# Mervar - Lab 4 (Pattern Recognition)

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#### Provided Code

```
library(ez) #for doing the ANOVAs
library(dplyr) # great library for massaging data
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##
       filter, lag
## The following objects are masked from 'package:base':
##
       intersect, setdiff, setequal, union
##
library(ggplot2)
\#\ I\ put\ the\ data\ file\ in\ a\ specific\ folder. If you don't have the same folder structures as me, you'll
data<-read.table("featureSearchResults.csv", stringsAsFactors=TRUE, sep=',', header = TRUE)</pre>
data<-filter(data,trial_type=="visual-search-circle") # only include actual feature search trials, not
data <-droplevels (data) #eliminate NULLS left over from instructions. Only include factor levels that a
sizes <-c(1,5,15,30) # create a list of the set sizes in their desired order
data$set_size<-factor(data$set_size, levels = sizes) #reorder the four levels of set_size so that they
table(data$subject_id) # make sure that everybody did the same number of trials
```

##							
##	2000081652		abassard	abmapete	adecourc	afwaddle	agpanago
##	4800	400	400	400	400	400	400
##	airwheel	amervar	anafe	andbstew	anfreel	anikouli3	anykim
##	400	400	400	400	400	400	400
##	apiero	apmolina	arwingar	asm9	astilian	atimothy	axelrodb
##	400	400	400	400	400	400	400
##	beckad	beejones	behughey	billgree	bkwatts	brjoande	brownlk
##	400	400	400	400	400	400	400
##	bunnerj	cadakinc (	cashew	caudrets	cfridman	chlmcnai	cisch
##	400	400	400	400	400	400	400
##	cphi	dahaggar	Dian Zhi	ebooras	efenogli	Eliwebs	emnpayne
##	400	400	400	400	400	400	400
##	episrael	escain	ggball	gghurley	gjude	gnbond	greeneaj
##	400	400	400	400	400	400	400
##	grifhall	gripatel	gwaldow	hahmann	halamerr	hcorbin	hkrasnow
##	400	400	400	400	400	400	400
##	howargr	igeorgia	isdbord	isherfic	islynch	jackmosk	jaenalex

```
400
##
          400
                      400
                                  400
                                              400
                                                                      400
                                                                                  400
##
                                                                             kdobias
     jotshiel
                 jowamajo
                             jsensanb
                                         jstamets
                                                      jtadley
                                                                       kb
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
##
      Keiland
                             kjkunkle
                                                                   lcwade
                                                                            lekowals
                 khapatel
                                         knakajim
                                                      lcgress
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
                                                               marlshep2 Maxwell Va
##
                               liziyi Madison By
      lfaimon
                 lgholmes
                                                     madvogel
##
           400
                      400
                                  400
                                              400
                                                          400
                                                                      400
##
     MAYGATES
                             mirshelt
                                        mklutzke
                                                                momamcgu moominpapa
                 micsiler
                                                       mlemos
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
## mrmornin2R
                 msmwakal
                             mvschnab
                                                        mzubi
                                                                   natcho
                                                                            nawhippo
                                        mzelenin
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
##
     ngperkin
                 nicgraha
                             nlepstei
                                         novricha
                                                      nwmaeda
                                                                 pauchamb
                                                                            philljoe
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
##
     pwsearle
                 rajulian
                             ramosjaa
                                         revankap
                                                     rkellems
                                                                 rodashby
                                                                            ronnapie
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
##
                 rymfrase
                              sakgoel
                                         samponde
                                                      sarodri
                                                                 sdalmia
                                                                               sdings
          rpw
##
          400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
                      400
##
     selzheng
                 sercolli
                              sidrath
                                         snwoodar
                                                      spunday
                                                                 stffrenc
                                                                             sullisea
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                      400
                                                                                  400
##
     sydsearc
                    tdell
                             thgibson
                                         tmdeckar
                                                      tnperez
                                                                             tyoberbr
                                                                 tyforajt
##
          400
                      400
                                  400
                                              400
                                                          400
                                                                                  400
                                                                      400
##
                                                                            zpetroff
     vtlanglo
                   weiyiy
                             wmanneri
                                          yuhtang
                                                     zegraber
                                                                 zhangjac
                                  400
                                                                                  400
##
          400
                                              400
                                                          400
                                                                      400
                      400
##
     zrajwany
                 zsdaniel
##
           400
                      400
par(mar = c(4,4,4,4), mfrow = c(1, 1)) # reset plots just in case it's necessary from whatever was being
#For looking at whether and how response time is influenced by the experimental variables
searchTimes<-filter(data, correct==1) # only include correct trials for response time analyses.
byseveral <-group_by(searchTimes, subject_id, target_presence, set_size, task) #break data down by subject,
```

400

Joe

400

johnpurc

400

josdougl

## `summarise()` has grouped output by 'subject\_id', 'target\_presence',

400

jakemage

##

##

400

jcworrel

400

jermaldo

400

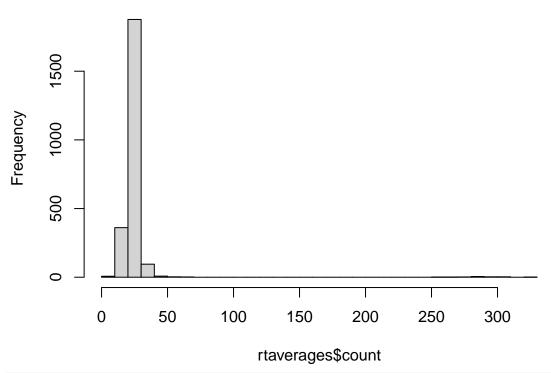
jm122

rtaverages<-summarize(byseveral,count=n(),rt=mean(rt, trim=0.1),year=max(year)) #show averages for each

<sup>## &#</sup>x27;set\_size'. You can override using the `.groups` argument.

