What Do Biolans Think Of Torrey Students?
A Survey

Fall 2011

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Executive Summary

This article describes a statistics project completed by two Research Assistants in Fall 2011. The data was compiled by a group of Introduction to Probability Statistics students, in which they surveyed classes at Biola University. The students were asked general questions about themselves as well as their opinions of Torrey students (the honors program at the University). The data was then analyzed using the statistical software R. The results of this study are as follows.

The main information that this data yielded was that Torrey Students are not are arrogant as they appear, from questions 10 and 12 (see page 19). This has an implication for both Torrey students and non-Torrey students. Torrey students need to realize that they are often perceived as arrogant and do their best to change that outlook. Non-Torrey students need to take time to get to know the Torrey students to see them for who they really are, instead of the often-arrogant first impression.

Contents

0. Survey
I. General Overview of Data
II. Comparison by Gender
III. Comparison by Year at Biola
IV. Comparison by Year at Biola (Senior and super senior combined)
V. Data according to Torrey Students Known
VI. Data according to Torrey Acquaintances
VII. Comparison According to Opinion
VIII. Inventory (Overall Opinion)
IX. Further Statistical Testing
X. Inventory analysis

0. Torrey Survey

Instructions: The purpose of this survey is to get an idea of non-Torrey students' perception of Torrey students. In this survey, we are asking you to generalize. Even though you may know some Torrey students who are at different ends of the spectrum presented, please respond by giving your personal impression of ALL Torrey students combined. If you know someone you are not certain is a Torrey student, please do not include them when considering your answers. This survey is conducted by both Torrey and non-Torrey students. The results will be shown to Torrey faculty and submitted to the Chimes. Please circle the best response for each item.

1. Are you male or female? Male Female

2. Are you a Torrey student? Yes No

3. How many years have you studied at Biola?

   Less than 1 2 3 4 5+

4. How many Torrey students do you consider acquaintances?

   0 1 2-5 6-10 more than 10

5. How many Torrey students do you know really well?

   0 1 2-5 6-10 more than 10

6. Over your time at Biola, has your opinion of Torrey students:

   Become more favorable Remained the same Become less favorable

……....

7. Torrey students tend to be standoffish or cliquish.

   Strongly disagree Disagree Neutral Agree Strongly agree

8. Torrey students tend to be interested in culturally unusual things.

   Strongly disagree Disagree Neutral Agree Strongly agree

9. Torrey students tend to be more intelligent than other Biola students.

   Strongly disagree Disagree Neutral Agree Strongly agree

10. Torrey students, in reality, tend to be arrogant.

    Strongly disagree Disagree Neutral Agree Strongly agree

11. Torrey students, in reality, tend to be humble.

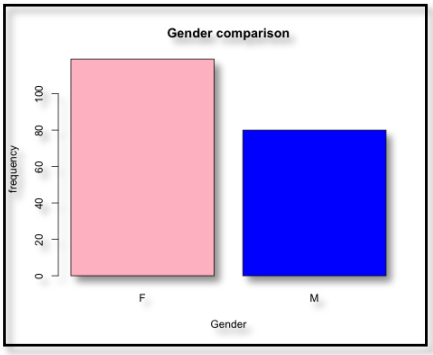
    Strongly disagree Disagree Neutral Agree Strongly agree

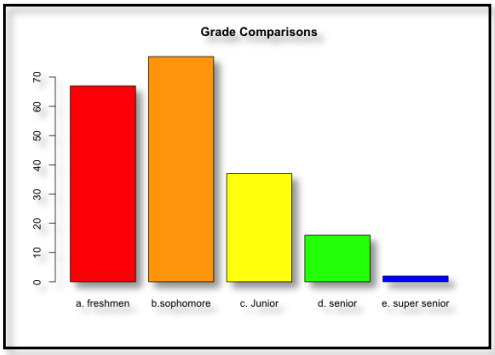
12. Torrey students tend to appear arrogant

    Strongly disagree Disagree Neutral Agree Strongly agree

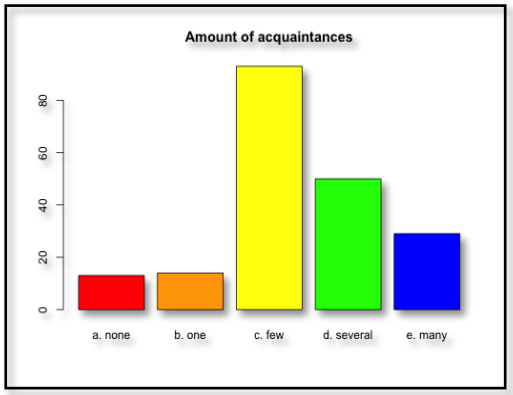
I. General Overview of Data

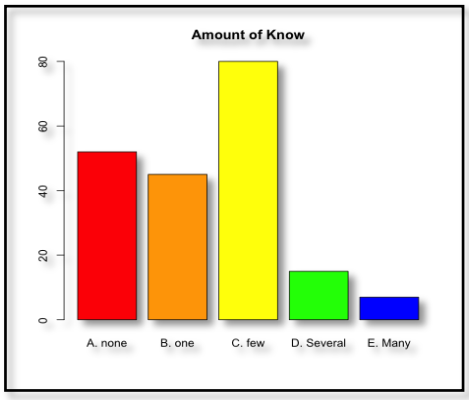
Answers to first 2 questions, displaying the breakdown of gender and grade.



