

# t tests, Robust and Non Robust

Code ▾

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```
library(ggplot2)
library(WRS)
library(pastecs)
library(reshape)
```

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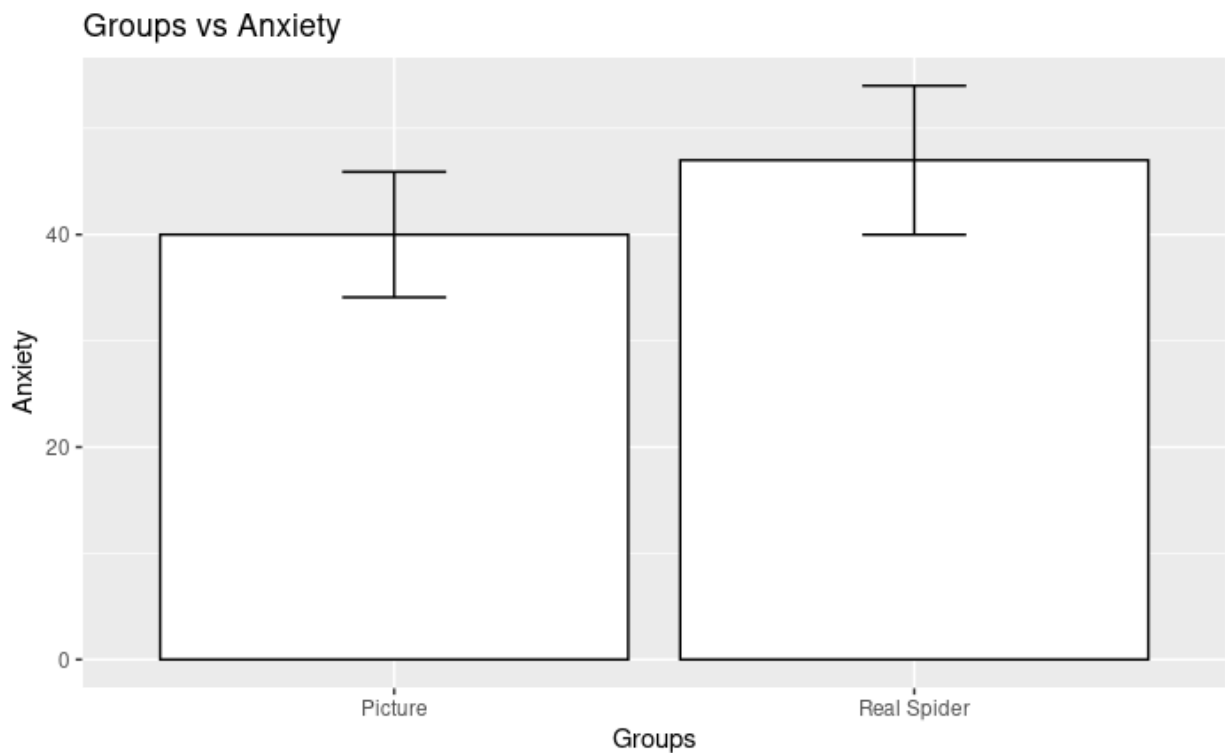
```
df<- read.delim('/home/atrides/Desktop/R/statistics_with_R/09_ComparingTwoMeans/Data_Files/SpiderLong.dat', header = TRUE)

head(df , 15)
```

	<b>Group</b> <chr>	<b>Anxiety</b> <int>
1	Picture	30
2	Picture	35
3	Picture	45
4	Picture	40
5	Picture	50
6	Picture	35
7	Picture	55
8	Picture	25
9	Picture	30
10	Picture	45
1-10 of 15 rows		Previous 1 2 Next

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```
# barplot for independent measure design , the difference will be with error bar when
# we will compare it to repeated measure design
bar<- ggplot(df, aes(Group, Anxiety))
bar<- bar+
  stat_summary(fun=mean, geom='bar', fill='white', colour='black')+
  stat_summary(fun.data=mean_cl_normal, geom='errorbar', width=0.2)+
  labs(x='Groups', y='Anxiety')+
  ggtitle('Groups vs Anxiety')
bar
```