<sup>#</sup> View(rtaverages) # if you want to see the whole frame with everybody's averages
hist(rtaverages\$count,breaks=40) #make sure that there's enough correct data from each of the cells

## Histogram of rtaverages\$count



rtaverages[rtaverages\$count<5,] # report subject\_id and condition in which low counts are found. If ev

```
## # A tibble: 3 x 7
## # Groups: subject_id, target_presence, set_size [3]
     subject_id target_presence set_size task
                                                              rt year
##
     <fct>
               <fct>
                               <fct>
                                         <fct>
                                                     <int> <dbl> <int>
## 1 astilian
              present
                                        disjunctive
                                                         2 1094. 2016
## 2 moominpapa present
                               5
                                        disjunctive
                                                         4 5142
                                                                  2018
                                        disjunctive
## 3 novricha
               present
                               15
                                                         1 1762
                                                                 2018
```

unique(rtaverages\$subject\_id) # tells us how many subjects we have

##	[1]		2000081652	abassard	abmapete	adecourc	afwaddle
##	[7]	agpanago	airwheel	amervar	anafe	andbstew	anfreel
##	[13]	anikouli3	anykim	apiero	apmolina	arwingar	asm9
##	[19]	astilian	atimothy	axelrodb	beckad	beejones	behughey
##	[25]	billgree	bkwatts	brjoande	brownlk	bunnerj	cadakinc (
##	[31]	cashew	caudrets	cfridman	chlmcnai	cisch	cphi
##	[37]	dahaggar	Dian Zhi	ebooras	efenogli	Eliwebs	emnpayne
##	[43]	episrael	escain	ggball	gghurley	gjude	gnbond
##	[49]	greeneaj	grifhall	gripatel	gwaldow	hahmann	halamerr
##	[55]	hcorbin	hkrasnow	howargr	igeorgia	isdbord	isherfic
##	[61]	islynch	jackmosk	jaenalex	jakemage	jcworrel	jermaldo
##	[67]	jm122	Joe	johnpurc	josdougl	jotshiel	jowamajo
##	[73]	jsensanb	jstamets	jtadley	kb	kdobias	Keiland
##	[79]	khapatel	kjkunkle	knakajim	lcgress	lcwade	lekowals
##	[85]	lfaimon	lgholmes	liziyi	Madison By	madvogel	marlshep2
##	[91]	Maxwell Va	MAYGATES	micsiler	mirshelt	mklutzke	mlemos
##	[97]	momamcgu	moominpapa	mrmornin2R	msmwakal	mvschnab	mzelenin

```
## [103] mzubi
                    natcho
                                nawhippo
                                           ngperkin
                                                      nicgraha
                                                                  nlepstei
## [109] novricha
                    nwmaeda
                                pauchamb
                                           philljoe
                                                       pwsearle
                                                                  rajulian
                    revankap
                                rkellems
                                           rodashby
                                                      ronnapie
## [115] ramosjaa
                                                                  rpw
## [121] rymfrase
                    sakgoel
                                samponde
                                           sarodri
                                                       sdalmia
                                                                  sdings
## [127] selzheng
                    sercolli
                                sidrath
                                           snwoodar
                                                      spunday
                                                                  stffrenc
## [133] sullisea
                    sydsearc
                                tdell
                                           thgibson
                                                       tmdeckar
                                                                  tnperez
## [139] tyforajt
                                vtlanglo
                    tyoberbr
                                           weiyiy
                                                       wmanneri
                                                                  yuhtang
## [145] zegraber
                    zhangjac
                                zpetroff
                                           zrajwany
                                                       zsdaniel
## 149 Levels: 2000081652 abassard abmapete adecourc afwaddle ... zsdaniel
```

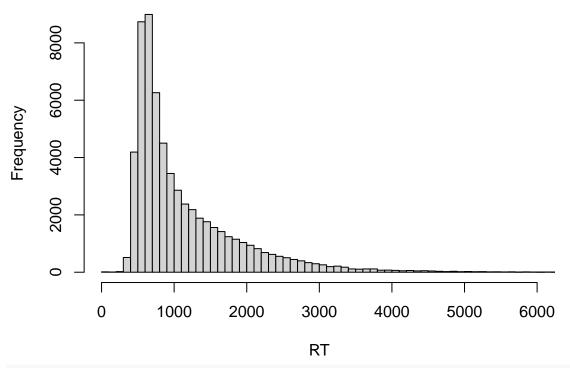
### # cleaning of data - throw out "bad" subjects

