental"
```

```
write.table(merged.VS.data, file = "Experiment 3 Data/merged_vs_data.txt", row.names = F)
```

```
#...count trials
totalTrialsVS = dim(merged.VS.data)[1]
observationDataVS = data.frame(ftable(blockType~sj, merged.VS.data))[,c(1,3)]

#...get the number of extreme trials <100 - anticipatory or fast responses
```

```
merged.VS.data= merged.VS.data[!merged.VS.data$rt<=100,]
validRTTrialsVS = dim(merged.VS.data)[1]
observationDataVS$validTrials = data.frame(ftable(blockType~sj, merged.VS.data))[c(3)]

print(paste("percent invalid trials = ", ((totalTrialsVS-validRTTrialsVS)/totalTrialsVS)*100))
```

```
## [1] "percent invalid trials = 0"
```

```
#...this code changes the 1550ms+ trials into errors
```

```
merged.VS.data$ac[merged.VS.data$rt>=1500] = 0
```

```
vsCorrect = merged.VS.data[merged.VS.data$ac ==1,]
```

```
errorsRemovedVS = dim(vsCorrect)[1]
```

```
observationDataVS$correctTrials = data.frame(ftable(blockType~sj, vsCorrect))[c(3)]
```

```
trimInfo = data.frame(totalTrialsVS, validRTTrialsVS, errorsRemovedVS)
```

```
head(trimInfo)
```

```
## totalTrialsVS validRTTrialsVS errorsRemovedVS
```

```
## 1 12800 12800 12397
```

```
#####
```

```
#...CHECK 20% CRITERION
```

```
#####
```

```
observationDataVS$percentLoss = ((observationDataVS$Freq-observationDataVS$correctTrials)/observationDataVS$Freq)*100
sum(observationDataVS$percentLoss>20)
```

```
## [1] 0
```

```
#...None!
```

```
#...RUN TRIMMING PROCEDURE
```

```
tempList = pjRecursiveTrim2(vsCorrect, #...dataset
                             "rt", #...dependent variables
                             c("sj",
                               "cb",
                               "setSize",
                               "posture")) #.independent variables
```

```
trimmedData=tempList[[1]]
```

```
totalN = tempList[[2]]
```

```
rejected = tempList[[3]]
```

```
percentTrimmed = tempList[[4]]
```

```
Ncells = tempList[[5]]
```

```
print(paste("Percent of outliers removed: ",round(percentTrimmed,3)))
```

```
## [1] "Percent of outliers removed: 1.339"
```

```
#...get the trimming info
output.out= data.frame(totalN, rejected,percentTrimmed,Ncells)
head(output.out)
```

```
##   totalN rejected percentTrimmed Ncells
## 1  12397      166      1.339034     200
```

```
#...get mean error data
vsPE = plyr::ddply(merged.VS.data,
                  .(sj,cb,setSize, posture),
                  summarise,
                  meanPE = 100 - (mean(ac)*100))
head(vsPE)
```

```
##   sj cb setSize  posture meanPE
## 1  1  1      4  SITTING 0.0000
## 2  1  1      4  STANDING 0.0000
## 3  1  1      8  SITTING 0.0000
## 4  1  1      8  STANDING 0.0000
## 5  2  1      4  SITTING 4.6875
## 6  2  1      4  STANDING 4.6875
```

```
vsRT = plyr::ddply(trimmedData,
                  .(sj, cb, setSize,posture),
                  summarise,
                  meanRT = mean(rt))
```

```
#...combine the RT and error data
vsCombined = cbind(vsRT,meanPE =vsPE$meanPE)
str(vsCombined)
```

```
## 'data.frame':   200 obs. of  6 variables:
## $ sj      : int  1 1 1 1 2 2 2 2 3 3 ...
## $ cb      : int  1 1 1 1 1 1 1 1 1 1 ...
## $ setSize: int  4 4 8 8 4 4 8 8 4 4 ...
## $ posture: chr  "SITTING" "STANDING" "SITTING" "STANDING" ...
## $ meanRT : num  677 593 736 620 792 ...
## $ meanPE : num  0 0 0 0 4.69 ...
```

```
#...set as factors
vsCombined$sj = factor(vsCombined$sj)
vsCombined$cb = factor(vsCombined$cb)
vsCombined$setSize = factor(vsCombined$setSize)
vsCombined$postureFactor = factor(vsCombined$posture)
summary(vsCombined$cb)
```

```
##   1   2
## 100 100
```

## Reaction time results

```
rtModelVS <- ezANOVA(vsCombined,
                     dv = .(meanRT),
                     wid=.(sj),
                     within=.(postureFactor,setSize),
                     detailed=TRUE,
                     type=3,
                     return_aov=TRUE)
```

```
rtModelVS$ANOVA
```

```
##           Effect DFn DFd      SSn      SSd      F      p p<.05
## 1      (Intercept)    1  49 1.084958e+08 1189588.17 4.469020e+03 8.326740e-50 *
## 2      postureFactor    1  49 2.052064e+04 153738.29 6.540411e+00 1.369090e-02 *
## 3          setSize    1  49 3.574624e+05 46863.03 3.737628e+02 1.414816e-24 *
## 4 postureFactor:setSize    1  49 2.246613e+01 35654.35 3.087534e-02 8.612429e-01
##           ges
## 1 9.870285e-01
## 2 1.418774e-02
## 3 2.004492e-01
## 4 1.575613e-05
```

```
rt.VS.MSE <- rtModelVS$ANOVA$SSd/rtModelVS$ANOVA$DFd
```

```
#...print ANOVA in nice format
```

```
paste(rtModelVS$ANOVA$Effect,": F(",
      rtModelVS$ANOVA$DFn,
      ", ",
      rtModelVS$ANOVA$DFd,
      ") = ",
      round(rtModelVS$ANOVA$F,3),
      ", MSE = ",
      round(rt.VS.MSE,3),
      ", p = ",
      round(rtModelVS$ANOVA$p,3),
      ", partialEtaSq = ",
      round(rtModelVS$ANOVA$SSn/(rtModelVS$ANOVA$SSn+rtModelVS$ANOVA$SSd),4),sep="")
```