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```
df_wide<- read.delim('/home/atrides/Desktop/R/statistics_with_R/09_Comparing
TwoMeans/Data_Files/SpiderWide.dat', header = TRUE)
df_wide
```

	picture <int>	real <int>
	30	40
	35	35
	45	50
	40	55
	50	65

	<b>picture</b> <int>	<b>real</b> <int>
	35	55
	55	50
	25	35
	30	30
	45	50
1-10 of 12 rows		
	Previous	1 2 Next

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```
grand_mean = mean(df$Anxiety)
mean_pic<- mean(df_wide$picture)
mean_real<- mean(df_wide$real)

cat(grand_mean,mean_pic,mean_real)
```

43.5 40 47

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```
df_wide$mean<- (df_wide$picture+df_wide$real)/2
head(df_wide)
```

	<b>picture</b> <int>	<b>real</b> <int>	<b>mean</b> <dbl>
1	30	40	35.0
2	35	35	35.0
3	45	50	47.5
4	40	55	47.5
5	50	65	57.5
6	35	55	45.0
6 rows			

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```
df_wide$adj<- grand_mean-df_wide$mean
df_wide$picture_adj<- df_wide$picture+df_wide$adj
df_wide$real_adj<- df_wide$real+df_wide$adj

# making an id column
df_wide$id<- gl(12, 1,12, labels=c(1:12))
names(df_wide)
```

```
[1] "picture"      "real"         "mean"         "adj"          "picture_adj" "r
eal_adj"       "id"
```

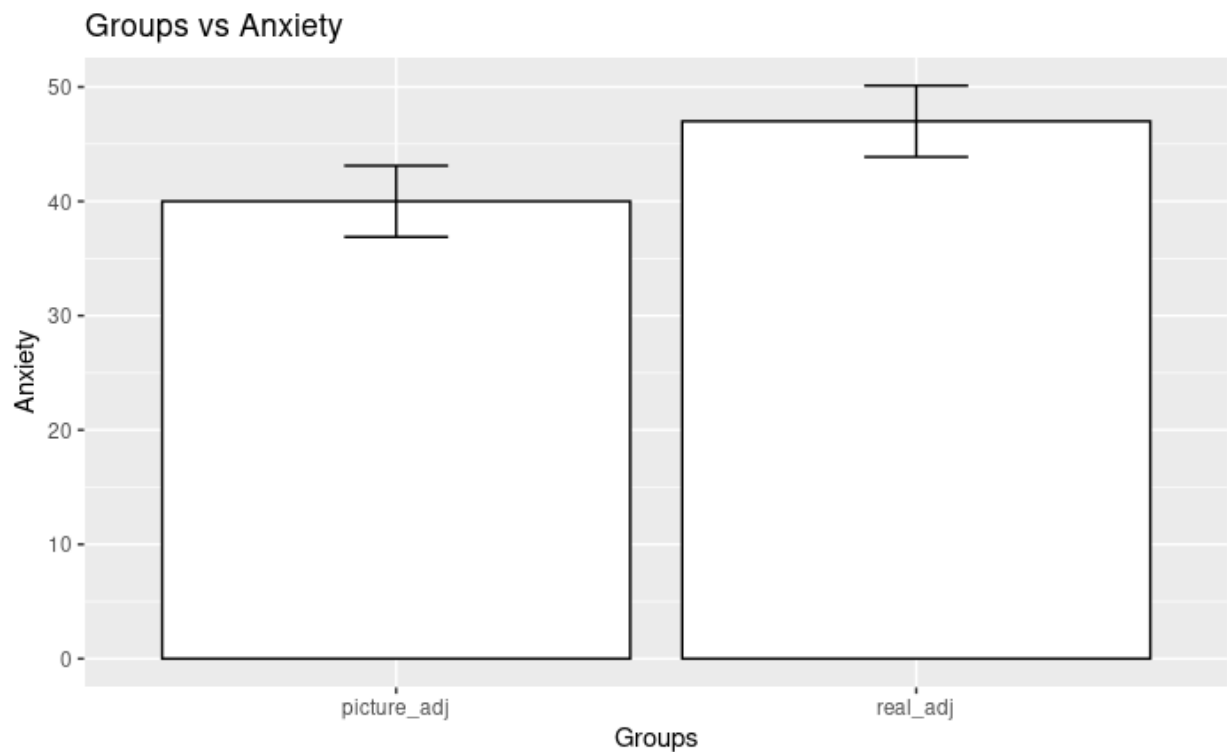
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```
df_long<- melt(df_wide, id.vars="id", measure.vars=c('picture_adj', 'real_adj'))
df_long
```

id <fctr>	variable <fctr>	value <dbl>
1	picture_adj	38.5
2	picture_adj	43.5
3	picture_adj	41.0
4	picture_adj	36.0
5	picture_adj	36.0
6	picture_adj	33.5
7	picture_adj	46.0
8	picture_adj	38.5
9	picture_adj	43.5
10	picture_adj	41.0
1-10 of 24 rows		Previous 1 2 3 Next

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```
bar2<- ggplot(df_long, aes(variable, value))
bar2<- bar2+
  stat_summary(fun=mean, geom='bar', fill='white', colour='black')+
  stat_summary(fun.data=mean_cl_normal, geom='errorbar', width=0.2)+
  labs(x='Groups', y='Anxiety')+
  ggtitle('Groups vs Anxiety')
bar2
```