unusualsubjects <- rtaverages\$subject\_id[rtaverages\$count < 5 | rtaverages\$count > 60 ] # make a list of rtaverages <- filter(rtaverages,!(subject\_id %in% unusualsubjects)) # only include data from good subject rtaverages<-droplevels(rtaverages) #drops levels (subjects) that are no longer represented in data after unique(rtaverages\$subject\_id) # tells us how many remaining subjects we have

```
##
     [1] 2000081652 abassard
                                abmapete
                                           adecourc
                                                       afwaddle
                                                                  agpanago
##
     [7] airwheel
                    amervar
                                anafe
                                           andbstew
                                                       anfreel
                                                                  anikouli3
##
    [13] anykim
                    apiero
                                apmolina
                                           arwingar
                                                       asm9
                                                                  atimothy
##
    [19] axelrodb
                    beckad
                                beejones
                                           behughey
                                                       billgree
                                                                  bkwatts
   [25] brjoande
                                bunnerj
##
                    brownlk
                                           cadakinc (cashew
                                                                  caudrets
##
   [31] cfridman
                                cisch
                                                                  Dian Zhi
                    chlmcnai
                                           cphi
                                                       dahaggar
##
    [37] ebooras
                    efenogli
                                Eliwebs
                                           emnpayne
                                                       episrael
                                                                  escain
## [43] ggball
                    gghurley
                                gjude
                                           gnbond
                                                       greeneaj
                                                                  grifhall
  [49] gripatel
                    gwaldow
                                hahmann
                                           {\tt halamerr}
                                                       hcorbin
                                                                  hkrasnow
  [55] howargr
##
                    igeorgia
                                isdbord
                                           isherfic
                                                       islynch
                                                                  jackmosk
   [61] jaenalex
                    jakemage
                                jcworrel
                                           jermaldo
                                                       jm122
                                                                  Joe
##
  [67] johnpurc
                    josdougl
                                jotshiel
                                           jowamajo
                                                       jsensanb
                                                                  jstamets
##
  [73] jtadley
                    kb
                                kdobias
                                           Keiland
                                                       khapatel
                                                                  kjkunkle
##
   [79] knakajim
                                lcwade
                                           lekowals
                    lcgress
                                                       lfaimon
                                                                  lgholmes
                    Madison By madvogel
##
   [85] liziyi
                                           marlshep2
                                                       MAYGATES
                                                                  micsiler
## [91] mirshelt
                    mklutzke
                                mlemos
                                           momamcgu
                                                       mrmornin2R msmwakal
## [97] mvschnab
                    mzelenin
                                mzubi
                                           natcho
                                                       nawhippo
                                                                  ngperkin
## [103] nicgraha
                    nlepstei
                                nwmaeda
                                           pauchamb
                                                       philljoe
                                                                  pwsearle
## [109] rajulian
                                           rkellems
                                                       rodashby
                    ramosjaa
                                revankap
                                                                  ronnapie
## [115] rpw
                    rymfrase
                                sakgoel
                                           samponde
                                                       sarodri
                                                                  sdalmia
## [121] sdings
                    selzheng
                                sercolli
                                           sidrath
                                                       snwoodar
                                                                  spunday
## [127] stffrenc
                    sullisea
                                sydsearc
                                           tdell
                                                       thgibson
                                                                  tmdeckar
## [133] tnperez
                    tyforajt
                                tyoberbr
                                           vtlanglo
                                                       weiyiy
                                                                  wmanneri
## [139] yuhtang
                    zegraber
                                zhangjac
                                           zpetroff
                                                       zrajwany
                                                                  zsdaniel
## 144 Levels: 2000081652 abassard abmapete adecourc afwaddle agpanago ... zsdaniel
```

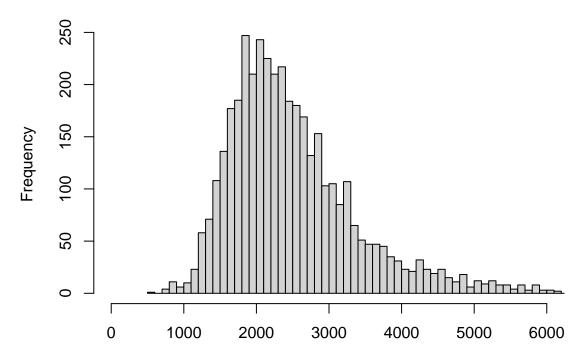
goodData<-filter(data,!(subject\_id %in% unusualsubjects)) # make a data frame that only includes data f goodData<-droplevels(goodData) #eliminate levels of dropped subjects
goodSearchTimes<-filter(goodData,correct==1) # for RT analysis, it is typical to only look at correct t
hist(searchTimes\$rt,breaks=200,xlim=c(0,6000),xlab="RT",ylab="Frequency") # get an overall feel for the

## Histogram of searchTimes\$rt



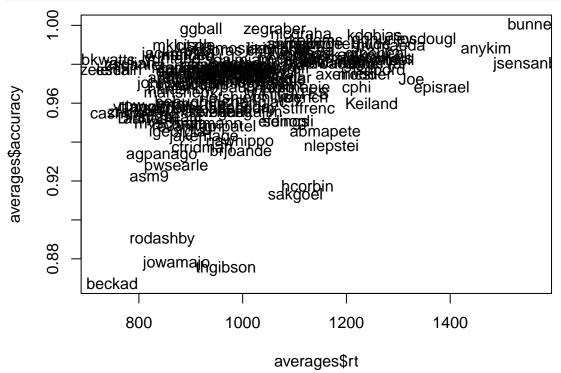
hist(filter(searchTimes,task=="conjunctive" & set\_size=="30" & target\_presence=="absent")\$rt,breaks=200

searchTimes, task == "conjunctive" & set\_size == "30" & target\_preser



>r(searchTimes, task == "conjunctive" & set\_size == "30" & target\_presence == "absent")

```
# Below is code to look overall at speed and accuracy of each subject
bysubject<-group_by(goodData,subject_id) # break down data by subject - notice that we're using ALL dat
averages<-summarize(bysubject,rt=mean(rt,trim=0.1),accuracy=sum(correct=="1")/n(),year=max(year)) #for
plot(averages$rt,averages$accuracy,type="n") # is there a speed-accuracy tradeoff? As people get faste
text(averages$rt,averages$accuracy,averages$subject_id)</pre>
```



cor.test(averages\$rt,averages\$accuracy) # is there a speed-accuracy tradeoff? Tends to be positive - a

```
##
##
   Pearson's product-moment correlation
##
## data: averages$rt and averages$accuracy
## t = 4.3971, df = 142, p-value = 2.136e-05
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
  0.1935670 0.4824387
## sample estimates:
##
         cor
## 0.3461818
averages$color<-recode(averages$year,"2016"="red","2017"="orange","2018"="green","2019"="blue") # Dplyr
## Warning: Unreplaced values treated as NA as `.x` is not compatible.
## Please specify replacements exhaustively or supply `.default`.
plot(averages$rt,averages$accuracy,pch=16,col=averages$color,xlab="Response Time",ylab="Accuracy") # is
```