```
## [1] "(Intercept): F(1, 49) = 4469.02, MSE = 24277.31, p = 0, partialEtaSq = 0.9892"
## [2] "postureFactor: F(1, 49) = 6.54, MSE = 3137.516, p = 0.014, partialEtaSq = 0.1178"
## [3] "setSize: F(1, 49) = 373.763, MSE = 956.388, p = 0, partialEtaSq = 0.8841"
## [4] "postureFactor:setSize: F(1, 49) = 0.031, MSE = 727.64, p = 0.861, partialEtaSq = 6e-04"
```

```
#...CALCULATE THE BAYES FACTORS FOR THE RT ANALYSIS
```

```
bfValues3 = anovaBF(meanRT~setSize*postureFactor+sj,
                    data = vsCombined,
                    whichRandom = "sj",
                    method="laplace")
```

```
bfValues3
```

```
## Bayes factor analysis
```

```
## -----
```



```
## [1] setSize + sj : 2.916459e+26 ±NA%
## [2] postureFactor + sj : 1.51507 ±NA%
## [3] setSize + postureFactor + sj : 1.321058e+28 ±NA%
## [4] setSize + postureFactor + setSize:postureFactor + sj : 2.585184e+27 ±NA%
##
## Against denominator:
## meanRT ~ sj
## ---
## Bayes factor type: BFlinearModel, JZS
```

```
warnings()
##...get the Bayes factor for the Null Interaction
bfValues3[3]/bfValues3[4]
```

```
## Bayes factor analysis
## -----
## [1] setSize + postureFactor + sj : 5.110113 ±NA%
##
## Against denominator:
## meanRT ~ setSize + postureFactor + setSize:postureFactor + sj
## ---
## Bayes factor type: BFlinearModel, JZS
```

```
1/(bfValues3[3]/bfValues3[4])
```

```
## Bayes factor analysis
## -----
## [1] setSize + postureFactor + setSize:postureFactor + sj : 0.1956904 ±NA%
##
## Against denominator:
## meanRT ~ setSize + postureFactor + sj
## ---
## Bayes factor type: BFlinearModel, JZS
```

```
#####
# GET DIFFERENCE SCORES - SEARCH RATE
#####
```

```
wideData = dcast(vsCombined, #the name of the dataframe you want to reshape
                 sj+cb #row variables
                 ~posture+setSize, #row variables ~ column variables
                 value.var = "meanRT")
head(wideData)
```

```
## sj cb SITTING_4 SITTING_8 STANDING_4 STANDING_8
## 1 1 1 676.5238 735.5397 593.1129 619.6406
## 2 2 1 792.4590 931.9474 815.7213 993.5000
## 3 3 1 721.2787 827.2222 654.1639 774.5238
## 4 4 1 695.7119 741.9298 660.2632 653.0172
## 5 5 1 693.6034 839.2903 705.1967 759.7419
## 6 6 1 625.3750 694.0484 592.4531 687.5645
```

```

wideData$sittingEffect = (wideData$SITTING_8-wideData$SITTING_4)/4
wideData$standingEffect = (wideData$STANDING_8-wideData$STANDING_4)/4
wideData$interaction = wideData$sittingEffect - wideData$standingEffect

searchratestand = mean(wideData$standingEffect) #...search rate in standing condition
searchratesit = mean(wideData$sittingEffect) #...search rate in the sitting condition

searchratestand

```

```
## [1] 21.30589
```

```
searchratesit
```

```
## [1] 20.97073
```

```

#One-sample t-tests
t.test(wideData$standingEffect)

```

```

##
## One Sample t-test
##
## data: wideData$standingEffect
## t = 16.69, df = 49, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 18.74050 23.87127
## sample estimates:
## mean of x
## 21.30589

```

```
t.test(wideData$sittingEffect)
```

```

##
## One Sample t-test
##
## data: wideData$sittingEffect
## t = 13.055, df = 49, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 17.74261 24.19884
## sample estimates:
## mean of x
## 20.97073

```

```

#...Exact Binomial SIGN TEST
binom.test(length(wideData$interaction[wideData$interaction>=0]),
            length(unique(vsCombined$sj)))

```

```

##
## Exact binomial test

```

```
##
## data: length(wideData$interaction[wideData$interaction >= 0]) and length(unique(vsCombined$sj))
## number of successes = 25, number of trials = 50, p-value = 1
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
## 0.355273 0.644727
## sample estimates:
## probability of success
## 0.5
```

## Percent error results

```
errModelVS <- ezANOVA(vsCombined,
  dv = .(meanPE),
  wid=.(sj),
  within=.(postureFactor,setSize),
  detailed=TRUE,
  type=3,
  return_aov = TRUE)
```

```
errModelVS
```

```
## $ANOVA
##           Effect DFn DFd      SSn      SSd      F      p p<.05      ges
## 1      (Intercept)   1  49 1982.531738 1158.9478 83.8209098 3.463466e-12 * 0.504342884
## 2      postureFactor   1  49   3.527832  227.7954  0.7588554 3.879351e-01  0.001807368
## 3           setSize   1  49  129.504395  343.5181  18.4727266 8.162026e-05 * 0.062324860
## 4 postureFactor:setSize   1  49   20.520020  218.1274   4.6096032 3.676850e-02 * 0.010422027
##
## $aov
##
## Call:
## aov(formula = formula(aov_formula), data = data)
##
## Grand Mean: 3.148438
##
## Stratum 1: sj
##
## Terms:
##           Residuals
## Sum of Squares  1158.948
## Deg. of Freedom    49
##
## Residual standard error: 4.863332
##
## Stratum 2: sj:postureFactor
##
## Terms:
##           postureFactor Residuals
## Sum of Squares      3.52783 227.79541
## Deg. of Freedom      1      49
##
```