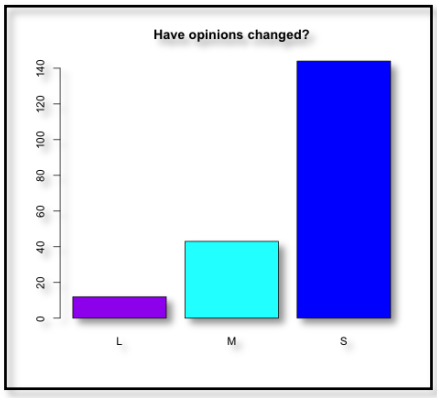


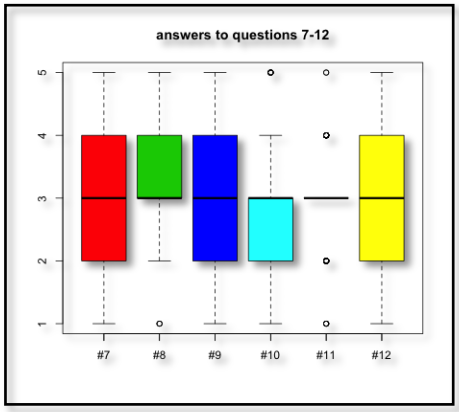
These graphs display the amount of Torrey students that those surveyed are acquaintances with and those that they actually know. None represents 0, one represents 1, few represents 2-5, several represents 6-10, and many represents more than 10.

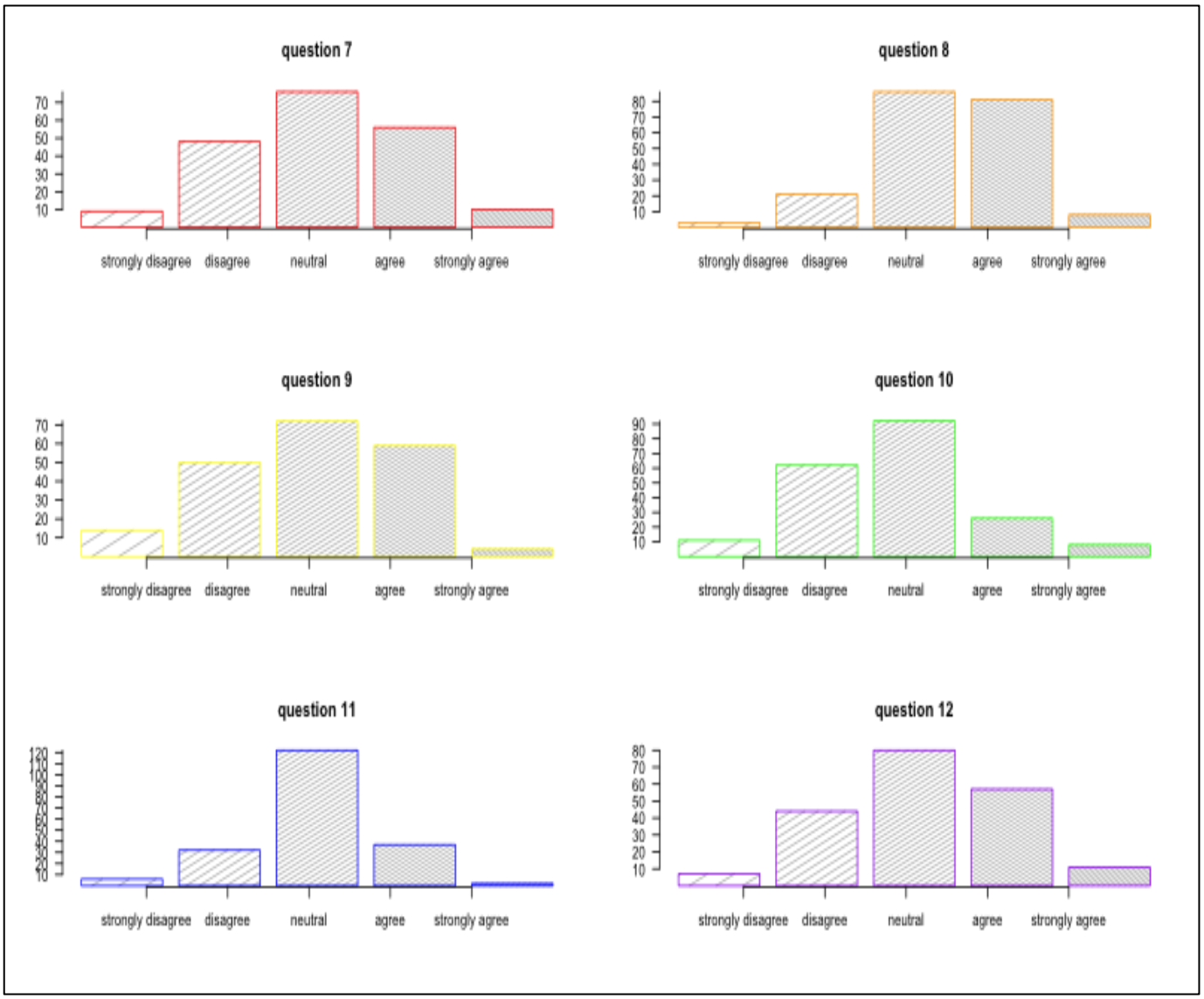




This graph represents how opinions of Torrey students have changed throughout their time at Biola. L represents opinions being less favorable, M represents opinions being more favorable, and S represents opinions remaining the same. The final graph is a general spread of responses to questions 7-12 on the survey. #1-#5 represents degrees of the Likert scale, one being "strongly disagree" and five being "strongly agree."







