

# Brain Science Project Milestone 1

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```
library(ggplot2)
library(MASS)
library(tidyverse)
```

```
## -- Attaching packages ----- tidyverse 1.3.0 --
```

```
## v tibble  3.0.5      v dplyr   1.0.3
## v tidyr   1.1.2      v stringr 1.4.0
## v readr   1.4.0      v forcats 0.5.1
## v purrr   0.3.4
```

```
## -- Conflicts ----- tidyverse_conflicts() --
```

```
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## x dplyr::select() masks MASS::select()
```

```
library(dplyr)
library(sqldf)
```

```
## Loading required package: gsubfn
```

```
## Loading required package: proto
```

```
## Loading required package: RSQLite
```

```
library(data.table)
```

```
##
```

```
## Attaching package: 'data.table'
```

```
## The following objects are masked from 'package:dplyr':
```

```
##
```

```
##      between, first, last
```

```
## The following object is masked from 'package:purrr':
```

```
##
```

```
##      transpose
```

```
library(ggtext)
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'

## The following object is masked from 'package:dplyr':
##
##      combine
```

```
library(gtable)
library(cowplot)
library(grid)
library(egg)
library(e1071)
dataFromCSV<-read.csv(file.choose())

fd<-dataFromCSV %>%
  group_by(Yp, NSAp, Zp>0) %>%
  summarise(
    cnt = n()
  ) %>%
  filter(
    Yp>1979
  )
```

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

```
yrCnt = NULL
years = 1980:2018

for (i in 1:length(years)){
  hht <- filter(fd, Yp==i+1979)
  yrCnt[i] <- ( sum(hht[4]))
}
```

```
#####
# FIGURE 2A - 1st Graph SA Categories
#####
```

```
# Specify years and categories to analyze
years <- 1980:2018
cats <- 1:4
```

```
# Create matrix to store SA papers in specified categories by years
yrSACat <- matrix(data=NA,nrow= length(cats)*2, ncol=length(years) )
```

```

# Create vectors to store total SA papers with below average citations in specified categories by years
yrSAtotNEG <- matrix(data=NA, nrow = 1, ncol = length(years))

# Create vectors to store total SA papers with above average citations in specified categories by years
yrSAtotPOS <- matrix(data=NA, nrow = 1, ncol = length(years))

# create negative & positive arrays to store values from yrSAcat
negarr_SA <- (cats-1)*2+1
posarr_SA <- (cats)*2

for (i in 1:length(years)){
  for (j in 1:(length(cats)*2)){
    rr <- filter(fd, Yp == (i+1979) )
    yrSAcat[j,i] <- rr[[j,4]]
  }
  yrSAtotNEG[1,i] <- sum(yrSAcat[negarr_SA,i])
  yrSAtotPOS[1,i] <- sum(yrSAcat[posarr_SA,i])
}

colnames(yrSAcat) <- c(1980:2018)
rownames(yrSAcat) <- c("SA1 Zp-", "SA1 Zp+", "SA2 Zp-", "SA2 Zp+", "SA3 Zp-", "SA3 Zp+", "SA4 Zp-", "SA4 Zp+")
colnames(yrSAtotNEG) <- paste(1980:2018, "Neg Cite.")
colnames(yrSAtotPOS) <- paste(1980:2018, "Pos Cite.")

SApercTotNEG <- matrix(data=NA, nrow = length(cats), ncol = length(years))
SApercTotPOS <- matrix(data=NA, nrow = length(cats), ncol = length(years))

for (i in 1:length(years)){
  for (j in 1:length(cats) ) {
    SApercTotNEG[j,i] <- yrSAcat[((j-1)*2+1),i]/yrSAtotNEG[1,i]
    SApercTotPOS[j,i] <- yrSAcat[(j*2),i]/yrSAtotPOS[1,i]
  }
}

#colnames(SApercTot) <- c(1980:2018)
rownames(SApercTotNEG) <- c("SA1 Zp- ", "SA2 Zp- ", "SA3 Zp- ", "SA4 Zp- ")
rownames(SApercTotPOS) <- c("SA1 Zp+ ", "SA2 Zp+ ", "SA3 Zp+ ", "SA4 Zp+ ")

```

```
#####
# FIGURE 2A - 2nd Graph CIP Categories
#####

# Specify years and categories to analyze
years <- 1980:2018
cats <- 1:4

# Store CIP values of all categories from CSV data
CIPp<-dataFromCSV %>%
  group_by(Yp, NCIPp, Zp>0) %>%
  summarise(
    cnt = n()
  ) %>%
  filter(
    Yp>1979
  )
```

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

```
# Create matrix to store CIP papers in specified categories by years
yrCIPcat <- matrix(data=NA,nrow= length(cats)*2, ncol=length(years) )

# Create vectors to store total CIP papers with below average citations in specified categories by year
yrCIPtotNEG <- matrix(data=NA, nrow = 1, ncol = length(years))
# Create vectors to store total CIP papers with above average citations in specified categories by year
yrCIPtotPOS <- matrix(data=NA, nrow = 1, ncol = length(years))