```
## Residual standard error: 2.156128
## 1 out of 2 effects not estimable
## Estimated effects are balanced
##
## Stratum 3: sj:setSize
##
## Terms:
##              setSize Residuals
## Sum of Squares 129.5044 343.5181
## Deg. of Freedom      1      49
##
## Residual standard error: 2.647749
## 1 out of 2 effects not estimable
## Estimated effects are balanced
##
## Stratum 4: sj:postureFactor:setSize
##
## Terms:
##           postureFactor:setSize Residuals
## Sum of Squares           20.52002 218.12744
## Deg. of Freedom           1      49
##
## Residual standard error: 2.109877
## Estimated effects are balanced
```

```
err.VS.MSE <- errModelVS$ANOVA$SSd/errModelVS$ANOVA$DFd
```

```
paste(errModelVS$ANOVA$Effect,": F(",
      errModelVS$ANOVA$DFn,
      ", ",
      errModelVS$ANOVA$DFd,
      ") = ",
      round(errModelVS$ANOVA$F,3),
      ", MSE = ",
      round(err.VS.MSE,3),
      ", p = ",
      round(errModelVS$ANOVA$p,3),
      ", partialEtaSq = ",
      round(errModelVS$ANOVA$SSn/(errModelVS$ANOVA$SSn+errModelVS$ANOVA$SSd),4),sep="")
```

```
## [1] "(Intercept): F(1, 49) = 83.821, MSE = 23.652, p = 0, partialEtaSq = 0.6311"
## [2] "postureFactor: F(1, 49) = 0.759, MSE = 4.649, p = 0.388, partialEtaSq = 0.0153"
## [3] "setSize: F(1, 49) = 18.473, MSE = 7.011, p = 0, partialEtaSq = 0.2738"
## [4] "postureFactor:setSize: F(1, 49) = 4.61, MSE = 4.452, p = 0.037, partialEtaSq = 0.086"
```

```
wideData = dcast(vsCombined, #the name of the dataframe you want to reshape
                 sj+cb #row variables
                 ~posture+setSize, #row variables ~ column variables
                 value.var = "meanPE")
head(wideData)
```

```
## sj cb SITTING_4 SITTING_8 STANDING_4 STANDING_8
## 1 1 1 0.0000 0.0000 0.0000 0.0000
```

```
## 2 2 1 4.6875 10.9375 4.6875 15.6250
## 3 3 1 1.5625 1.5625 0.0000 0.0000
## 4 4 1 6.2500 10.9375 4.6875 6.2500
## 5 5 1 3.1250 3.1250 1.5625 1.5625
## 6 6 1 0.0000 1.5625 0.0000 1.5625
```

```
wideData$sittingEffect = (wideData$SITTING_8-wideData$SITTING_4)/4
wideData$standingEffect = (wideData$STANDING_8-wideData$STANDING_4)/4
wideData$interaction = wideData$sittingEffect - wideData$standingEffect
```

```
searchratestand = mean(wideData$standingEffect) #...search rate in standing condition
searchratesit = mean(wideData$sittingEffect) #...search rate in the sitting condition
```

```
searchratestand
```

```
## [1] 0.5625
```

```
searchratesit
```

```
## [1] 0.2421875
```

```
#One-sample t-tests
t.test(wideData$standingEffect)
```

```
##
## One Sample t-test
##
## data: wideData$standingEffect
## t = 4.0858, df = 49, p-value = 0.0001623
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 0.2858399 0.8391601
## sample estimates:
## mean of x
## 0.5625
```

```
t.test(wideData$sittingEffect)
```

```
##
## One Sample t-test
##
## data: wideData$sittingEffect
## t = 2.4588, df = 49, p-value = 0.01752
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 0.04424588 0.44012912
## sample estimates:
## mean of x
## 0.2421875
```

## Make plots for visual search

```
graphRT3 = describeBy(vsCombined$meanRT,
                      list(vsCombined$posture,vsCombined$setSize),
                      mat=TRUE,
                      digits = 1)
graphPE3 = describeBy(vsCombined$meanPE,
                      list(vsCombined$posture,vsCombined$setSize),
                      mat=TRUE,
                      digits = 1)

graphRT3 = graphRT3[,c("group1","group2","mean","se")]
graphPE3 = graphPE3[,c("group1","group2","mean","se")]

names(graphRT3) = c("posture","setSize","mean","se")
names(graphPE3) = c("posture","setSize","mean","se")

graphRT3$posture = str_to_upper(graphRT3$posture)

#####
#..calculate the within subjects confidence intervals based on loftus and masson
#..the confidence intervals are based on the interaction term.
#####

graphRT3$se = sqrt((rt.VS.MSE[4])/length(unique(vsCombined$sj)))
graphPE3$se= sqrt((err.VS.MSE[4])/length(unique(vsCombined$sj)))

#####
#..calculate the within subjects confidence intervals based on loftus and masson
#..the confidence intervals are based on the interaction term.
#####

critT3 = qt(p=.025,df=length(unique(vsCombined$sj))-2,lower.tail =FALSE)

#---add the min and max for the confidence intervals
graphRT3$min = graphRT3$mean - (graphRT3$se*critT3)
graphRT3$max = graphRT3$mean + (graphRT3$se*critT3)

####GET AC DATA FROM twoAnimalWordsPRPac.R
graphRT3$ac = paste("(",format(round(graphPE3$mean,digits=1),nsmall = 1),")",sep="")
head(graphRT3)
```