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```
# Doing independent t-test
```

```
# when data is in long format
```

```
ttest_long<- t.test(Anxiety~Group , data=df, paired=FALSE)
ttest_long
```

Welch Two Sample t-test

data: Anxiety by Group

t = -1.6813, df = 21.385, p-value = 0.1072

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-15.648641 1.648641

sample estimates:

mean in group Picture	mean in group Real Spider
40	47

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```
# when data is in wide format
```

```
ttest_wide<- t.test(df_wide$picture, df_wide$real, paired=FALSE)
ttest_wide
```

## Welch Two Sample t-test

```
data: df_wide$picture and df_wide$real
t = -1.6813, df = 21.385, p-value = 0.1072
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -15.648641  1.648641
sample estimates:
mean of x mean of y
      40      47
```

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```
# Robust Methods for independent ttest
# we need to have data in wide format for these robusts tests
robust_t1<- WRS::yuen(df_wide$picture, df_wide$real, tr=.2 , alpha=.05)
robust_t1
```

```
$n1
[1] 12

$n2
[1] 12

$est.1
[1] 40

$est.2
[1] 46.75

$ci
[1] -17.929361  4.429361

$p.value
[1] 0.2161433

$dif
[1] -6.75

$se
[1] 5.209309

$teststat
[1] 1.295757

$crit
[1] 2.146035

$df
[1] 13.91372
```

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```
robust_t2<- WRS::yuenbt(df_wide$picture, df_wide$real, tr=.2, nboot = 599, alpha=0.05, side=F)
```

```
[1] "NOTE: p-value computed only when side=T"
```

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```
robust_t2
```

```
$ci
[1] -17.726696    6.151929

$test.stat
[1] -1.193625

$p.value
[1] NA

$est.1
[1] 40

$est.2
[1] 46.75

$est.dif
[1] -6.75

$n1
[1] 12

$n2
[1] 12
```

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```
robust_t3<- WRS::pb2gen(df_wide$picture, df_wide$real, nboot=2000)
```

```
[1] "Taking bootstrap samples. Please wait."
```

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```
robust_t3
```



```
$est.1
[1] 40

$est.2
[1] 46.82025

$est.dif
[1] -6.820247

$ci
[1] -16.152594 6.082384

$p.value
[1] 0.169

$sq.se
[1] 21.07953

$n1
[1] 12

$n2
[1] 12
```

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```
# Effect Size, r<- sqrt(t**2/(t**2+df))
r<- sqrt((ttest_wide$statistic[[1]])^2/((ttest_wide$statistic[[1]])^2+(24-2)))
r
```

```
[1] 0.3374392
```