# create negative & positive arrays to store values from yrCIPcat
negarr_CIP <- (cats-1)*2+1
posarr_CIP <- (cats)*2

zer <- matrix(data = 0, nrow = 8, ncol = 4)
tt2 <- tibble(Yp =(Yp = zer[1:8]), NCIPp=as.integer(0), 'Zp > 0'=FALSE, cnt= as.integer(0))

for (i in 1:length(years)){
  tt <- filter(CIPp, Yp == (i+1979) )
  if (dim(tt)[1] < 8){
    tt2 <- tibble(Yp = as.integer(zer[(8-dim(tt)[1]):8]), NCIPp=as.integer(0), 'Zp > 0'=FALSE, cnt= as.integer(0))
    tt <- tt %>% full_join(tt2,by=NULL)
  }
  for (j in 1:dim(tt)[1]){
    if (j>8){
      next
    }

    yrCIPcat[j,i] <- tt[[j,4]]

  }
  yrCIPtotNEG[1,i] <- sum(yrCIPcat[negarr_CIP,i])
  yrCIPtotPOS[1,i] <- sum(yrCIPcat[posarr_CIP,i])
}
```

```

## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")

## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NCIPp", "Zp > 0", "cnt")

colnames(yrCIPcat) <- c(1980:2018)
rownames(yrCIPcat) <- c("CIP1 Zp-", "CIP1 Zp+", "CIP2 Zp-", "CIP2 Zp+", "CIP3 Zp-", "CIP3 Zp+", "CIP4 Zp-", "CIP4 Zp+")
colnames(yrCIPtotNEG) <- paste(1980:2018, "Neg Cite.")
colnames(yrCIPtotPOS) <- paste(1980:2018, "Pos Cite.")

CIPpercTotNEG <- matrix(data=NA, nrow = length(cats), ncol = length(years))
CIPpercTotPOS <- matrix(data=NA, nrow = length(cats), ncol = length(years))

for (i in 1:length(years)){
  for (j in 1:length(cats) ) {
    CIPpercTotNEG[j,i] <- yrCIPcat[((j-1)*2+1),i]/yrCIPtotNEG[1,i]
    CIPpercTotPOS[j,i] <- yrCIPcat[(j*2),i]/yrCIPtotPOS[1,i]
  }
}

colnames(CIPpercTotNEG) <- c(1980:2018)
colnames(CIPpercTotPOS) <- c(1980:2018)

rownames(CIPpercTotNEG) <- c("CIP1 Zp- %", "CIP2 Zp- %", "CIP3 Zp- %", "CIP4 Zp- %")
rownames(CIPpercTotPOS) <- c("CIP1 Zp+ %", "CIP2 Zp+ %", "CIP3 Zp+ %", "CIP4 Zp+ %")

#####
# FIGURE 2A - 3rd Graph SA & CIP Categories
#####

# Specify years and categories to analyze
years <- 1980:2018
cats <- 1:4

SA_CIP1 <- dataFromCSV %>%
  group_by(Yp, NSAp, NCIPp, Zp>0) %>%
  summarise(
    cnt = n()
  ) %>%
  filter(NCIPp == 1 &
         NSAp == 1 & Yp>1979)

```

## 'summarise()' has grouped output by 'Yp', 'NSAp', 'NCIPp'. You can override using the '.groups' argument

```
SA_CIP2 <- dataFromCSV %>%
  group_by(Yp, NSAp, NCIPp, Zp>0) %>%
  summarise(
    cnt = n()
  ) %>%
  filter(NCIPp == 2 &
         NSAp == 2 &
         Yp>1979)
```

## 'summarise()' has grouped output by 'Yp', 'NSAp', 'NCIPp'. You can override using the '.groups' argument

```
SA_CIP3 <- dataFromCSV %>%
  group_by(Yp, NSAp, NCIPp, Zp>0) %>%
  summarise(
    cnt = n()
  ) %>%
  filter(NCIPp == 3 &
         NSAp == 3 &
         Yp>1979)
```

## 'summarise()' has grouped output by 'Yp', 'NSAp', 'NCIPp'. You can override using the '.groups' argument

```
SA_CIP4 <- dataFromCSV %>%
  group_by(Yp, NSAp, NCIPp, Zp>0) %>%
  summarise(
    cnt = n()
  ) %>%
  filter(NCIPp == 4 &
         NSAp == 4 &
         Yp>1979)
```

## 'summarise()' has grouped output by 'Yp', 'NSAp', 'NCIPp'. You can override using the '.groups' argument

```
SA_CIP <- SA_CIP1 %>% full_join(SA_CIP2, by = NULL) %>% full_join(SA_CIP3, by = NULL) %>% full_join(SA_CIP4, by = NULL)
```