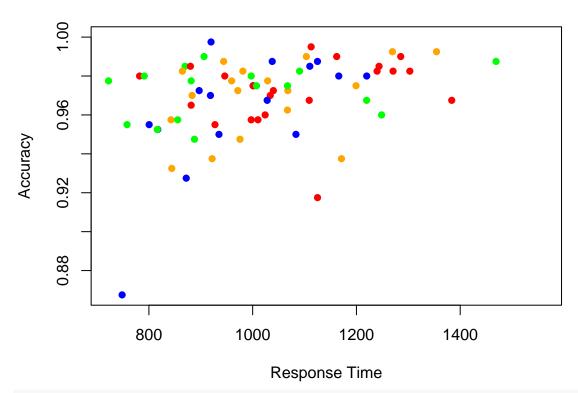


table1 <- tapply(X=rtaverages\$rt,INDEX=list(rtaverages\$set\_size,rtaverages\$target\_presence,rtaverages\$t # table1 # show means so that one can begin to interpret the data group\_by(goodSearchTimes,set\_size,target\_presence,task) %>% summarize(mean(rt,trim=0.1)) # an alternati

```
## `summarise()` has grouped output by 'set_size', 'target_presence'. You can
## override using the `.groups` argument.
## # A tibble: 16 x 4
##
  # Groups:
                set_size, target_presence [8]
      set_size target_presence task
                                              mean(rt, trim = 0.1)
##
##
      <fct>
                <fct>
                                 <fct>
                                                                <dbl>
##
    1 1
                absent
                                 conjunctive
                                                                 601.
                                                                 633.
##
    2 1
                absent
                                 disjunctive
##
    3 1
                                                                 544.
                present
                                 conjunctive
##
    4 1
                present
                                 disjunctive
                                                                 613.
    5 5
                                                                 827.
##
                absent
                                 conjunctive
                                                                 897.
##
    6 5
                absent
                                 disjunctive
    7 5
                                                                 703.
##
                present
                                 conjunctive
##
    8 5
                                                                 688.
                present
                                 disjunctive
                                                                1529.
##
    9 15
                absent
                                 conjunctive
## 10 15
                absent
                                 disjunctive
                                                                1637.
## 11 15
                present
                                 conjunctive
                                                                1054.
## 12 15
                                                                 761.
                present
                                 disjunctive
## 13 30
                absent
                                 conjunctive
                                                                2405.
                                                                2040.
## 14 30
                absent
                                 disjunctive
## 15 30
                present
                                                                1519.
                                 conjunctive
## 16 30
                                                                 847.
                present
                                 disjunctive
head(goodSearchTimes)
```

yuhtang visual-search-circle

trial\_type key\_press set\_size correct

70

##

## 1

trial\_index

rt subject\_id

2 1712

```
## 2
               3 741
                         yuhtang visual-search-circle
                                                              74
                                                                        1
                                                                                1
## 3
               4 566
                                                              74
                         yuhtang visual-search-circle
                                                                        1
                                                                                1
## 4
               5 998
                         yuhtang visual-search-circle
                                                              70
                                                                        1
                                                                                1
## 5
               6 579
                         yuhtang visual-search-circle
                                                              70
                                                                        1
                                                                                1
## 6
               7
                  803
                         yuhtang visual-search-circle
                                                              74
                                                                                1
                            task id year
##
     target_presence
## 1
              absent conjunctive 3 2017
## 2
             present conjunctive 4 2017
## 3
             present conjunctive 5 2017
## 4
              absent conjunctive 6 2017
## 5
              absent conjunctive 7 2017
## 6
             present conjunctive 8 2017
```

```
Fill in missing chunks
#Code to conduct actual ANOVA of the Response Times results
model<-ezANOVA(data=goodSearchTimes,dv=rt,within=c(set_size,target_presence,task),wid=subject_id) # You
## Warning: Collapsing data to cell means. *IF* the requested effects are a subset
## of the full design, you must use the "within_full" argument, else results may be
## inaccurate.
# could include year as a variable with "between=year". Main effect maybe but would hope there wouldn'
model # show results of the ANOVA model
## $ANOVA
##
                            Effect DFn DFd
                                                   F
                                                                 p p<.05
## 2
                                    3 429 993.80568 1.160813e-192
                          set_size
## 3
                   target presence
                                    1 143 807.77887 1.077007e-60
## 4
                                    1 143 103.56653 1.233287e-18
                              task
## 5
         set_size:target_presence
                                    3 429 457.54124 3.036174e-133
## 6
                                    3 429 130.08584 6.200153e-60
                     set_size:task
## 7
                                    1 143 95.28818 1.451633e-17
              target_presence:task
## 8 set_size:target_presence:task
                                    3 429 37.41166 1.705784e-21
           ges
## 2 0.62857261
## 3 0.34080939
## 4 0.03547688
## 5 0.25421847
## 6 0.10306314
## 7 0.01564004
## 8 0.01233006
```

```
## $`Mauchly's Test for Sphericity`
## Effect W
```

## 8 set\_size:target\_presence:task 0.2863555 2.150772e-36

##
\$`Sphericity Corrections`

## Effect GGe p[GG] p[GG]<.05 HFe
## 2 set\_size 0.5578729 7.577823e-109 \* 0.5637096
## 5 set\_size:target\_presence 0.5423290 1.197865e-73 \* 0.5476909
## 6 set\_size:task 0.5674096 3.125745e-35 \* 0.5735428