```
##      posture setSize  mean      se      min      max      ac
## X11  SITTING      4 704.7 3.814813 697.0298 712.3702 (2.5)
## X12  STANDING      4 683.8 3.814813 676.1298 691.4702 (2.2)
## X13  SITTING      8 788.6 3.814813 780.9298 796.2702 (3.5)
## X14  STANDING      8 769.0 3.814813 761.3298 776.6702 (4.4)
```

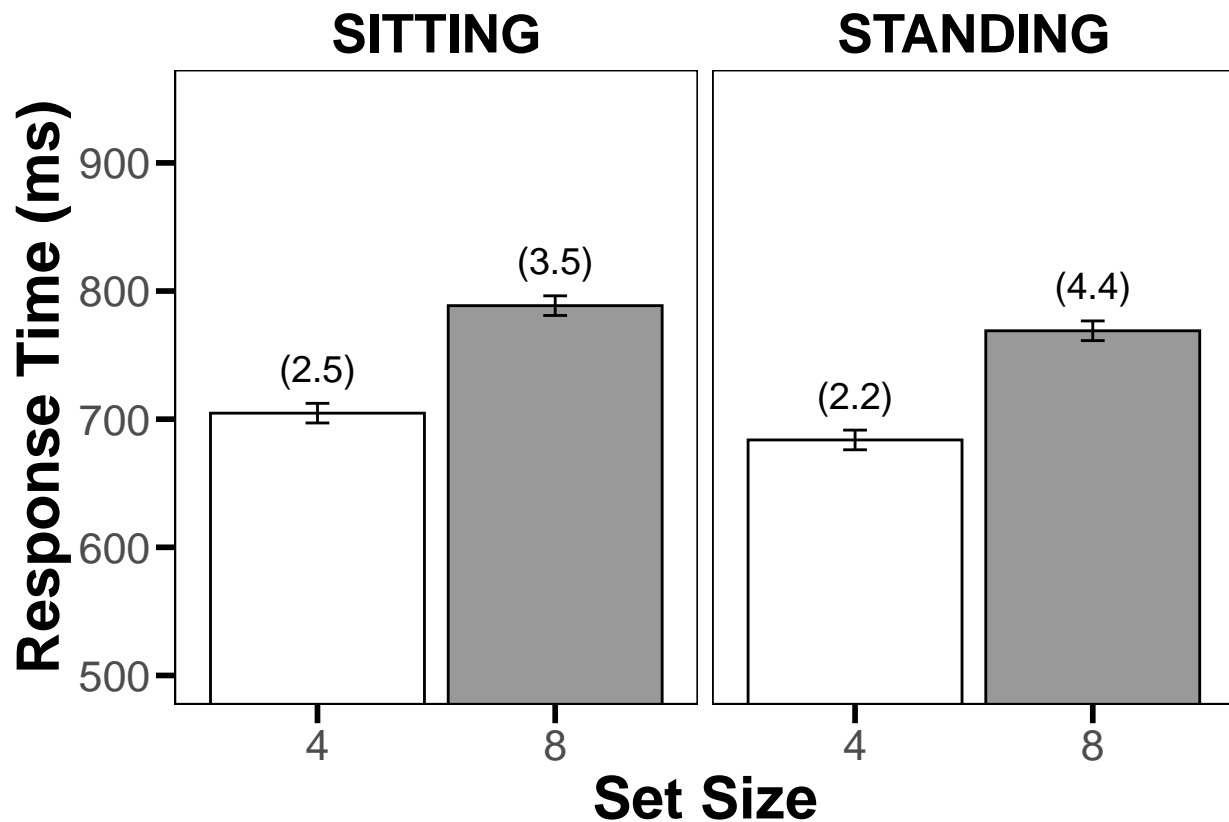
```
graphRT3$vAdj = 35 #down
graphRT3$vAdj[graphRT3$setSize=="incongruent"]=35 #up
graphRT3$hAdj = 0 #right
```

```
#graphRT$hAdj[graphRT$posture=="SITTING"]=-60 #left

graphRT3$congruency = factor(graphRT3$setSize,labels = c("4","8"))

interactionPlot3 <- ggplot(graphRT3, aes(setSize, mean, group=posture)) +
  theme(legend.position = "none")+
  scale_fill_manual(values=c("#FFFFFF","#999999","#FFFFFF","#999999"))+
  coord_cartesian(ylim=c(500,950),expand=TRUE)+
  scale_y_continuous(breaks = round(seq(500, 950, by = 100),0))+
  geom_text(aes(label=ac),nudge_x=graphRT3$hAdj,nudge_y =graphRT3$vAdj,size=5)+
  geom_bar(stat="identity", aes(fill=interaction(setSize)),colour="black")+
  geom_errorbar(aes(ymin=min,ymax=max,group=interaction(posture,setSize)), width=.1)+
  labs(x = "Set Size", y = "Response Time (ms)") +
  theme(axis.ticks = element_line(size = 1, colour = "black", linetype = "solid"),
        axis.ticks.length = unit(.25,"cm"),
        #axis.line = element_line(size = 1, colour = "black", linetype = "solid"),
        panel.background = element_rect(fill = "white", colour = "white", size = 1),
        axis.text=element_text(size=16),
        axis.title=element_text(size=22,face="bold"),
        strip.text = element_text(size = 20, face = "bold",colour = "black", angle = 0),
        panel.border = element_rect(colour = "black", fill = NA, size = 0.50),
        strip.background = element_rect(fill=NA,colour="NA",size = 2))+
  facet_grid(~posture)

interactionPlot3
```



```
ggsave(interactionPlot3,
       file = "plots/exp3_visual_search_interaction_plot.pdf",
       units = "in",
       width = 8.5,
       height = 5,
       dpi = 600)
```

## Reproduce results from Smith et al.

```
# Data source: The data from all the experiments are available at:
# http://rabrams.net under the Resources tab.