```
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
```

```
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
```

```
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
```

```
# Create matrix to store SA_CIP papers in specified categories by years
yrSA_CIPcatNEG1 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=FALSE, cnt= 0)
yrSA_CIPcatPOS1 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=TRUE, cnt= 0)
yrSA_CIPcatNEG2 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=FALSE, cnt= 0)
yrSA_CIPcatPOS2 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=TRUE, cnt= 0)
yrSA_CIPcatNEG3 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=FALSE, cnt= 0)
yrSA_CIPcatPOS3 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=TRUE, cnt= 0)
yrSA_CIPcatNEG4 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=FALSE, cnt= 0)
```

```

yrSA_CIPcatPOS4 <- tibble(Yp = 0, NSAp=0, NCIPp=0, `Zp > 0`=TRUE, cnt= 0)

# Create vectors to store total CIP papers with below average citations in specified categories by year
yrSA_CIPtotNEG <- matrix(data=NA, nrow = 1, ncol = length(years))

# Create vectors to store total CIP papers with above average citations in specified categories by year
yrSA_CIPtotPOS <- matrix(data=NA, nrow = 1, ncol = length(years))

# tmp1 <- tibble(Yp = as.integer(Yp = zer[1:8]), NCIPp=as.integer(0), 'Zp > 0'=FALSE, cnt= as.integer(0))
for (i in 1:length(years)) {

  # Filter SA_CIP of all categories
  tmp1 <- filter(SA_CIP, Yp == (i+1979) )

  yrSA_CIPcatNEG1 <- yrSA_CIPcatNEG1 %>% full_join(filter(tmp1, (NCIPp == 1 | NSAp == 1) & `Zp > 0` == FALSE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))
  yrSA_CIPcatPOS1 <- yrSA_CIPcatPOS1 %>% full_join(filter(tmp1, (NCIPp == 1 | NSAp == 1) & `Zp > 0` == TRUE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))

  yrSA_CIPcatNEG2 <- yrSA_CIPcatNEG2 %>% full_join(filter(tmp1, (NCIPp == 2 | NSAp == 2) & `Zp > 0` == FALSE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))
  yrSA_CIPcatPOS2 <- yrSA_CIPcatPOS2 %>% full_join(filter(tmp1, (NCIPp == 2 | NSAp == 2) & `Zp > 0` == TRUE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))

  yrSA_CIPcatNEG3 <- yrSA_CIPcatNEG3 %>% full_join(filter(tmp1, (NCIPp == 3 | NSAp == 3) & `Zp > 0` == FALSE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))
  yrSA_CIPcatPOS3 <- yrSA_CIPcatPOS3 %>% full_join(filter(tmp1, (NCIPp == 3 | NSAp == 3) & `Zp > 0` == TRUE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))

  yrSA_CIPcatNEG4 <- yrSA_CIPcatNEG4 %>% full_join(filter(tmp1, (NCIPp == 4 | NSAp == 4) & `Zp > 0` == FALSE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))
  yrSA_CIPcatPOS4 <- yrSA_CIPcatPOS4 %>% full_join(filter(tmp1, (NCIPp == 4 | NSAp == 4) & `Zp > 0` == TRUE), by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt"))

  # }

  yrSA_CIPtotNEG[1,i] <- sum(filter(tmp1, `Zp > 0` == FALSE)[[5]])
  yrSA_CIPtotPOS[1,i] <- sum(filter(tmp1, `Zp > 0` == TRUE)[[5]])

}

```

```

## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")
## Joining, by = c("Yp", "NSAp", "NCIPp", "Zp > 0", "cnt")

```

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

```
#colnames(yrSA_CIPcat) <- c(1980:2018)
#rownames(yrSA_CIPcat) <- c("SA_CIP1 Zp-", "SA_CIP1 Zp+", "SA_CIP2 Zp-", "SA_CIP2 Zp+", "SA_CIP3 Zp-",
colnames(yrSA_CIPtotNEG) <- paste(1980:2018, "Neg Cite.")
colnames(yrSA_CIPtotPOS) <- paste(1980:2018, "Pos Cite.")

SA_CIPpercTotNEG <- matrix(data=NA, nrow = length(cats), ncol = length(years))
SA_CIPpercTotPOS <- matrix(data=NA, nrow = length(cats), ncol = length(years))

for (i in 1:length(years)){

  SA_CIPpercTotNEG[1,i] <- sum(filter(yrSA_CIPcatNEG1, Yp == i + 1979)[[5]]) / yrSA_CIPtotNEG[1,i]
  SA_CIPpercTotPOS[1,i] <- sum(filter(yrSA_CIPcatPOS1, Yp == i + 1979)[[5]]) / yrSA_CIPtotPOS[1,i]

  SA_CIPpercTotNEG[2,i] <- sum(filter(yrSA_CIPcatNEG2, Yp == i + 1979)[[5]]) / yrSA_CIPtotNEG[1,i]
  SA_CIPpercTotPOS[2,i] <- sum(filter(yrSA_CIPcatPOS2, Yp == i + 1979)[[5]]) / yrSA_CIPtotPOS[1,i]