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```
# which is a medium effect size
```

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```
# Doing Dependent ttest

ttest_dep<- t.test(df_wide$picture, df_wide$real, paired = TRUE)
ttest_dep
```

## Paired t-test

```
data: df_wide$picture and df_wide$real
t = -2.4725, df = 11, p-value = 0.03098
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -13.2312185 -0.7687815
sample estimates:
mean of the differences
                -7
```

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```
# Robust method for dependent ttest
yuend(df_wide$picture, df_wide$real)
```

```
$ci
[1] -15.343818  1.843818

$p.value
[1] 0.1056308

$est1
[1] 40

$est2
[1] 46.75

$dif
[1] -6.75

$se
[1] 3.634327

$teststat
[1] -1.85729

$n
[1] 12

$df
[1] 7
```

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```
ydbt(df_wide$picture, df_wide$real, nboot=2000)
```

```
[1] "Taking bootstrap samples. Please wait."
```

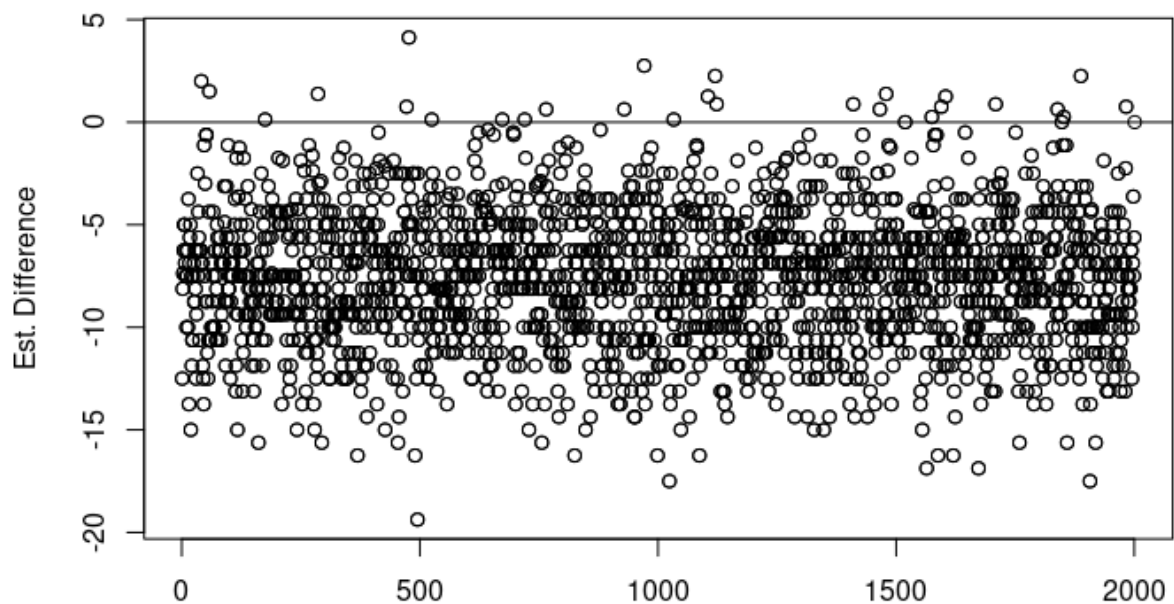
```
the standard deviation is zero
```

```
$ci  
[1] -14.857588  1.357588  
  
$dif  
[1] -6.75  
  
$p.value  
[1] 0.103
```

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```
bootdpci(df_wide$picture, df_wide$real, nboot=2000, est=tmean)
```

```
[1] "dif=T, so analysis is done on difference scores"  
$output  
      con.num psihat p.value p.crit ci.lower ci.upper  
[1,]      1   -7.5  0.028  0.05  -13.75  -1.125
```

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```
# effect size, df=11  
r<- sqrt(((ttest_dep$statistic[[1]])^2)/((ttest_dep$statistic[[1]])^2+11))  
r
```

```
[1] 0.5976869
```