p p<.05

```
##
              p[HF] p[HF]<.05
## 2 5.924683e-110
     2.397734e-74
## 6
      1.394190e-35
## 8
     8.266325e-15
table1 <- list(rtaverages$set_size,rtaverages$task) #find breakdown just of setsize and task - less br
table1 #show means so that one can begin to interpret the data. You'll break down rtaverages in differ
##
   [[1]]
##
      [1] 1
             1
                 5
                    5
                        15 15 30 30 1
                                        1
                                           5
                                               5
                                                  15 15 30 30 1
                                                                  1
                                                                      5
                                                                         5
                                                                             15 15 30 30
##
                        15 15 30 30 1
                                            5
                                               5
                                                  15 15 30 30 1
##
                                                  15 15 30 30 1
     [49]
                 5
                    5
                        15 15 30 30 1
                                            5
                                               5
                                                                   1
                                                                      5
                                                                         5
                                                                             15 15 30 30
                                        1
##
     [73]
                 5
                    5
                        15 15 30 30 1
                                            5
                                               5
                                                  15 15 30 30 1
                                                                  1
                                                                      5
                                                                         5
                                                                             15 15 30 30
              1
                                        1
##
                 5
                    5
                        15 15 30 30 1
                                            5
                                               5
                                                  15 15 30 30 1
                                                                      5
                                                                         5
     [97] 1
              1
                                        1
                                                                   1
                                                                             15 15 30 30
    [121] 1
              1
                    5
                        15 15 30 30 1
                                        1
                                            5
                                               5
                                                  15 15 30 30
                                                               1
                                                                   1
                                                                      5
                                                                             15 15 30
##
    [145] 1
                 5
                    5
                        15 15 30 30
                                           5
                                               5
                                                  15 15 30
                                                                      5
                                                                         5
                                                                             15 15 30 30
              1
                                    1
                                        1
                                                            30
                                                               1
                                                                   1
                 5
                                           5
##
    [169] 1
              1
                    5
                        15 15 30 30 1
                                        1
                                               5
                                                  15 15 30 30 1
                                                                   1
                                                                      5
                                                                         5
                                                                             15 15 30
                                               5
##
    [193] 1
                 5
                    5
                        15 15 30 30 1
                                           5
                                                  15 15 30 30 1
                                                                      5
                                                                         5
                                                                             15 15 30 30
              1
                                        1
                                                                   1
##
    [217] 1
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## 8 set\_size:target\_presence:task 0.6397745 1.200915e-14

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## [1129] 1
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## [1177] 1
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## [1225] 1
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## [1273] 1
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## [1585] 1
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## [1681] 1
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## [2233] 1
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## [2257] 1
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## [2281] 1
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## [[2]] [1] conjunctive disjunctive conjunctive disjunctive conjunctive ## [7] conjunctive disjunctive conjunctive disjunctive conjunctive ## [13] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## ## [19] conjunctive disjunctive conjunctive disjunctive disjunctive ## [25] conjunctive disjunctive conjunctive disjunctive [31] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [37] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## ## [43] conjunctive disjunctive conjunctive disjunctive conjunctive ## [49] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [55] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [61] conjunctive disjunctive conjunctive disjunctive disjunctive ## [67] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive [73] conjunctive disjunctive conjunctive disjunctive disjunctive ## ## [79] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [85] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [91] conjunctive disjunctive conjunctive disjunctive conjunctive ## [97] conjunctive disjunctive conjunctive disjunctive conjunctive [103] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## ## [109] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [115] conjunctive disjunctive conjunctive disjunctive disjunctive [121] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive ## [127] conjunctive disjunctive conjunctive disjunctive disjunctive [133] conjunctive disjunctive conjunctive disjunctive disjunctive ## [139] conjunctive disjunctive conjunctive disjunctive disjunctive ## [145] conjunctive disjunctive conjunctive disjunctive disjunctive ## [151] conjunctive disjunctive conjunctive disjunctive conjunctive [157] conjunctive disjunctive conjunctive disjunctive conjunctive ## [163] conjunctive disjunctive conjunctive disjunctive disjunctive [169] conjunctive disjunctive conjunctive disjunctive conjunctive ## [175] conjunctive disjunctive conjunctive disjunctive disjunctive ## [181] conjunctive disjunctive conjunctive disjunctive conjunctive ## [187] conjunctive disjunctive conjunctive disjunctive disjunctive [193] conjunctive disjunctive conjunctive disjunctive disjunctive ## [199] conjunctive disjunctive conjunctive disjunctive disjunctive ## [205] conjunctive disjunctive conjunctive disjunctive disjunctive [211] conjunctive disjunctive conjunctive disjunctive disjunctive ## [217] conjunctive disjunctive conjunctive disjunctive disjunctive [223] conjunctive disjunctive conjunctive disjunctive disjunctive ## ## [229] conjunctive disjunctive conjunctive disjunctive disjunctive [235] conjunctive disjunctive conjunctive disjunctive disjunctive ## [241] conjunctive disjunctive conjunctive disjunctive disjunctive [247] conjunctive disjunctive conjunctive disjunctive disjunctive ## [253] conjunctive disjunctive conjunctive disjunctive disjunctive [259] conjunctive disjunctive conjunctive disjunctive disjunctive ## [265] conjunctive disjunctive conjunctive disjunctive disjunctive ## [271] conjunctive disjunctive conjunctive disjunctive conjunctive ## [277] conjunctive disjunctive conjunctive disjunctive disjunctive [283] conjunctive disjunctive conjunctive disjunctive disjunctive ## [289] conjunctive disjunctive conjunctive disjunctive disjunctive ## [295] conjunctive disjunctive conjunctive disjunctive disjunctive ## [301] conjunctive disjunctive conjunctive disjunctive disjunctive ## [307] conjunctive disjunctive conjunctive disjunctive conjunctive [313] conjunctive disjunctive conjunctive disjunctive conjunctive disjunctive

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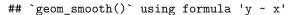
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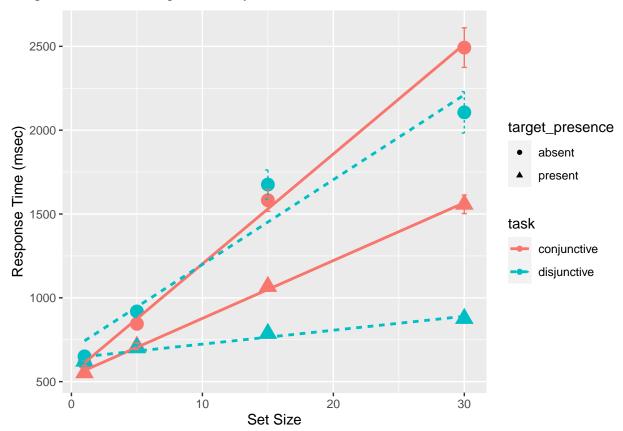
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## Levels: conjunctive disjunctive
```

# The next bit of code is to reproduce Treisman and Gelade's Figure 1, including best lines of fit rtaverages\$set\_size\_num<-sizes[rtaverages\$set\_size] # added a new column to rtaverage data frame which # You need to fill in the XXXs in the ggplot below. Think about what you want to appear on Y axes, and ggplot(rtaverages,aes(x=set\_size\_num,y=rt,shape=target\_presence,color=task, linetype=task))+ stat\_summarkers.

```
## Warning: `guides(<scale> = FALSE)` is deprecated. Please use `guides(<scale> =
## "none")` instead.
```