  SA_CIPpercTotNEG[3,i] <- sum(filter(yrSA_CIPcatNEG3, Yp == i + 1979)[[5]]) / yrSA_CIPtotNEG[1,i]
  SA_CIPpercTotPOS[3,i] <- sum(filter(yrSA_CIPcatPOS3, Yp == i + 1979)[[5]]) / yrSA_CIPtotPOS[1,i]

  SA_CIPpercTotNEG[4,i] <- sum(filter(yrSA_CIPcatNEG4, Yp == i + 1979)[[5]]) / yrSA_CIPtotNEG[1,i]
  SA_CIPpercTotPOS[4,i] <- sum(filter(yrSA_CIPcatPOS4, Yp == i + 1979)[[5]]) / yrSA_CIPtotPOS[1,i]
}

colnames(SA_CIPpercTotNEG) <- c(1980:2018)
colnames(SA_CIPpercTotPOS) <- c(1980:2018)

rownames(SA_CIPpercTotNEG) <- c("SA_CIP1 Zp- %", "SA_CIP2 Zp- %", "SA_CIP3 Zp- %", "SA_CIP4 Zp- %")
rownames(SA_CIPpercTotPOS) <- c("SA_CIP1 Zp+ %", "SA_CIP2 Zp+ %", "SA_CIP3 Zp+ %", "SA_CIP4 Zp+ %")
```

```
years <- 1980:2018
```

```
#PLOTING for SA
```

```
p1 = data.frame(years=years, Fraction = (SApercTotPOS[1,]))  
p2 = data.frame(years=years, Fraction = (SApercTotPOS[2,]))  
p3 = data.frame(years=years, Fraction = SApercTotPOS[3,])  
p4 = data.frame(years=years, Fraction = (SApercTotPOS[4,]))
```

```
n1 = data.frame(years=years, Fraction = (SApercTotNEG[1,]))  
n2 = data.frame(years=years, Fraction = (SApercTotNEG[2,]))  
n3 = data.frame(years=years, Fraction = SApercTotNEG[3,])  
n4 = data.frame(years=years, Fraction = (SApercTotNEG[4,]))
```

```
e1<-ggplot()+geom_line(data=p1, mapping = aes(x=years,y=Fraction), size=0.5, color="grey30") + geom_line(  
  geom_line(data=p3, mapping = aes(x=years,y=Fraction), size=0.5, color="royalblue") + geom_  
  geom_line(data=n1, mapping = aes(x=years,y=Fraction), linetype = "dashed", size=0.5, color=  
  geom_line(data=n3, mapping = aes(x=years,y=Fraction), linetype = "dashed", size=0.5, color=
```

```
e2<-e1+theme_bw() + theme(panel.border = element_rect(colour = "black", fill=NA, size=1), panel.grid.ma  
  panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"),  
  axis.text.x = element_text(size=10))
```

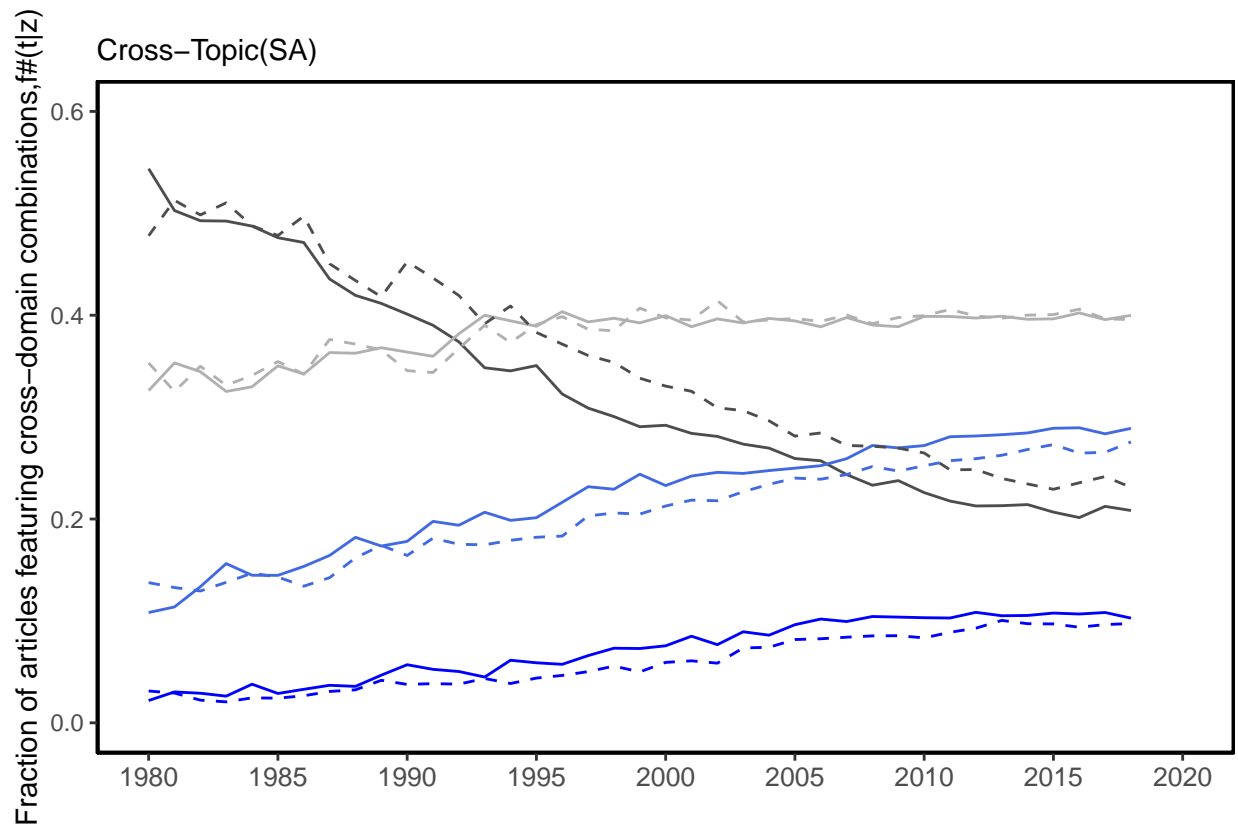
```
e3<-e2+scale_x_continuous(limits=c(1980, 2020), breaks=seq(1980, 2020, 5))+scale_y_continuous(limits=c(
```