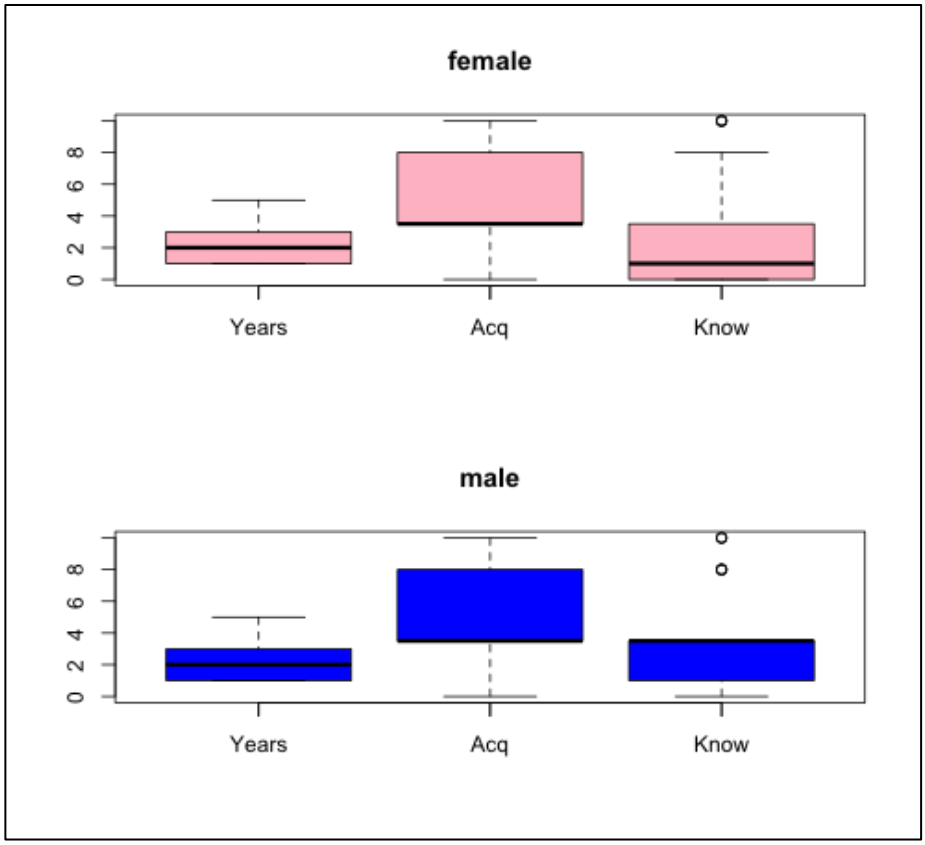
General overview of questions 7-12

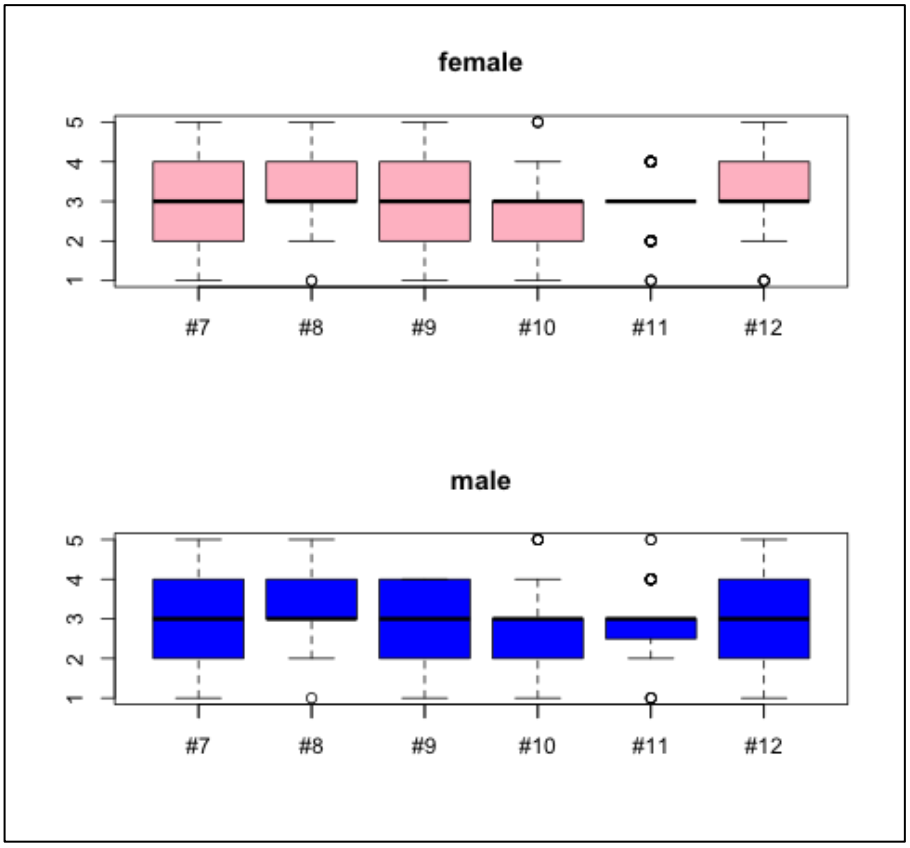
COMMENTS

From this first section of graphs and overviews, we can see several things:

- More females than males participated in the survey
- Most of the participants were underclassmen (Freshmen and sophomores)
- The participants had a fair amount of Torrey acquaintances, but a low amount of Torrey students they actually knew
- Most of the participants Torrey opinions have not changed
- If Torrey opinions have changed, most of them now have better opinions
- For questions 7-12:
    - Most students have no opinion (Neutral) or do not wish to share their opinions
    - Almost all of the questions have a traditional bell curve spread (#7,9,and 11 especially)