### Experiment 1 (Stroop)

#load acc data
Smith_Exp1_acc <- read_excel("smith_data.xlsx",
                             sheet = "Exp1Acc",
                             n_max = 14) #Sample size in Smith

#load rt data
Smith_Exp1_rt <- read_excel("smith_data.xlsx",
                             sheet = "Exp1RT",
                             n_max = 14)

#Restructure from wide to narrow, using tidyr
Smith_Exp1_acc_narrow <- Smith_Exp1_acc %>%
  pivot_longer(cols = sit_neut:sta_con, names_to = "condition", values_to = "acc") %>%
  separate(col = condition, into = c("posture", "con"))

Smith_Exp1_rt_narrow <- Smith_Exp1_rt %>%
  pivot_longer(cols = sit_neut:sta_con, names_to = "condition", values_to = "rt") %>%
  separate(col = condition, into = c("posture", "con"))

Smith_Exp1 <- merge(Smith_Exp1_acc_narrow, Smith_Exp1_rt_narrow)

Smith_exp1_anova_acc <- aov_ez(data = Smith_Exp1,
                               dv = 'acc',
                               id = 'subj',
                               within = c('posture', 'con'),
                               anova_table = list(es = "pes", correction = "none"),
                               type = 3)

kable(nice(Smith_exp1_anova_acc), caption = "ANOVA results for Smith Exp 1 - accuracy")
```

Table 2: ANOVA results for Smith Exp 1 - accuracy

Effect	df	MSE	F	pes	p.value
posture	1, 13	4.59	0.51	.038	.488
con	2, 26	3.19	3.76 *	.224	.037
posture:con	2, 26	2.18	1.47	.101	.250



```
Smith_exp1_anova_rt <- aov_ez(data = Smith_Exp1,
  dv = 'rt',
  id = 'subj',
  within = c('posture', 'con'),
  anova_table = list(es = "pes", correction = "none"),
  type = 3)
kable(nice(Smith_exp1_anova_rt), caption = "ANOVA results for Smith Exp 1 - RT")
```

Table 3: ANOVA results for Smith Exp 1 - RT

Effect	df	MSE	F	pes	p.value
posture	1, 13	816.34	0.09	.007	.768
con	2, 26	150.32	3.45 *	.210	.047
posture:con	2, 26	128.10	4.73 *	.267	.018

```
### Experiment 2 (Task-switching)

#load acc data
Smith_Exp2_acc <- read_excel("smith_data.xlsx",
  sheet = "Exp2Acc",
  n_max = 30)

#load rt data
Smith_Exp2_rt <- read_excel("smith_data.xlsx",
  sheet = "Exp2RT",
  n_max = 30)

#Restructure from wide to narrow, using tidyr
Smith_Exp2_acc_narrow <- Smith_Exp2_acc %>%
  pivot_longer(cols = sit_congruent_noswitch:stand_incongruent_switch,
    names_to = "condition", values_to = "acc") %>%
  separate(col = condition, into = c("posture", "con", "switch"))

Smith_Exp2_rt_narrow <- Smith_Exp2_rt %>%
  pivot_longer(cols = sit_congruent_noswitch:stand_incongruent_switch,
    names_to = "condition", values_to = "rt") %>%
  separate(col = condition, into = c("posture", "con", "switch"))

Smith_Exp2 <- merge(Smith_Exp2_acc_narrow, Smith_Exp2_rt_narrow)

Smith_exp2_anova_acc <- aov_ez(data = Smith_Exp2,
  dv = 'acc',
  id = 'subj',
  within = c('posture', 'con', 'switch'),
  anova_table = list(es = "pes", correction = "none"),
  type = 3)
kable(nice(Smith_exp2_anova_acc), caption = "ANOVA results for Smith Exp 2 - accuracy")
```

Table 4: ANOVA results for Smith Exp 2 - accuracy

Effect	df	MSE	F	pes	p.value
posture	1, 29	0.00	2.86	.090	.101
con	1, 29	0.00	67.40 ***	.699	<.001
switch	1, 29	0.00	62.94 ***	.685	<.001
posture:con	1, 29	0.00	1.68	.055	.205
posture:switch	1, 29	0.00	5.54 *	.160	.026
con:switch	1, 29	0.00	23.34 ***	.446	<.001
posture:con:switch	1, 29	0.00	0.50	.017	.484

```
Smith_exp2_anova_rt <- aov_ez(data = Smith_Exp2,
                             dv = 'rt',
                             id = 'subj',
                             within = c('posture', 'con', 'switch'),
                             anova_table = list(es = "pes", correction = "none"),
                             type = 3)
kable(nice(Smith_exp2_anova_rt), caption = "ANOVA results for Smith Exp 2 - RT")
```

Table 5: ANOVA results for Smith Exp 2 - RT

Effect	df	MSE	F	pes	p.value
posture	1, 29	0.02	0.03	.001	.856
con	1, 29	0.00	40.95 ***	.585	<.001
switch	1, 29	0.00	115.10 ***	.799	<.001
posture:con	1, 29	0.00	0.49	.017	.489
posture:switch	1, 29	0.00	0.10	.004	.751
con:switch	1, 29	0.00	4.77 *	.141	.037
posture:con:switch	1, 29	0.00	0.67	.023	.420

```
### Experiment 3 (Visual Search)

#load acc data
Smith_Exp3_acc <- read_excel("smith_data.xlsx",
                             sheet = "Exp3Acc",
                             n_max = 12) %>%

  select(subj:sit8)

#load rt data
Smith_Exp3_rt <- read_excel("smith_data.xlsx",
                             sheet = "Exp3RT",
                             n_max = 12) %>%

  select(subj:sit8)

#Restructure from wide to narrow, using tidyr
Smith_Exp3_acc_narrow <- Smith_Exp3_acc %>%
  pivot_longer(cols = stand4:sit8, names_to = "condition", values_to = "acc") %>%
  separate(col = condition, into = c("posture", "set.size"), sep = -1)

Smith_Exp3_rt_narrow <- Smith_Exp3_rt %>%
  pivot_longer(cols = stand4:sit8, names_to = "condition", values_to = "rt") %>%
```

```

separate(col = condition, into = c("posture", "set.size"), sep = -1)

Smith_Exp3 <- merge(Smith_Exp3_acc_narrow, Smith_Exp3_rt_narrow)