```
e4<-e3+labs(title = "", x = "", y = "")
```

```
e5<-e4+ scale_color_manual(name = "Y series")
```

```
e5+theme(legend.title = element_text(size=12, color = "salmon", face="bold"),  
  legend.justification=c(0,1),  
  legend.position=c(0.05, 0.95),  
  legend.background = element_blank(),  
  legend.key = element_blank()) +
```

```
labs(subtitle="Cross-Topic(SA)")+ylab("Fraction of articles featuring cross-domain combinations,f#(t|
```



*#Plotting for CIP*

```
cp1 = data.frame(years=years, Fraction = (CIPpercTotPOS[1,]))
cp2 = data.frame(years=years, Fraction = (CIPpercTotPOS[2,]))
cp3 = data.frame(years=years, Fraction = (CIPpercTotPOS[3,]))
cp4 = data.frame(years=years, Fraction = (CIPpercTotPOS[4,]))

cn1 = data.frame(years=years, Fraction = (CIPpercTotNEG[1,]))
cn2 = data.frame(years=years, Fraction = (CIPpercTotNEG[2,]))
cn3 = data.frame(years=years, Fraction = (CIPpercTotNEG[3,]))
cn4 = data.frame(years=years, Fraction = (CIPpercTotNEG[4,]))

ce1<-ggplot()+geom_line(data=cp1, mapping = aes(x=years,y=Fraction), size=0.5, color="grey30") + geom_line(
  data=cp3, mapping = aes(x=years,y=Fraction), size=0.5, color="royalblue") + geom_line(data=cn1, mapping = aes(x=years,y=Fraction), linetype = "dashed", size=0.5, color="grey30") +
  geom_line(data=cn3, mapping = aes(x=years,y=Fraction), linetype = "dashed", size=0.5, color="royalblue")

ce2<-ce1+theme_bw() + theme(panel.border = element_rect(colour = "black", fill=NA, size=1), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"),
  axis.text.x = element_text(size=10))
ce3<-ce2+scale_x_continuous(limits=c(1980, 2020), breaks=seq(1980, 2020, 5))+scale_y_continuous(limits=c(0.0, 0.6), breaks=seq(0.0, 0.6, 0.2))
```

```

ce4<-ce3+labs(title = "", x = "", y = "")

ce5<-ce4 +annotation_custom(
  ggplotGrob(ce4+annotation_logticks() +
    scale_y_log10(limits = c(NA,0.1))+scale_x_continuous(limits=c(1980, 2020), breaks=seq(19
    xmin = 1983, xmax = 2007, ymin = 0.23, ymax = 0.8)

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

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

## Warning: Transformation introduced infinite values in continuous y-axis
## Warning: Transformation introduced infinite values in continuous y-axis
## Warning: Transformation introduced infinite values in continuous y-axis
## Warning: Transformation introduced infinite values in continuous y-axis