II. Comparison by Gender

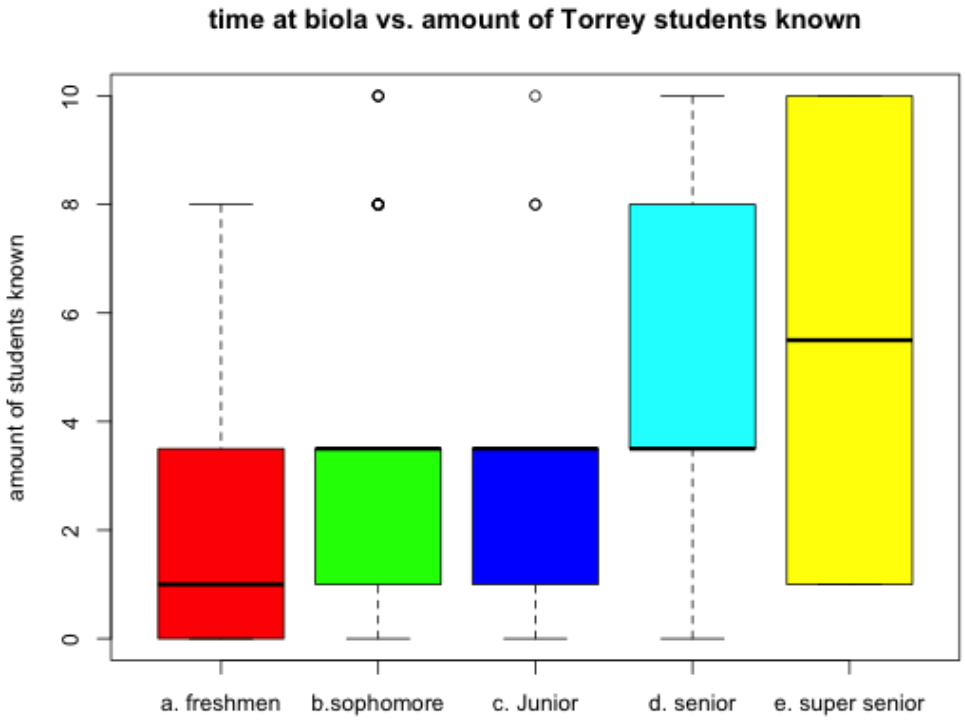


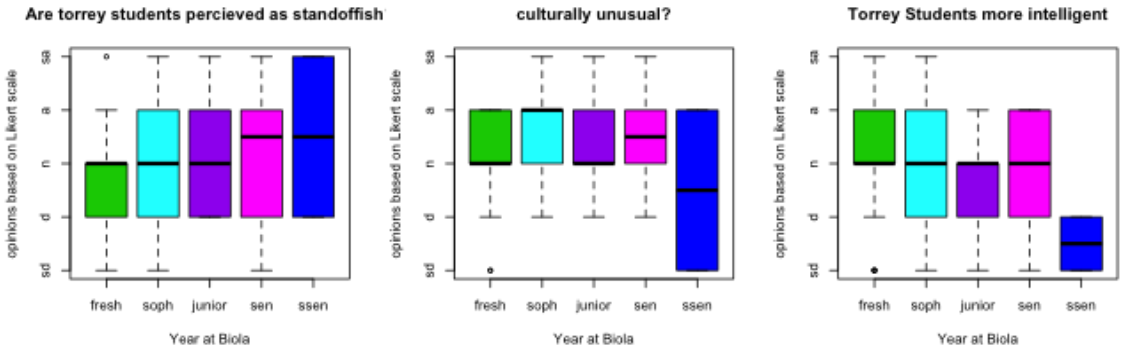


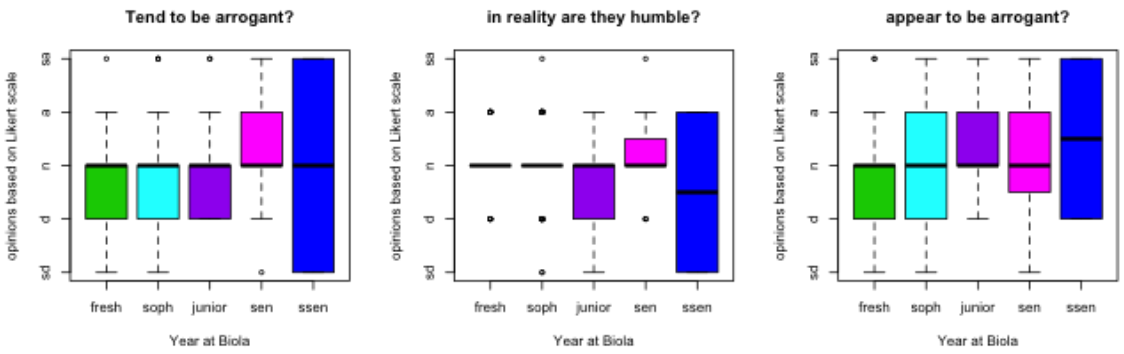
COMMENTS ON GENDER RESPONSES:

- Between the males and females there were no major difference between Know, acquaintances, and years at biola
- Also, no major differences between questions 7-11
- A slight difference with question 12, the males feeling Torrey students do not appear to be arrogant