Smith_exp3_anova_acc <- aov_ez(data = Smith_Exp3,
                               dv = 'acc',
                               id = 'subj',
                               within = c('posture', 'set.size'),
                               anova_table = list(es = "pes", correction = "none"),
                               type = 3)
kable(nice(Smith_exp3_anova_acc), caption = "ANOVA results for Smith Exp 3 - accuracy")

```

Table 6: ANOVA results for Smith Exp 3 - accuracy

Effect	df	MSE	F	pes	p.value
posture	1, 11	4.61	0.76	.065	.401
set.size	1, 11	1.75	3.44 +	.238	.090
posture:set.size	1, 11	1.38	7.96 *	.420	.017

```

Smith_exp3_anova_rt <- aov_ez(data = Smith_Exp3,
                               dv = 'rt',
                               id = 'subj',
                               within = c('posture', 'set.size'),
                               anova_table = list(es = "pes", correction = "none"),
                               type = 3)
kable(nice(Smith_exp3_anova_rt), caption = "ANOVA results for Smith Exp 3 - RT")

```

Table 7: ANOVA results for Smith Exp 3 - RT

Effect	df	MSE	F	pes	p.value
posture	1, 11	2323.81	0.23	.021	.639
set.size	1, 11	473.24	81.88 ***	.882	<.001
posture:set.size	1, 11	298.96	5.91 *	.350	.033

## Overall summary plots: Smith and replication

```

smith_anovas <- lst(Smith_exp1_anova_acc$anova_table,
                   Smith_exp1_anova_rt$anova_table,
                   Smith_exp2_anova_acc$anova_table,
                   Smith_exp2_anova_rt$anova_table,
                   Smith_exp3_anova_acc$anova_table,
                   Smith_exp3_anova_rt$anova_table)

repl_anovas <- lst(aov_ez(data = stroopCombined,
                          dv = "meanPE",
                          id = "sj",

```

```

        within = c("posture", "congruency"),
        type = 3,
        anova_table = list(es = "pes")),
aov_ez(data = stroopCombined,
      dv = "meanRT",
      id = "sj",
      within = c("posture", "congruency"),
      type = 3,
      anova_table = list(es = "pes")),
accModelTS,
rtModelTS,
aov_ez(data = vsCombined,
      dv = "meanPE",
      id = "sj",
      within = c("postureFactor", "setSize"),
      type = 3,
      anova_table = list(es = "pes")),
aov_ez(data = vsCombined,
      dv = "meanRT",
      id = "sj",
      within = c("postureFactor", "setSize"),
      type = 3,
      anova_table = list(es = "pes")))

for (i in 1:6){

smith_anovas[[i]] <- smith_anovas[[i]] %>%
  rownames_to_column() %>%
  as.data.frame() %>%
  rowwise() %>%
  mutate(LL = get.ci.partial.eta.squared(F, `num Df`, `den Df`, conf.level = 0.9)$LL,
         UL = get.ci.partial.eta.squared(F, `num Df`, `den Df`, conf.level = 0.9)$UL)

repl_anovas[[i]] <- repl_anovas[[i]]$anova_table %>%
  rownames_to_column() %>%
  as.data.frame() %>%
  rowwise() %>%
  mutate(LL = get.ci.partial.eta.squared(F, `num Df`, `den Df`, conf.level = 0.9)$LL,
         UL = get.ci.partial.eta.squared(F, `num Df`, `den Df`, conf.level = 0.9)$UL)
}

###Exp1 (Stroop)
smith.stroop <- smith_anovas[[1]] %>%
  ungroup() %>%
  bind_rows(smith_anovas[[2]]) %>%
  select(Effect = rowname, pes, LL, UL) %>%
  mutate(dv = rep(c("acc","rt"), each = 3), col = rep(c("black","black","red"),2))

repl.stroop <- repl_anovas[[1]] %>%
  ungroup() %>%
  bind_rows(repl_anovas[[2]]) %>%
  select(Effect = rowname, pes, LL, UL) %>%
  mutate(dv = rep(c("acc","rt"), each = 3), col = rep(c("black","black","red"),2),

```

```

    Effect = smith.stroop$Effect)

stroop.effects <- merge(smith.stroop, repl.stroop,
    by = c("Effect","dv"), suffixes = c("Smith","Replication"))

stroop.plot <- ggplot(data = stroop.effects, aes(x = pesSmith, y = pesReplication, shape = dv)) +
  geom_point(size = 2.5, col = stroop.effects$colSmith) +
  xlim(0, 1.00) +
  ylim(0, 1.00) +
  geom_abline(slope = 1, intercept = 0, col = "blue") +
  theme_classic() +
  theme(legend.position = c(0.2, 0.85),
    legend.background = element_rect(colour = "black",
    linetype = "solid",
    fill = "lightgray"),
    legend.title = element_blank(),
    legend.margin=margin(-3,5,0,0)) +
  labs(y = "Replication", x = "Smith et al.", title = "Stroop")

###Exp2 (Task-switching)
smith.ts <- smith_anovas[[3]] %>%
  ungroup() %>%
  bind_rows(smith_anovas[[4]]) %>%
  select(Effect = rowname, pes, LL, UL) %>%
  mutate(dv = rep(c("acc","rt"), each = 7),
    col = rep(c("black","black","black","black","red","black","black"),2))

repl.ts <- repl_anovas[[3]] %>%
  ungroup() %>%
  bind_rows(repl_anovas[[4]]) %>%
  select(Effect = rowname, pes, LL, UL) %>%
  mutate(dv = rep(c("acc","rt"), each = 7),
    col = rep(c("black","black","black","black","red","black","black"),2),
    Effect = smith.ts$Effect)

ts.effects <- merge(smith.ts, repl.ts,
    by = c("Effect","dv"), suffixes = c("Smith","Replication"))

ts.plot <- ggplot(data = ts.effects, aes(x = pesSmith, y = pesReplication, shape = dv)) +
  geom_point(size = 2.5, col = ts.effects$colSmith) +
  xlim(0, 1.00) +
  ylim(0, 1.00) +
  geom_abline(slope = 1, intercept = 0, col = "blue") +
  theme_classic() +
  theme(legend.position = c(0.2, 0.85),
    legend.background = element_rect(colour = "black",
    linetype = "solid",
    fill = "lightgray"),
    legend.title = element_blank(),

```