## Warning: Removed 39 row(s) containing missing values (geom_path).

## Warning: Removed 24 row(s) containing missing values (geom_path).

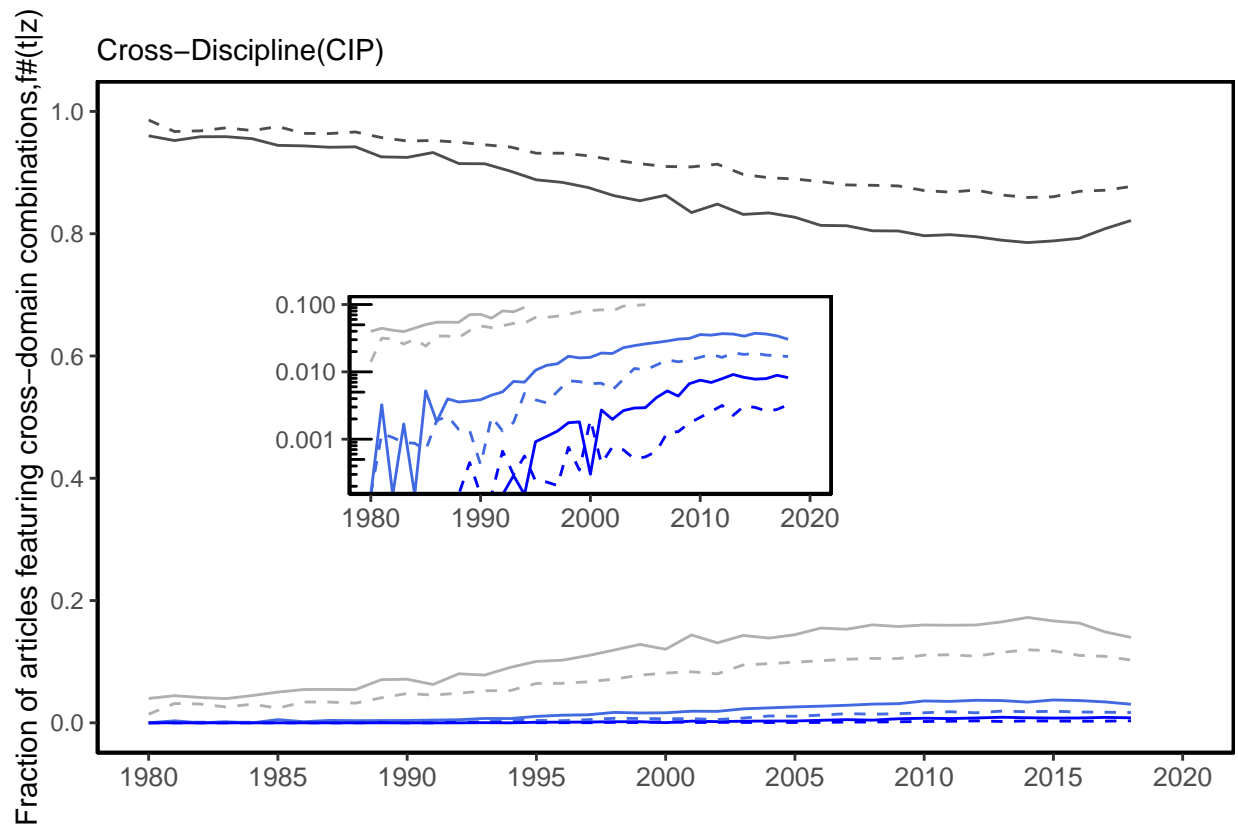
## Warning: Removed 39 row(s) containing missing values (geom_path).

## Warning: Removed 13 row(s) containing missing values (geom_path).

ce5+theme(legend.title = element_text(size=12, color = "salmon", face="bold"),
  legend.justification=c(0,1),
  legend.position=c(0.05, 0.95),
  legend.background = element_blank(),
  legend.key = element_blank()) +
  labs(subtitle="Cross-Discipline(CIP)")+ylab("Fraction of articles featuring cross-domain combinations

```





#### #Plotting for SACIP

```
scp1 = data.frame(years=years, Fraction = (SA_CIPpercTotPOS[1,]))
scp2 = data.frame(years=years, Fraction = (SA_CIPpercTotPOS[2,]))
scp3 = data.frame(years=years, Fraction = SA_CIPpercTotPOS[3,])
scp4 = data.frame(years=years, Fraction = (SA_CIPpercTotPOS[4,]))

scn1 = data.frame(years=years, Fraction = (SA_CIPpercTotNEG[1,]))
scn2 = data.frame(years=years, Fraction = (SA_CIPpercTotNEG[2,]))
scn3 = data.frame(years=years, Fraction = SA_CIPpercTotNEG[3,])
scn4 = data.frame(years=years, Fraction = (SA_CIPpercTotNEG[4,]))

sce1<-ggplot()+geom_line(data=scp1, mapping = aes(x=years,y=Fraction), size=0.5, color="grey30") + geom_line(
  data=scp3, mapping = aes(x=years,y=Fraction), size=1, color="royalblue") + geom_line(data=scp2, mapping = aes(x=years,y=Fraction), size=0.5, color="grey30") +
  geom_line(data=scn1, mapping = aes(x=years,y=Fraction), linetype = "dashed", size=0.5, color="grey30") + geom_line(data=scn3, mapping = aes(x=years,y=Fraction), linetype = "dashed", size=0.5, color="royalblue")

sce2<-sce1+theme_bw() + theme(panel.border = element_rect(colour = "black", fill=NA, size=1), panel.grid.major = element_line(colour = "black", size=0.5),
  panel.grid.minor = element_blank(), axis.line = element_line(colour = "black", size=0.5), axis.text.x = element_text(size=10))

sce3<-sce2+scale_x_continuous(limits=c(1980, 2020), breaks=seq(1980, 2020, 5))+scale_y_continuous(limits=c(0.0, 1.0), breaks=seq(0.0, 1.0, 0.2))

sce4<-sce3+labs(title = "", x = "", y = "")
```

```

sce5<-sce4 +annotation_custom(
  ggplotGrob(sce4+annotation_logticks() +
    scale_y_log10(limits = c(NA,0.1))+scale_x_continuous(limits=c(1980, 2020), breaks=seq(19
    xmin = 1980, xmax = 2005, ymin = 0.19, ymax = 0.79)