#stat\_summary makes a summary of the points, first showing data as points, then adding line of best fit
ca<-lm(rt~set\_size\_num,data=filter(rtaverages,task=="conjunctive" & target\_presence=="absent")) # if yo
# cp<-#Deleted piece of code to determine the slope and intercept of the best fitting line for the conj
cp <- lm(rt~set\_size\_num,data=filter(rtaverages,task=="conjunctive" & target\_presence=="present"))</pre>

byseveral <- group\_by(goodData,subject\_id,target\_presence,set\_size,task)#Should be just like the analog pcaverages<-summarize(byseveral,percentCorrect=sum(correct==1)/n()) #gives average accuracy broken down

```
## `summarise()` has grouped output by 'subject_id', 'target_presence',
## 'set_size'. You can override using the `.groups` argument.
```

```
model <- ezANOVA(data=byseveral, dv=rt, within=c(set_size, target_presence, task), wid=subject_id) #conduct
\#\# Warning: Collapsing data to cell means. *IF* the requested effects are a subset
## of the full design, you must use the "within_full" argument, else results may be
## inaccurate.
model # show results of the ANOVA model
## $ANOVA
##
                           Effect DFn DFd
                                                   F
                                                                 p p<.05
## 2
                                    3 429 1023.37053 4.718545e-195
                         set_size
## 3
                                    1 143 758.76353 4.762601e-59
                   target_presence
## 4
                             task
                                    1 143
                                           118.81909 1.625435e-20
## 5
          set_size:target_presence
                                    3 429 424.81652 4.991384e-128
## 6
                    set_size:task
                                    3 429
                                           146.33061 2.644614e-65
             target_presence:task
                                    1 143 125.14903 2.905726e-21
## 8 set_size:target_presence:task
                                    3 429
                                            47.87046 1.053651e-26
##
            ges
## 2 0.63650320
## 3 0.32704209
## 4 0.04056876
## 5 0.23773476
## 6 0.11390641
## 7 0.02034845
## 8 0.01572533
##
## $`Mauchly's Test for Sphericity`
##
## 2
                          set_size 0.1803983 2.116392e-50
## 5
          set size:target presence 0.1194348 6.096605e-63
                    set_size:task 0.2321395 9.492383e-43
## 8 set_size:target_presence:task 0.2838950 1.179251e-36
## $`Sphericity Corrections`
##
                           Effect
                                        GGe
                                                    p[GG] p[GG]<.05
                                                                          HFe
## 2
                          set size 0.5569078 5.374592e-110
                                                                  * 0.5627146
## 5
          set_size:target_presence 0.5400024 1.591316e-70
                                                                  * 0.5452941
                    set_size:task 0.5646910 4.043705e-38
                                                                  * 0.5707392
## 8 set_size:target_presence:task 0.6330863 7.575542e-18
                                                                  * 0.6413698
            p[HF] p[HF]<.05
## 2 4.123231e-111
## 5 3.466127e-71
## 6 1.693054e-38
## 8 4.776154e-18
table1 <- list(pcaverages$set_size, pcaverages$task, pcaverages$percentCorrect) #apply mean function to
table1 # show means so that one can begin to interpret the data
## [[1]]
##
               5 5 15 15 30 30 1 1 5 5 15 15 30 30 1 1 5 5 15 15 30 30
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     [25] 1 1
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## [1081] 1
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## [1153] 1
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## [1273] 1
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## [1321]
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     [57] 0.9629630 0.9600000 0.9130435 0.9444444 0.9310345 0.9677419 0.6666667
     [64] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9655172 0.9655172
##
##
     [71] 1.0000000 1.0000000 1.0000000 0.9600000 0.9629630 0.8965517 0.9523810
##
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     [85] 0.9615385 0.9615385 0.9600000 1.0000000 0.9600000 0.9565217 0.8421053
##
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##
##
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##
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##
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    [134] 1.0000000 1.0000000 1.0000000 1.0000000 0.8947368 0.9500000 0.9473684
##
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##
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    [176] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
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##
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##
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##
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    [232] 1.0000000 1.0000000 0.9047619 1.0000000 0.9310345 1.0000000 0.9523810
    [239] 1.0000000 0.9615385 0.9677419 0.9259259 1.0000000 1.0000000 0.9411765
    [246] 1.0000000 1.0000000 1.0000000 1.0000000 0.9565217 1.0000000 1.0000000
##
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    [260] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9090909 0.8800000
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##
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    [309] 0.9230769 0.9523810 0.9310345 1.0000000 0.9500000 0.8181818 0.8888889
##
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##
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##
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##
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    [386] 1.0000000 0.9310345 1.0000000 0.9642857 1.0000000 0.9333333 1.0000000
##
    [393] 0.8947368 0.8709677 0.9047619 0.9523810 1.0000000 1.0000000 0.8500000
##
##
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    [407] 1.0000000 1.0000000 1.0000000 1.0000000 0.9545455 0.9583333 1.0000000
    [414] 1.0000000 0.8846154 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
```

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    [435] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
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    [449] 0.9642857 0.9583333 1.0000000 0.9629630 1.0000000 1.0000000 1.0000000
##
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##
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##
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    [568] 1.0000000 1.0000000 0.9285714 0.9545455 0.9166667 0.9230769 0.9615385
    [575] 0.7857143 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
##
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##
    [596] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
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##
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##
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##
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##
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##
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##
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##
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##
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##
##
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```

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##
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    [834] 0.9285714 1.0000000 0.9545455 1.0000000 1.0000000 0.8620690 0.9600000
##
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##
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##
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##
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##
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##
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##
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##
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```

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## [1177] 0.9655172 0.9473684 0.9285714 0.9166667 1.0000000 0.9565217 1.0000000
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## [1387] 0.9130435 1.0000000 0.9629630 1.0000000 0.8800000 0.9500000 0.9047619
  [1394] 0.9655172 1.0000000 1.0000000 0.9666667 1.0000000 1.0000000 1.0000000
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## [1520] 0.9130435 1.0000000 0.9642857 1.0000000 0.9642857 1.0000000 1.0000000
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```