```

    legend.margin=margin(-3,5,0,0)) +
  labs(y = "Replication", x = "Smith et al.", title = "Task-Switching")

###Exp3 (Visual Search)
smith.vs <- smith_anovas[[5]] %>%
  ungroup() %>%
  bind_rows(smith_anovas[[6]]) %>%
  select(Effect = rowname, pes, LL, UL) %>%
  mutate(dv = rep(c("acc", "rt"), each = 3),
         col = rep(c("black", "black", "red"), 2))

repl.vs <- repl_anovas[[5]] %>%
  ungroup() %>%
  bind_rows(repl_anovas[[6]]) %>%
  select(Effect = rowname, pes, LL, UL) %>%
  mutate(dv = rep(c("acc", "rt"), each = 3),
         col = rep(c("black", "black", "red"), 2),
         Effect = smith.vs$Effect)

vs.effects <- merge(smith.vs, repl.vs,
                   by = c("Effect", "dv"), suffixes = c("Smith",
                                                         "Replication"))

vs.plot <- ggplot(data = vs.effects, aes(x = pesSmith, y = pesReplication, shape = dv)) +
  geom_point(size = 2.5, col = vs.effects$colSmith) +
  xlim(0, 1) +
  ylim(0, 1) +
  geom_abline(slope = 1, intercept = 0, col = "blue") +
  theme_classic() +
  theme(legend.position = c(0.2, 0.85),
        legend.background = element_rect(colour = "black",
                                           linetype = "solid",
                                           fill = "lightgray"),
        legend.title = element_blank(),
        legend.margin=margin(-3,5,0,0)) +
  labs(y = "Replication", x = "Smith et al.", title = "Visual Search")

all.plot <- plot_grid(stroop.plot, ts.plot, vs.plot, ncol = 3)

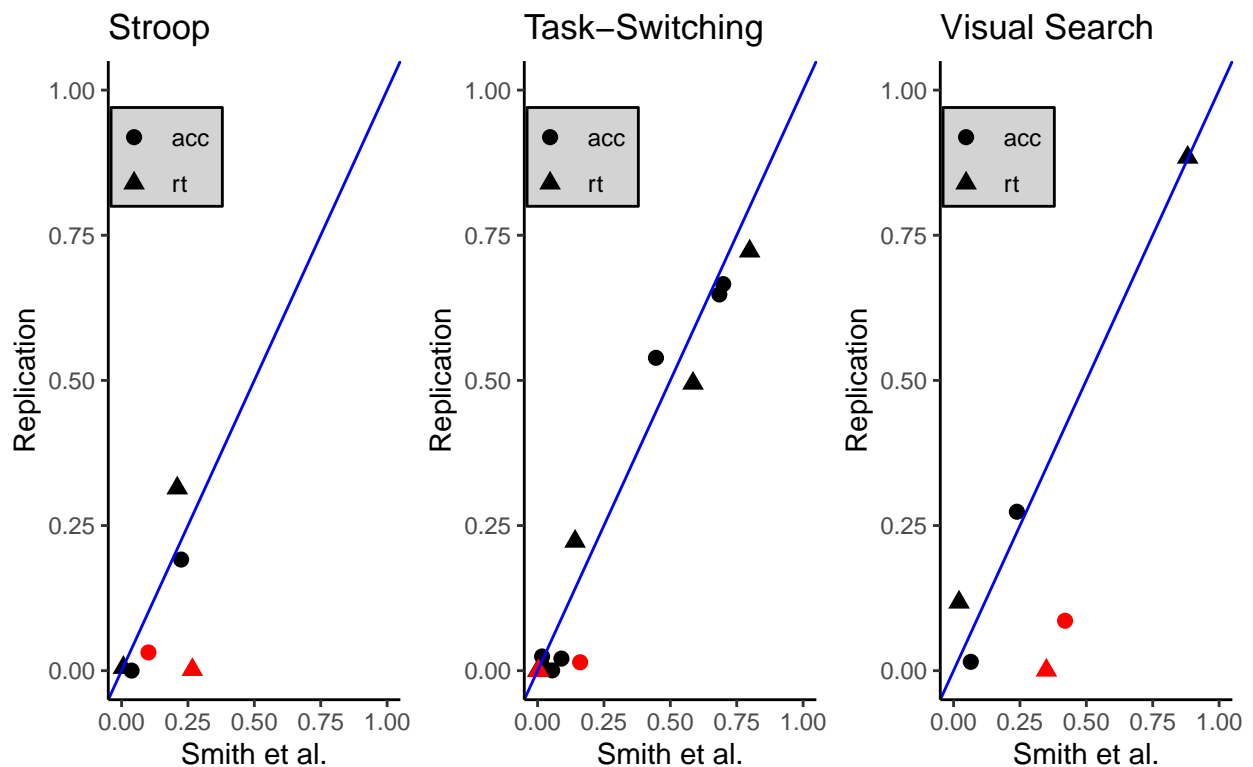
title <- ggdraw() +
  draw_label(
    "Effect Size Comparisons",
    fontface = 'bold',
    x = 0,
    hjust = 0
  ) +
  theme(
    # add margin on the left of the drawing canvas,
    # so title is aligned with left edge of first plot
    plot.margin = margin(0, 0, 0, 7)
  )

```