III. Comparison by Year at Biola



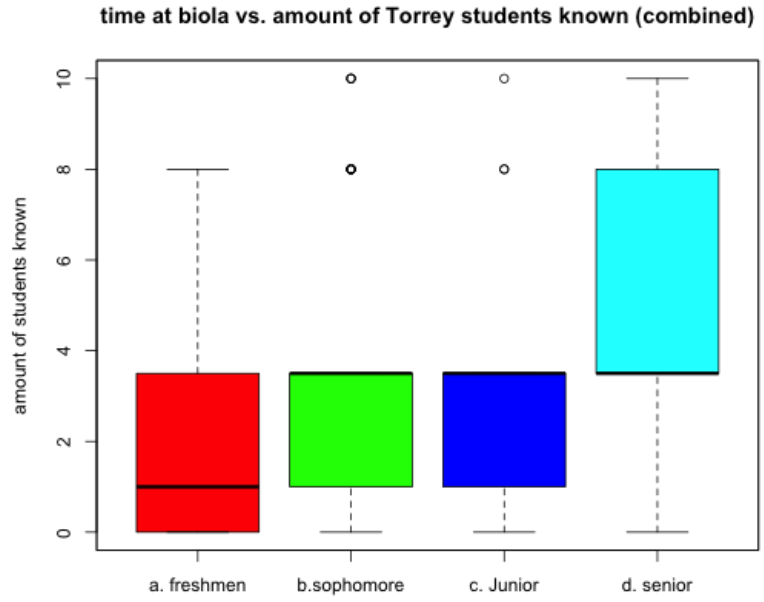


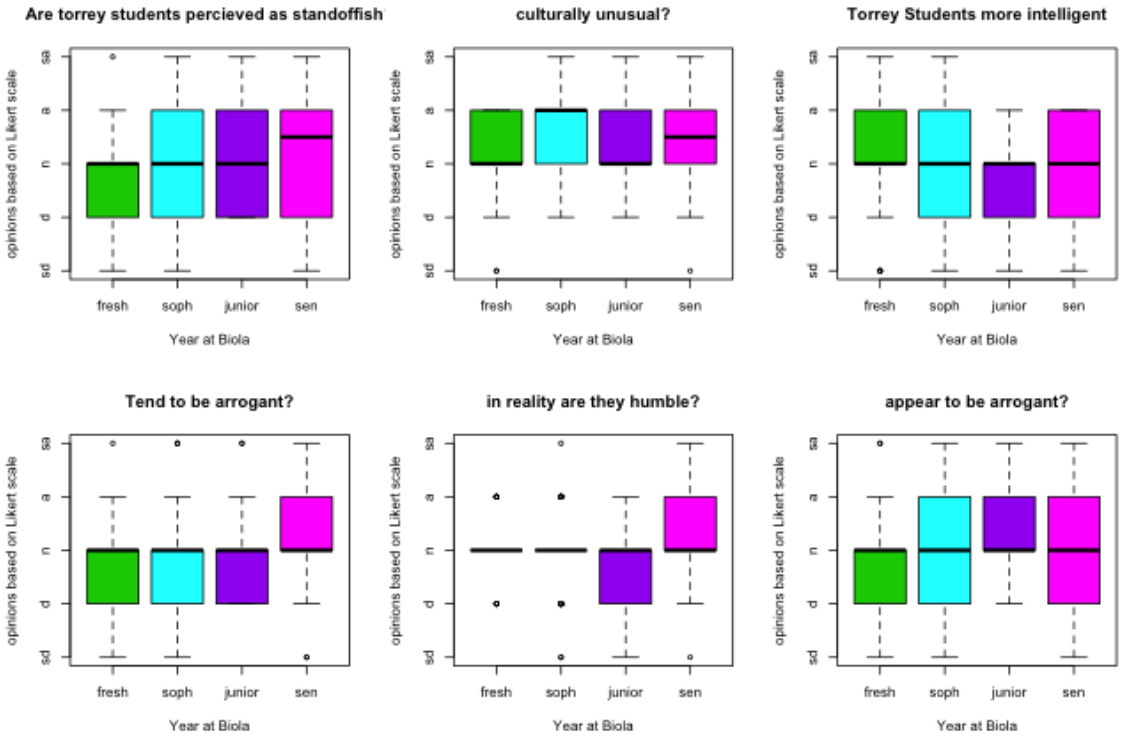


COMMENTS ON COMPARIONS ACCORDING TO YEAR AT BIOLA:

- there were only 2 super seniors in the data, so this is not an accurate account, see the combined information (Senior and super senior combined)

IV. Comparison by Year at Biola (Senior and super senior combined)

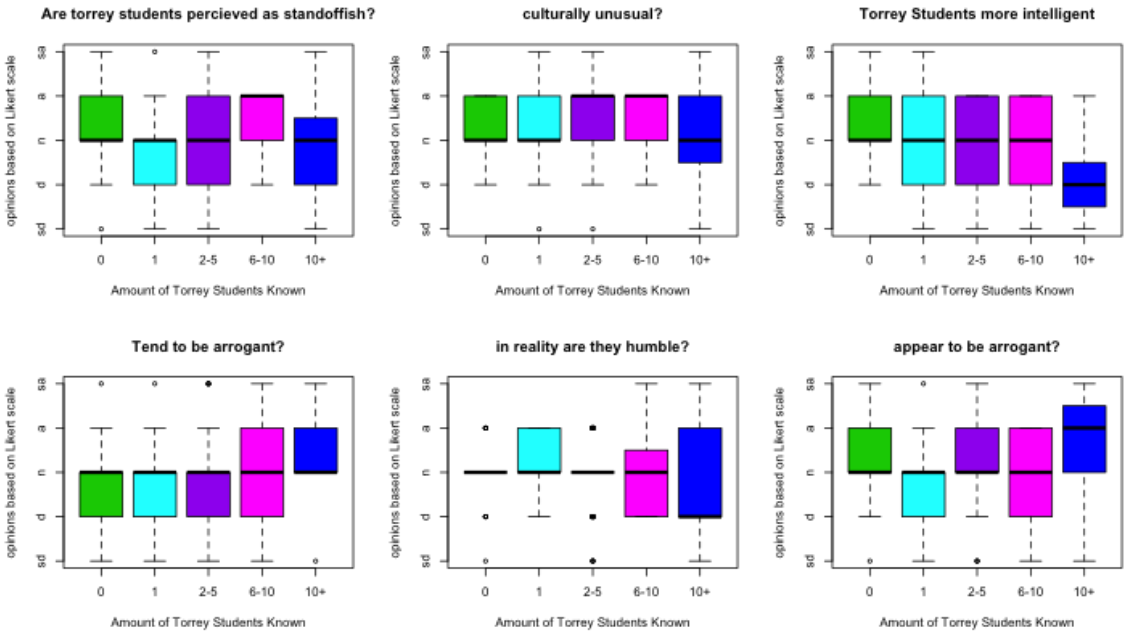




COMMENTS ON YEARS AT BIOLA (SENIOR /SUPER SENIOR COMBINED)

- the longer you have been at biola, the more torrey students you know
- as a whole, the more years at biola resulted in a more negative view of Torrey students
- Seniors felt Torrey students were more arrogant then underclassmen (question #10)