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## [1555] 0.9687500 1.0000000 1.0000000 0.9500000 1.0000000 1.0000000 1.0000000
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  [1744] 0.9500000 1.0000000 1.0000000 0.9545455 1.0000000 1.0000000 1.0000000
  [1751] 1.0000000 1.0000000 1.0000000 0.9545455 1.0000000 1.0000000 1.0000000
## [1758] 1.0000000 0.8846154 1.0000000 0.9615385 0.9285714 0.8928571 0.9259259
## [1765] 1.0000000 1.0000000 0.9444444 0.9473684 1.0000000 0.9545455 1.0000000
  [1772] 0.9130435 0.8750000 0.9565217 0.9062500 0.9677419 1.0000000 1.0000000
  [1779] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
  [1786] 0.9545455 1.0000000 1.0000000 0.9565217 1.0000000 0.9642857 1.0000000
  [1793] 0.7619048 0.9629630 1.0000000 0.9565217 1.0000000 0.8823529 1.0000000
## [1800] 1.0000000 0.8620690 0.8695652 0.8709677 1.0000000 0.8275862 1.0000000
## [1807] 0.2500000 0.9629630 0.9629630 1.0000000 1.0000000 0.9259259 1.0000000
## [1814] 1.0000000 1.0000000 1.0000000 1.0000000 0.9565217 1.0000000 1.0000000
  [1821] 0.8846154 0.9677419 0.8620690 0.9600000 1.0000000 1.0000000 0.9687500
  [1828] 1.0000000 0.9545455 0.9615385 0.9130435 1.0000000 1.0000000 0.9090909
  [1835] 1.0000000 0.9411765 0.9285714 0.9583333 0.8148148 0.9677419 1.0000000
  [1842] 1.0000000 0.9666667 0.9600000 1.0000000 1.0000000 1.0000000 1.0000000
## [1849] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9545455 0.9230769
## [1856] 0.9583333 0.9200000 1.0000000 0.9655172 1.0000000 1.0000000 0.9666667
## [1863] 1.0000000 1.0000000 0.9200000 0.9666667 0.8571429 0.9000000 0.8260870
## [1870] 0.9500000 0.4400000 0.8888889 1.0000000 0.9583333 1.0000000 1.0000000
  [1877] 1.0000000 1.0000000 1.0000000 1.0000000 0.9655172 0.9615385 0.9523810
  [1884] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9666667
## [1891] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9615385 1.0000000
## [1898] 1.0000000 0.9677419 1.0000000 0.9310345 1.0000000 0.8400000 1.0000000
## [1905] 0.9565217 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [1912] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9523810 1.0000000
## [1919] 0.8461538 0.9687500 1.0000000 0.9615385 1.0000000 1.0000000 1.0000000
## [1926] 0.9473684 1.0000000 1.0000000 1.0000000 0.8148148 1.0000000
```

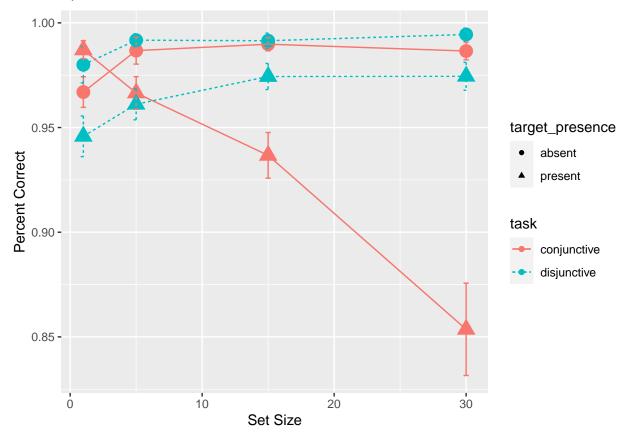
```
## [1933] 0.7083333 0.9354839 0.8461538 1.0000000 0.9629630 0.9615385 0.9629630
## [1940] 1.0000000 1.0000000 1.0000000 0.9629630 0.9523810 1.0000000 0.9166667
## [1947] 0.9565217 0.9259259 0.9130435 0.9166667 0.8695652 0.9655172 0.8421053
## [1954] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [1961] 0.9677419 0.9655172 0.9583333 0.8750000 0.9230769 1.0000000 0.7391304
## [1968] 1.0000000 1.0000000 0.9629630 1.0000000 0.9677419 1.0000000 1.0000000
  [1975] 1.0000000 1.0000000 1.0000000 0.9565217 0.9677419 0.9473684 1.0000000
## [1982] 0.9642857 0.8260870 0.9090909 1.0000000 1.0000000 1.0000000 1.0000000
  [1989] 0.9655172 1.0000000 1.0000000 1.0000000 0.9500000 1.0000000
  [1996] 0.9629630 0.9523810 0.9565217 0.9090909 0.9666667 0.9629630 1.0000000
  [2003] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9565217
## [2010] 0.9411765 0.9583333 0.9200000 0.8518519 1.0000000 0.7931034 0.9642857
## [2017] 0.9473684 1.0000000 1.0000000 0.9565217 1.0000000 0.9600000 0.9629630
## [2024] 1.0000000 1.0000000 0.8500000 0.9583333 0.9259259 0.8750000 1.0000000
## [2031] 0.8260870 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2038] 1.0000000 0.9600000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
  [2045] 0.9565217 1.0000000 0.8800000 1.0000000 0.9047619 1.0000000 1.0000000
  [2052] 0.9583333 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9583333
## [2059] 1.0000000 0.9230769 0.9565217 0.9545455 0.6071429 1.0000000 0.9166667
## [2066] 0.9615385 0.9565217 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2073] 0.9615385 1.0000000 1.0000000 0.9687500 1.0000000 1.0000000 0.9583333
## [2080] 1.0000000 1.0000000 0.4800000 1.0000000 0.9565217 0.9583333 0.8636364
## [2087] 0.9259259 0.9655172 1.0000000 0.5600000 1.0000000 0.8888889 0.8461538
## [2094] 0.8571429 0.6956522 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2101] 0.9565217 1.0000000 1.0000000 1.0000000 0.9333333 1.0000000
  [2108] 0.9642857 1.0000000 0.9642857 0.9166667 1.0000000 0.9166667 1.0000000