```
all.plot <- plot_grid(
  title, all.plot,
  ncol = 1,
  # rel_heights values control vertical title margins
  rel_heights = c(0.1, 1)
)

all.plot
```

## Effect Size Comparisons



```
ggsave(all.plot,
  file = "plots/all_effects_plot.pdf",
  units = "in",
  width = 9.5,
  height = 4.50,
  dpi = 600)

### Forest plot
#Graph comparison of key effects for all three experiments
forest.colors <- c("black", "red")

forest.data <- data.frame(Experiment = rep(c("Smith", "Replication"), 3),
  name = rep(c("Stroop", "Task-switching", "Visual Search"), each = 2),
  dv = rep(c("rt", "acc", "rt"), each = 2),
  pes = numeric(6),
```

```

      LL = numeric(6),
      UL = numeric(6))
forest.data[1,4:6] <- smith_anovas[[2]][3,c(6,8,9)]
forest.data[2,4:6] <- repl_anovas[[2]][3,c(6,8,9)]

forest.data[3,4:6] <- smith_anovas[[3]][5,c(6,8,9)]
forest.data[4,4:6] <- repl_anovas[[3]][5,c(6,8,9)]

forest.data[5,4:6] <- smith_anovas[[6]][3,c(6,8,9)]
forest.data[6,4:6] <- repl_anovas[[6]][3,c(6,8,9)]

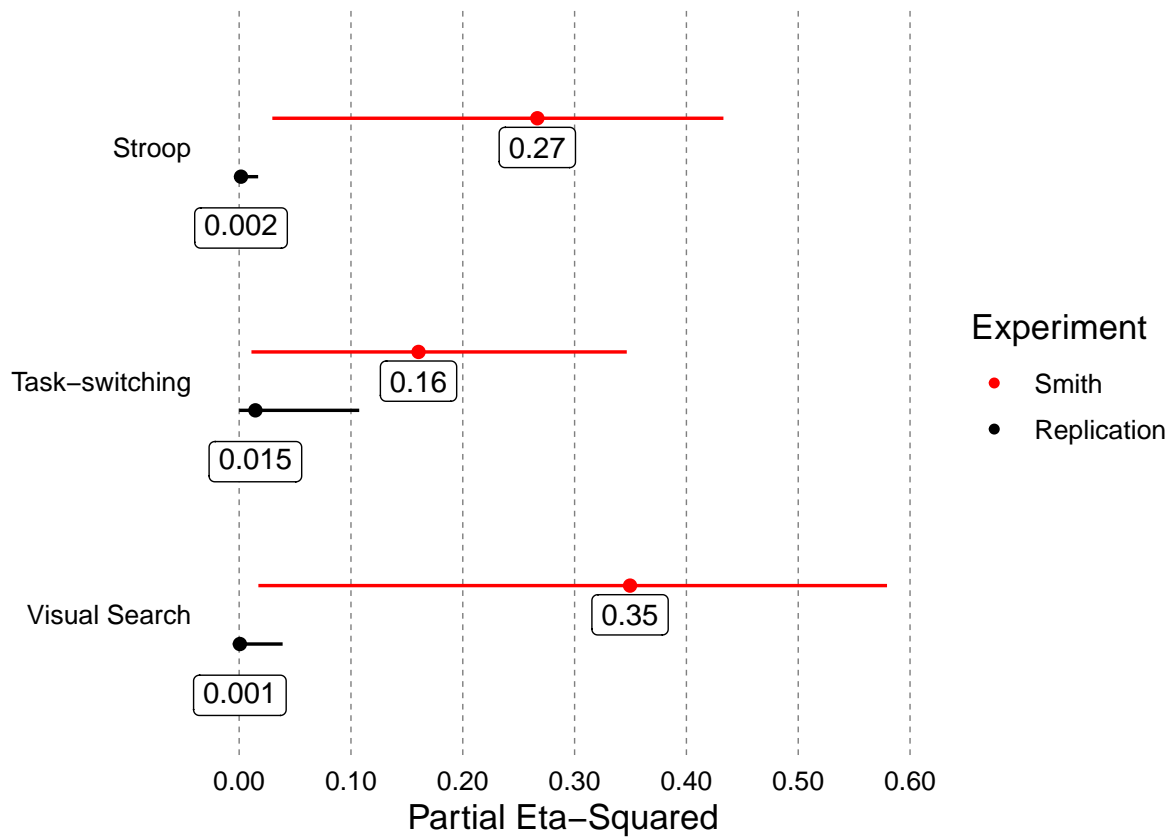
forest.comp <- mod.forestplot(df = forest.data,
                             estimate = pes,
                             ci.lower = LL,
                             ci.upper = UL,
                             colour = Experiment,
                             xlab = "Partial Eta-Squared"
) +
  scale_color_manual(values = forest.colors) +
  scale_x_continuous(labels = label_number(accuracy = 0.01), breaks = seq(0.00, 0.60, 0.10)) +
  #Too busy w/numbers for effects?
  geom_label(data = subset(forest.data, Experiment == "Smith"),
            aes(label = round(pes, digits = 2))) +
  geom_label(data = subset(forest.data, Experiment == "Replication"),
            aes(label = round(pes, digits = 3)),
            vjust = 2.50) +
  coord_cartesian(clip="off") #Disable clipping to draw outside plot area

## Scale for 'colour' is already present. Adding another scale for 'colour', which will replace the
## existing scale.

forest.comp

```





```
ggsave(forest.comp,
  file = "plots/forest_plot.pdf",
  units = "in",
  width = 6,
  height = 6,
  dpi = 600)

#Compare proportions: replication divided by original effect sizes
replication.effects <- subset(forest.data, Experiment == "Replication")
original.effects    <- subset(forest.data, Experiment == "Smith")

#As a percentage
prop.effects <- (replication.effects$pes/original.effects$pes)*100
#< 1%, ~9%, and <1%
prop.effects
```

```
## [1] 0.6181838 9.0496059 0.1801278
```

```
#Average proportion is 3.28%
mean(prop.effects)
```

```
## [1] 3.282639
```