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

## Warning: Transformation introduced infinite values in continuous y-axis

## Warning: Transformation introduced infinite values in continuous y-axis

## Warning: Transformation introduced infinite values in continuous y-axis

## Warning: Transformation introduced infinite values in continuous y-axis

## Warning: Removed 39 row(s) containing missing values (geom_path).

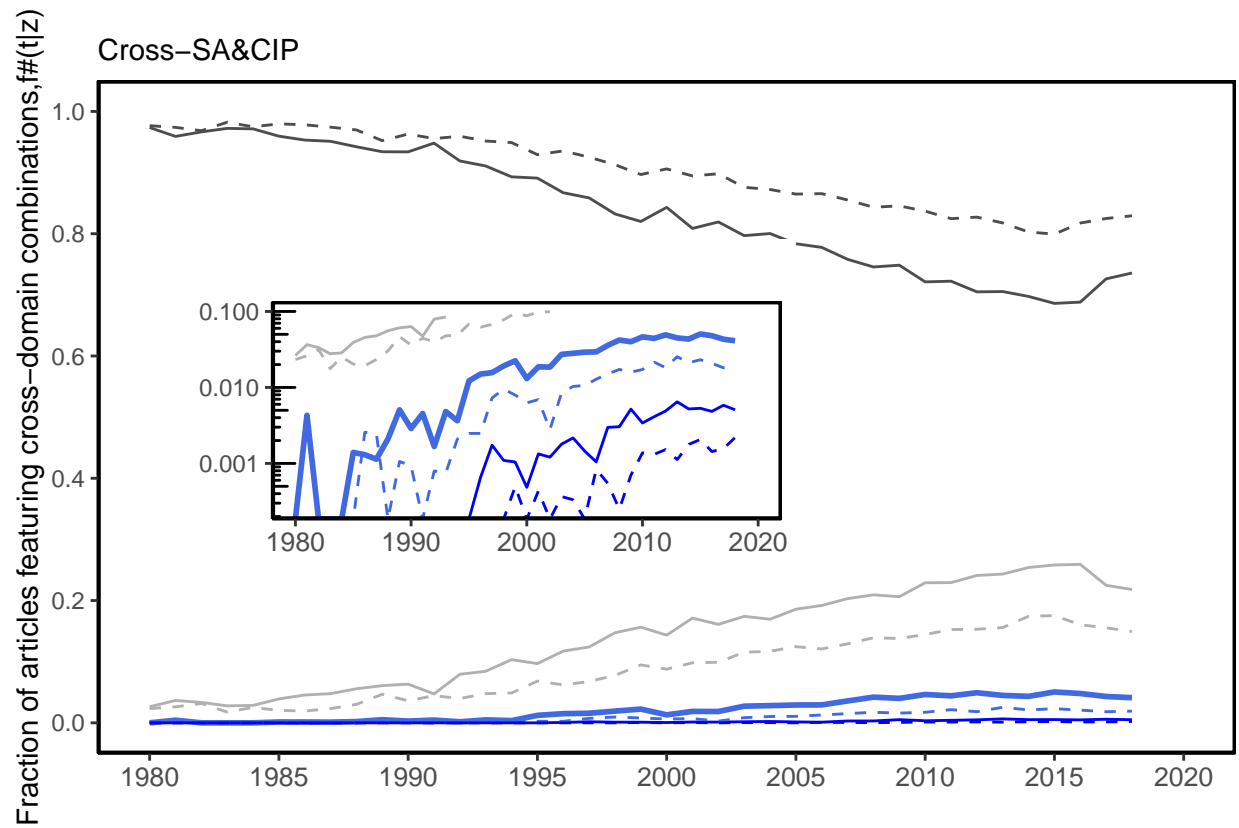
## Warning: Removed 23 row(s) containing missing values (geom_path).