## [2115] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2122] 1.0000000 0.9166667 0.9600000 0.9545455 1.0000000 0.8888889 0.9583333
## [2129] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2136] 1.0000000 1.0000000 0.9642857 0.9629630 0.9600000 1.0000000 1.0000000
## [2143] 0.9333333 0.9642857 1.0000000 1.0000000 0.8947368 1.0000000 1.0000000
  [2150] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.8695652
## [2157] 0.9545455 0.9565217 0.9047619 1.0000000 0.9565217 0.9333333 1.0000000
## [2164] 0.9629630 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2171] 0.9583333 0.9565217 0.8846154 1.0000000 0.6923077 1.0000000 0.9565217
## [2178] 0.9600000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 0.9583333
## [2185] 1.0000000 0.9600000 0.9545455 1.0000000 0.9259259 1.0000000 0.9523810
## [2192] 0.9615385 0.9583333 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2199] 1.0000000 1.0000000 1.0000000 0.9583333 0.9642857 0.9642857 1.0000000
## [2206] 1.0000000 0.9629630 0.9600000 1.0000000 1.0000000 0.9565217 1.0000000
  [2213] 1.0000000 0.9473684 0.9545455 1.0000000 1.0000000 0.9666667 1.0000000
## [2220] 1.0000000 0.9565217 0.9354839 1.0000000 1.0000000 1.0000000 1.0000000
## [2227] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2234] 1.0000000 1.0000000 0.9655172 1.0000000 1.0000000 1.0000000 1.0000000
## [2241] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2248] 1.0000000 1.0000000 0.9655172 1.0000000 0.9545455 0.7600000 1.0000000
## [2255] 0.7142857 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2262] 1.0000000 1.0000000 1.0000000 0.9583333 1.0000000 1.0000000
## [2269] 0.8750000 0.9500000 0.8666667 1.0000000 0.9310345 1.0000000 0.9523810
## [2276] 1.0000000 1.0000000 1.0000000 0.9523810 1.0000000 1.0000000 0.8571429
## [2283] 0.9310345 0.8421053 0.9047619 1.0000000 0.8965517 0.9655172 0.9166667
## [2290] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [2297] 0.9615385 0.9655172 0.9615385 0.9642857 0.9200000 1.0000000 1.0000000
## [2304] 1.0000000
```

pcaverages\$set\_size\_num<-sizes[pcaverages\$set\_size] # added a new column to rtaverage data frame which # Plot the results (which turn out to be surprising) that mirror the response times results, but for ac head(pcaverages)

## # A tibble: 6 x 6 ## # Groups: subject\_id, target\_presence, set\_size [3] ## subject\_id target\_presence set\_size task percentCorrect set\_size\_num <fct> <fct> <dbl> ## <fct> <dbl> ## 1 2000081652 absent conjunctive 1 1 1 ## 2 2000081652 absent 1 disjunctive 1 ## 3 2000081652 absent 5 conjunctive 1 5 ## 4 2000081652 absent 5 disjunctive 5 ## 5 2000081652 absent 15 conjunctive 15 1 ## 6 2000081652 absent 15 disjunctive 0.941 15

ggplot(pcaverages,aes(x=set\_size\_num,y=percentCorrect,shape=target\_presence,color=task, linetype=task))

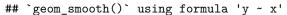
## Warning: `guides(<scale> = FALSE)` is deprecated. Please use `guides(<scale> =
## "none")` instead.

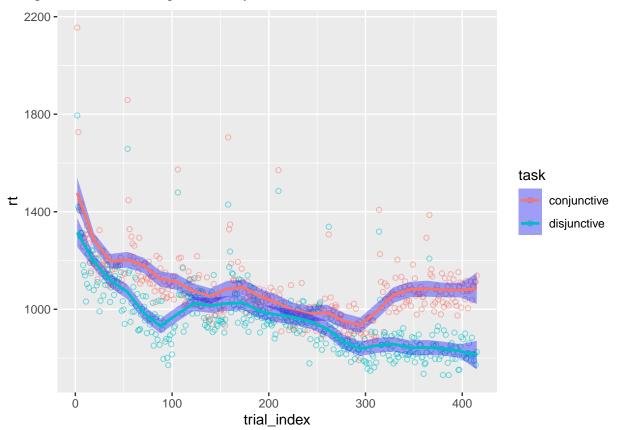


#The following analysis begins to look at learning effects. Are there improvements over all trials wit byseveral<-group\_by(goodSearchTimes,task,trial\_index) #break data down by task and which trial number. averages<-summarize(byseveral,rt=mean(rt,trim=.1)) #show averages for each subject for each cell of the

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

ggplot(averages,aes(x=trial\_index,y=rt,colour=task))+geom\_point(shape=1,alpha=1/2)+ geom\_smooth(method=





#### #Are there improvements over trials within each block?

goodSearchTimes\$trialInBlock<-(goodSearchTimes\$trial\_index-1) %% 52 # add another colums to describe wh byseveral<-group\_by(goodSearchTimes,subject\_id,task,trialInBlock) #break data down by subject, schedule averages<-summarize(byseveral,rt=mean(rt,trim=.3)) #show averages for each subject for each cell of the

```
## `summarise()` has grouped output by 'subject_id', 'task'. You can override
## using the `.groups` argument.
```

ggplot(averages,aes(x=trialInBlock,y=rt,colour=task))+geom\_point(shape=1,alpha=1/2)+ geom\_smooth(method

- ## `geom\_smooth()` using formula 'y ~ x'
- ## Warning: Removed 13 rows containing non-finite values (stat\_smooth).
- ## Warning: Removed 13 rows containing missing values (geom\_point).