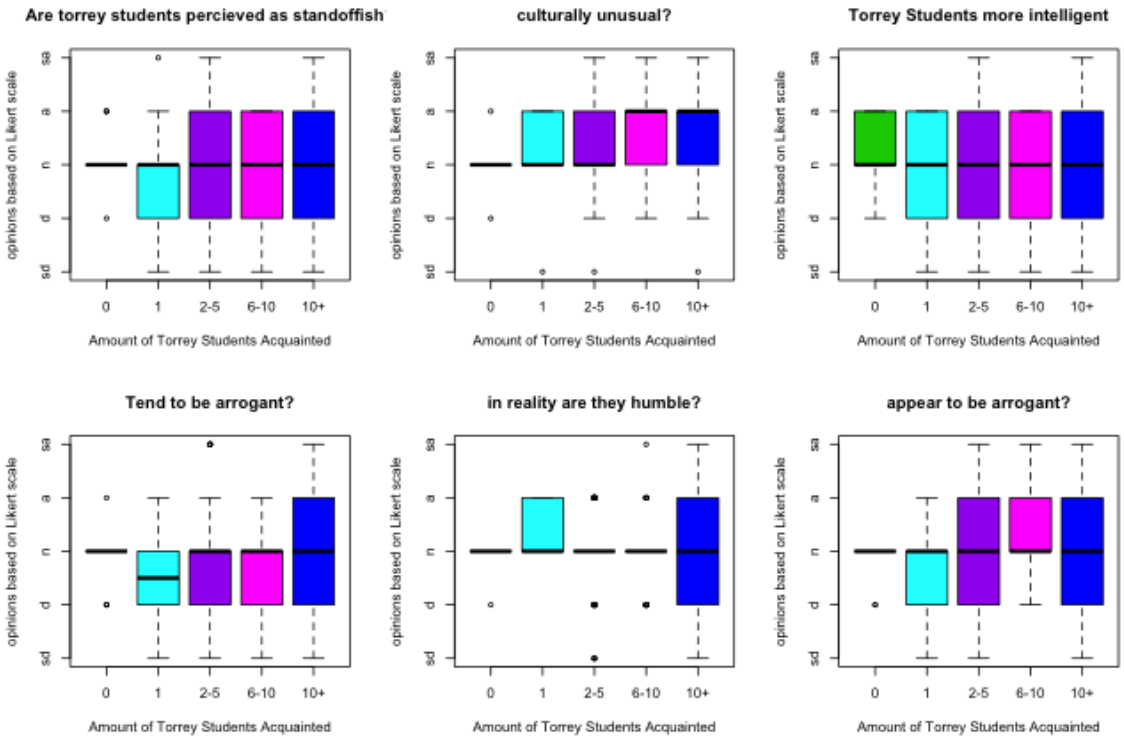
V. Data According to Torrey Students Known



COMMENTS ACCORDING TO HOW MANY TORREY STUDENTS KNOWN:

- The more Torrey students known, the lesser the opinion of them
- The students that knew more Torrey students, disagreed that Torrey Students tend to be more intelligent than other students (Question #9)

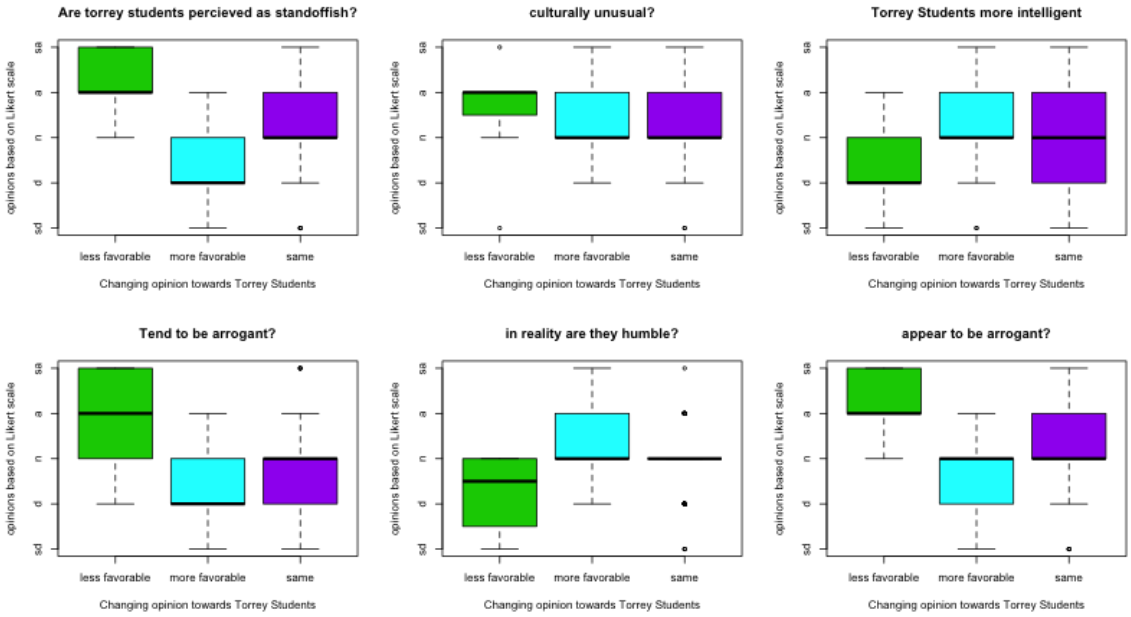
VI. Data According to Torrey Acquaintances



COMMENTS ON TORREY ACQUAINTANCES:

- nothing interesting in this data
- Juniors and Seniors agreed that students tend to be interested in culturally unusual things

VII. Comparison According to Opinion



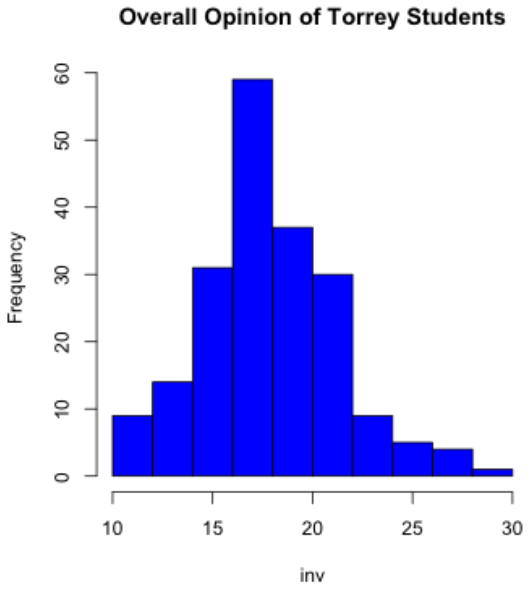
opinion vs. Know table.