## Warning: Removed 39 row(s) containing missing values (geom_path).

## Warning: Removed 16 row(s) containing missing values (geom_path).

sce5+theme(legend.title = element_text(size=12, color = "salmon", face="bold"),
  legend.justification=c(0,1),
  legend.position=c(0.05, 0.95),
  legend.background = element_blank(),
  legend.key = element_blank()) +
  labs(subtitle="Cross-SA&CIP")+ylab("Fraction of articles featuring cross-domain combinations,f#(t|z)".

```



```

grid.arrange(arrangeGrob(e5 + theme(legend.position="none"),
                          ce5 + theme(legend.position="none"),
                          sce5 + theme(legend.position="none"),
                          nrow = 3,
                          top = textGrob("", vjust = 1, gp = gpar(fontface = "bold", cex = 1)),
                          left = textGrob("Fraction of articles featuring cross-domain combinations,  $f\#(t|z)$ ",
                          right = textGrob("Cross-Topic(SA) Cross-Discipline(CIP) Cross - SA&CIP", rot = 90),

```

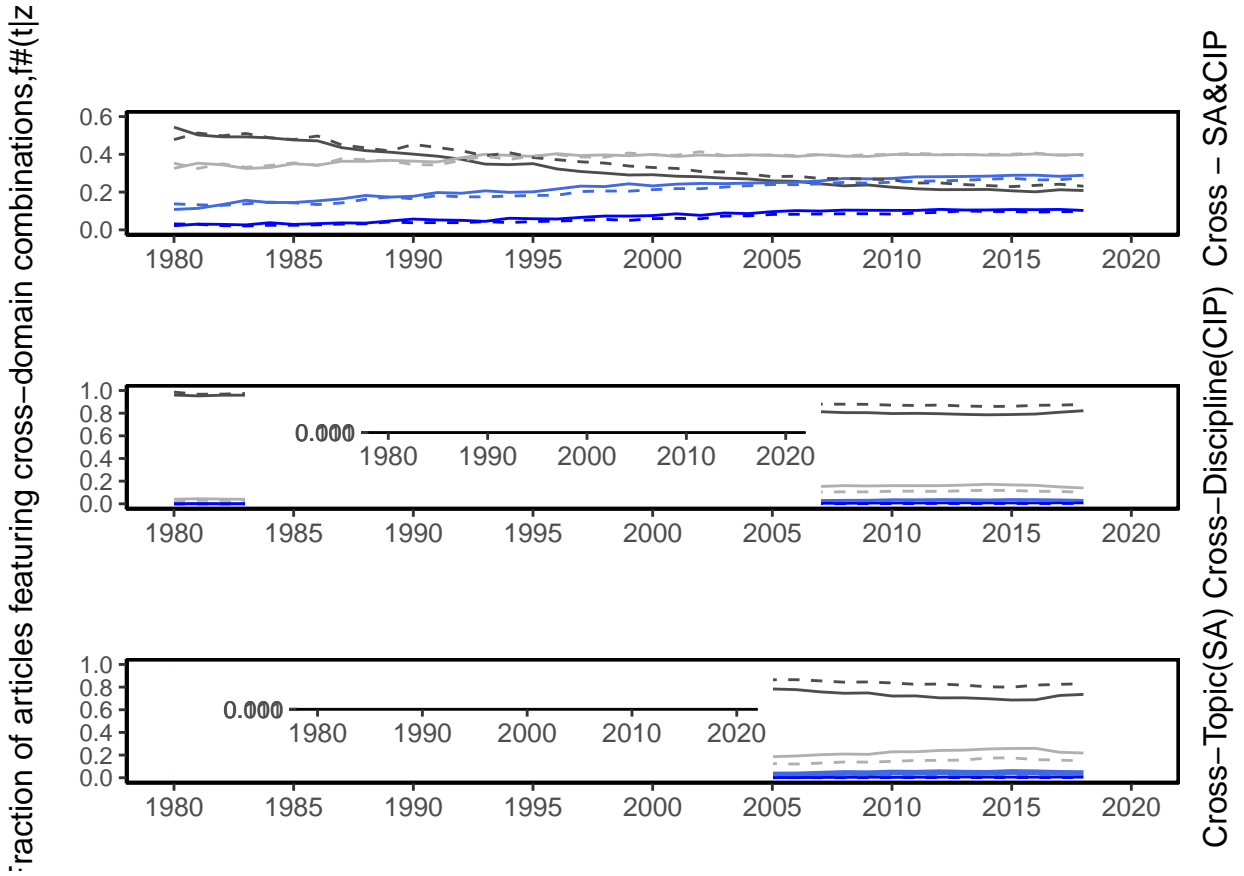


Figure 2A is showing from 1980 to 2020 the trend towards more cross-disciplinary and cross topic research in brain science. Four main categories are studied with 2 plots for each category representing above-average cited papers (solid line) and below average cited papers (dashed lines). Results are compared as fractions to the number of papers published as a whole. In 1980, cross-disciplinary and cross topic research in the 1st categories made up the vast the majority of research papers published related to brain science but gradually the trend has started to level with more diverse cross-topic research papers published. Cross-Disciplinary (CIP) research has also increased across many disciplines in Neuro/Biology though the vast majority of collaborations still publish in category 1 (CIP1).

Figure 2B is showing from 1999-2008 and 2009-2018 the interconnected social network of researchers publishing in brain related research in continental regions around the world (North America, Europe, Australasia). The bigger circles represent researchers with more citations to their work and their lifetime work can be shown early on making major impacts in their fields of research and continuing onward throughout their life continuing to publish as first author of heavily cited research papers.