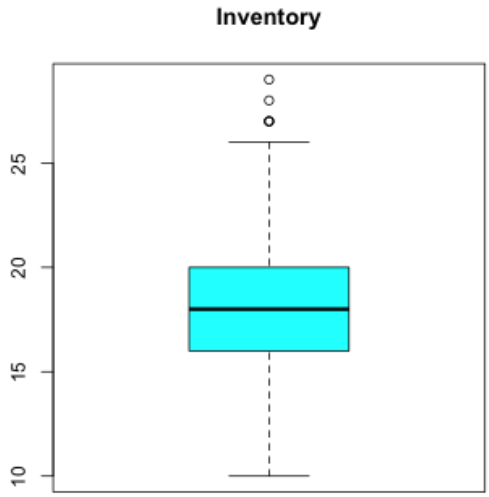
Opinion	**0**	**1**	**3.5**	**8**	**10**
L	2	0	9	0	1
M	7	11	18	6	1
S	43	34	53	9	5

COMMENTS ON TORREY OPINIONS:

- This is exactly as expected:
    - If the opinion became less favorable towards Torrey Students:
        - An overall negative opinion (more standoffish, more arrogant, less intelligent, more culturally unusual, etc.)
    - If the opinion was more favorable towards Torrey Students:
        - An overall more positive opinion (Less standoffish, less arrogant, more intelligent, etc)
    - Same opinion, neutral responses

VIII. Inventory (Overall Opinion)





Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
10.00	16.00	18.00	18.37	20.00	29.00

The minimum possible value would be 6, meaning that the student consistently put the highest opinion for Torrey students. The highest possible score would be 30, meaning that the student consistently put the lowest opinion of Torrey students. Questions 9 and 11 have been scored opposite to accommodate this.

IX. Further Statistical Testing

COMMENTS: Since we performed 21 different tests, the level of significance we are using is .0024, to take into account the large testing fallacy.

CORRELATIONS

A. correlation test between Know and X7

- *cor.test(Torrey$Know, Torrey$X7, alternative="two.sided", method="spearman")*

OUTPUT:
Spearman's rank correlation rho

```
data:  Torrey$Know and Torrey$X7
S = 1357495, p-value = 0.6378
alternative hypothesis: true rho is not equal to 0
sample estimates:
      rho
-0.03357339
```

B. correlation test between Know and X8

- *cor.test(Torrey$Know, Torrey$X8, alternative="two.sided", method="spearman")*

OUTPUT:
Spearman's rank correlation rho

```
data:  Torrey$Know and Torrey$X8
S = 1134443, p-value = 0.05499
alternative hypothesis: true rho is not equal to 0
sample estimates:
     rho
0.1362547
```

C. correlation test between Know and X9

cor.test(Torrey$Know, Torrey$X9, alternative="two.sided", method="spearman")

OUTPUT:
Spearman's rank correlation rho

data: Torrey$Know and Torrey$X9
S = 1523725, **p-value = 0.02386**
alternative hypothesis: true rho is not equal to 0
sample estimates:
rho
-0.160138

D. correlation test between Know and X10

- *cor.test(Torrey$Know,Torrey$X10,alternative="two.sided",method="spearman")*

OUTPUT:
Spearman's rank correlation rho

data: Torrey$Know and Torrey$X10
S = 1270502, **p-value = 0.647**
alternative hypothesis: true rho is not equal to 0
sample estimates:
rho
0.03266217

E. correlation test between Know and X11

- *cor.test(Torrey$Know,Torrey$X11,alternative="two.sided",method="spearman")*

OUTPUT:
Spearman's rank correlation rho

data: Torrey$Know and Torrey$X11
S = 1407056, **p-value = 0.3169**
alternative hypothesis: true rho is not equal to 0
sample estimates:
rho
-0.07130791

F. correlation test between Know and X12

- *cor.test(Torrey$Know,Torrey$X12,alternative="two.sided",method="spearman")*

OUTPUT:
Spearman's rank correlation rho

data: Torrey$Know and Torrey$X12
S = 1198581, **p-value = 0.2195**
alternative hypothesis: true rho is not equal to 0
sample estimates:
rho
0.08742154

COMMENTS: We can see from these correlation tests that none of the data was very significant. We were not able to conclude anything from these correlation tests.

PAIRED T-TEST

A. Paired t-test of Know and X12

- *t.test(Know, X12, paired=TRUE)*

OUTPUT:

Paired t-test

data: Know and X12
t = -2.747, df = 198, **p-value = 0.006569**
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.9021018 -0.1481494
sample estimates:
mean of the differences
-0.5251256

```
cor.test(Torrey$Know, Torrey$X7, alternative="two.sided",
 method="spearman")
cor.test(Torrey$Know, Torrey$X8, alternative="two.sided", method="spearman")
cor.test(Torrey$Know, Torrey$X9, alternative="two.sided", method="spearman")
cor.test(Torrey$Know, Torrey$X10, alternative="two.sided", method="spearman")
cor.test(Torrey$Know, Torrey$X11, alternative="two.sided", method="spearman")
cor.test(Torrey$Know, Torrey$X12, alternative="two.sided", method="spearman")
```

CHI-SQUARED TEST

A. Chi-squared test of independence

d <- table(Know, Years)

Years

Know	Underclassmen (below senior)	Seniors+
0	50	2

1	44	2
3.5	73	6
8	14	8

chisq.test(d)

Pearson's Chi-squared test

data: d
X-squared = 23.1009, df = 3, p-value = 3.847e-05

The disagree in the tables is a combination of strongly disagree and disagree, similarly for the agree, combining agree and strongly agree.

B.Chi-squared test Know and X7

d<- table(Know, X7)

X7

Know	Disagree	Neutral	Agree
0	12	19	21
1	15	19	12
3.5	24	32	23
8	6	6	10

chisq.test(d)

Pearson's Chi-squared test

data: d
X-squared = 4.769, df = 6, p-value = 0.5738

C. Chi-squared Know and X8

d <- table(Know, X8)

X8

Know	Disagree	Neutral	Agree
0	5	29	18

1	7	22	17
3.5	8	28	43
8	4	7	11

chisq.test(d)

Pearson's Chi-squared test

data: d
X-squared = 9.0643, df = 6, p-value = 0.17

D. Chi-squared Know and X9

d <- table(Know, X9)

X9

Know	Disagree	Neutral	Agree
0	12	21	19
1	13	19	14
3.5	28	27	24
8	11	5	6

chisq.test(d)

Pearson's Chi-squared test

data: d
X-squared = 6.3566, df = 6, p-value = 0.3844

E.Chi-squared Know and X10

d <- table(Know, X10)

X10

Know	Disagree	Neutral	Agree
0	14	31	7
1	20	23	3

3.5	33	30	16
8	6	8	8

chisq.test(d)

Pearson's Chi-squared test

data: d
X-squared = 15.4563, df = 6, p-value = 0.01699

F. Chi-squared Know and X11

d <- table(Know, X11)

X11

Know	Disagree	Neutral	Agree
0	6	40	6
1	5	29	12
3.5	18	47	14
8	9	6	7

chisq.test(d)

Pearson's Chi-squared test

data: d
X-squared = 20.0506, df = 6, p-value = 0.002712

G.Chi-squared Know and X12

d <- table(Know, X12)

X12

Know	Disagree	Neutral	Agree
0	10	26	16
1	16	21	9
3.5	19	27	33
8	6	6	10

chisq.test(d)

Pearson's Chi-squared test

```
data:  d
X-squared = 10.8477, df = 6, p-value = 0.0932
```

PAIRED T-TEST

A. Paired t-test between X10 and X12

t.test(TorreyKY$X10, TorreyKY$X12, alternative='two.sided', conf.level=.95, paired=TRUE)

Paired t-test

```
data:  TorreyKY$X10 and TorreyKY$X12
t = -5.9632, df = 198, p-value = 1.119e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.4212768 -0.2118891
sample estimates:
mean of the differences
          -0.3165829
```

COMMENT: Torrey students are not as arrogant as they appear.

SAMPLE T-TEST

A. Welch's two sample t-test for Gender and Years

t.test(Years~Gender, alternative='two.sided', conf.level=.95,
+ var.equal=FALSE, data=Torrey)

Welch Two Sample t-test

```
data:  Years by Gender
t = 0.9877, df = 153.991, p-value = 0.3249
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.1425685  0.4276525
sample estimates:
mean in group F mean in group M
      2.105042       1.962500
```

Comments: This means that there is a good cross section (same ratio male and female as they have been at school longer)

X. Inventory analysis

COMMENTS: Inventory is a combination of the responses to questions 7-12. A high score is a more negative opinion and a low score is a more positive opinion.

Welch Two Sample t-test

data: inv by Gender
t = -0.2717, df = 145.089, p-value = 0.7863
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-1.1508990 0.8727477
sample estimates:
mean in group F mean in group M
18.31092 18.45000

> Anova(AnovaModel.3)
Anova Table (Type II tests)

Response: inv
Sum Sq Df F value Pr(>F)
CATacq 47.99 4 1.0393 0.3881
Residuals 2227.83 193

> tapply(TorreyOpinion2$inv, list(CATacq=TorreyOpinion2$CATacq), mean,
+ na.rm=TRUE) # means
CATacq
0 1 3.5 8 10
17.76923 16.85714 18.36559 18.82000 18.57143

> tapply(TorreyOpinion2$inv, list(CATacq=TorreyOpinion2$CATacq), sd,
+ na.rm=TRUE) # std. deviations
CATacq
0 1 3.5 8 10
1.423250 2.957575 3.556332 3.055206 4.167143

> tapply(TorreyOpinion2$inv, list(CATacq=TorreyOpinion2$CATacq), function(x)
+ sum(!is.na(x))) # counts
CATacq
0 1 3.5 8 10
13 14 93 50 28

> Anova(AnovaModel.4)
Anova Table (Type II tests)

Response: inv

```
          Sum Sq  Df F value  Pr(>F)
CATknow    155.42   5  2.8288 0.01724 *
Residuals 2120.80 193
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

> tapply(TorreyOpinion2$inv, list(CATknow=TorreyOpinion2$CATknow), mean,
+   na.rm=TRUE) # means
CATknow
     0       1       2     3.5       8      10
18.28846 17.28889 27.00000 18.68354 18.93333 19.85714

> tapply(TorreyOpinion2$inv, list(CATknow=TorreyOpinion2$CATknow), sd,
+   na.rm=TRUE) # std. deviations
CATknow
     0       1       2     3.5       8      10
2.746381 2.616575       NA 3.770820 4.096456 3.891382

> tapply(TorreyOpinion2$inv, list(CATknow=TorreyOpinion2$CATknow),
+   function(x) sum(!is.na(x))) # counts
CATknow
 0  1  2 3.5  8 10
52 45  1 79 15  7
```

> AnovaModel.5 <- (lm(inv ~ Opinion, data=TorreyOpinion2))

> Anova(AnovaModel.5)
Anova Table (Type II tests)

```
Response: inv
          Sum Sq  Df F value    Pr(>F)
Opinion    426.68   2  22.608 1.463e-09 ***
Residuals 1849.54 196
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

> tapply(TorreyOpinion2$inv, list(Opinion=TorreyOpinion2$Opinion), mean,
+   na.rm=TRUE) # means
Opinion
     L       M       S
23.41667 16.69767 18.44444

> tapply(TorreyOpinion2$inv, list(Opinion=TorreyOpinion2$Opinion), sd,
+   na.rm=TRUE) # std. deviations
Opinion
     L       M       S
```

2.968267 2.956308 3.112748

```
> tapply(TorreyOpinion2$inv, list(Opinion=TorreyOpinion2$Opinion),
+   function(x) sum(!is.na(x))) # counts
Opinion
 L  M  S
12 43 144
```

```
X11r = 6 - X11
 X9r= 6- X9
TorreyOpinion2 = data.frame(TorreyOpinion,X11r)
inv = X7+X8+X9r+X10+X11r+X12
TorreyOpinion2 = data.frame(TorreyOpinion2,inv)
summary(inv)
hist(inv)
```