

Socio-demo stats

June 4, 2021

1 Introduction

This is a notebook to see if there is an impact of the socio-demographic variables on the tendency for the subject to get Right or Wrong. It also serves as a recoding and cleaning notebook to obtain a clean dataset that can be reused for other analysis in the future.

1.1 Import modules and functions

1.1.1 Modules

1.1.2 Functions

2 Data

2.1 Loading

2.2 Recoding

2.2.1 Recode True - Fake news

We recoded the different option of Fake news and True news and the answers to follow a easier format. Rather than having the answer being dependent to the question to know if it was a correct or no we did as following:

1. Recode the type of news as either True new or Fake news.
2. In case of the subject thought a True news as True, the answer was recoded as Right
3. In case of the subject thought a Fake news was Fake, the answer was recoded as Right
4. In case of the subject thought a True news was Fake, the answer was recoded as Wrong
5. In case of the subject thought a Fake news was True, the answer was recoded as Wrong

2.2.2 Create count_error

We created a variable called count_error. We simply check the number of time a subject did a mistake. * When the subject got Right to all answer, we coded No error * If a subject did a mistake (regardless of considering a Fake news as True, or a True news as Fake), we recoded as 1 error * If a subject did 2 mistakes, we recoded as 2 errors

2.2.3 Create the 4 categories variables

We created another way to group subjects. Here we followed the idea to divide in the 4 possible scenario

1. The subject got the True news Right and the Fake news Right: TR-FR
2. The subject got the True news Right and the Fake news Wrong: TR-FW
3. The subject got the True news Wrong and the Fake news Right: TW-FR
4. The subject got the True news Wrong and the Fake news Wrong: TW-FW

```
[14]:      cat_tf_rw
TR-FR      447
TR-FW      267
TW-FR      232
TW-FW      117
```

2.2.4 Create the 2 categories

Here, created a category with only the Right and Wrong distinction

```
[16]:  R-W
W  616
R  447
```

2.2.5 Recode religion

We decided to recode the religion into a dichotomic variable. The logic behind is that there were a lot of of Católico (n=512), Ateo (n=237) and Agnóstico (n=164), while other religions where low in number (n<10) (see the table under). We could do it different and keep the following coding as alternative (not done here) but it is a sensitive decision.

- Católico
- Ateo
- Agnóstico
- Other faiths

```
[18]:                                     dm_pref_religion
Católico                                512
Ateo                                    237
Agnóstico                               164
NS/NC                                    91
Islámico                                10
-                                         9
Evangélico                              8
Cristiano                               4
Protestante                             4
Budista                                 4
```

| | |
|--|---|
| Pastafari | 1 |
| Católico Pero No Acudo A Misa | 1 |
| Católica No Practicante | 1 |
| Soy Agnóstico | 1 |
| Personal. Abierto Y Reflexivo. | 1 |
| Ácrata | 1 |
| Católico No Practicante | 1 |
| Ni Creo Ni Dejo De Creer | 1 |
| Testigo De Jehová | 1 |
| Musulmán | 1 |
| Sincretismo Pragmático | 1 |
| Propio Y Muy Particular | 1 |
| Soy Cristiana | 1 |
| Creo En Las Ciencias Ocultas Y La Espiritualidad | 1 |
| Ortodoxo | 1 |
| Grigoriano Apostolico | 1 |
| Creo En Dios A Través De Jesucristo. | 1 |
| Es Largo De Explicar , Es Una Iglesia Moderna | 1 |
| Ningún Punto Religioso..Creo En La Vida. | 1 |
| Soy Cristiano, Creo En Dios | 1 |

After recoding, we obtained the following repartition between Believers and Atheists/Agnostics

```
[19]: recode_religion
Believers          555
Atheists/Agnostics 404
```

2.2.6 Recode politics

This variable has been recoded into Izquierda, Centro, Derecha, from the original question. The recoding is not necessarily needed. Again we can decide to change that later.

- Izquierda: 'Izquierda', 'Centro izquierda'
- Centro: 'Centro'
- Derecha: 'Derecha', 'Centro derecha'

```
[20]: dm_politica
Izquierda          262
NS/NC              220
Centro             180
Centro izquierda   180
Centro derecha     124
Derecha            84
-                  13
```

After recoding, we obtained the following repartition

```
[22]:          recode_politics
      Izquierda          442
      Derecha           208
      Centro            180
```

2.2.7 Recode age

Age as been recoded to group in 3 categories:

- <=18-34: '< 18 años', '18-24 años', '25-34 años'
- 35-54: '35-44 años', '45-54 años'
- >55: '55-65 años', '> 65 años'

```
[23]:          recode_age
      35-54          549
      <=18-34       258
      >55            256
```

2.2.8 Recode education

Education has been recoded in two forms. One is to group the subject into Uni vs No Uni. While the distinction makes sense regarding the data, it has been considered too *university-self-centered*. Therefore we fall back on a three categories distinctions

- up_to_secundaria: 'Primaria', 'Secundaria', 'No tiene estudios en educación formal'
- up_to_bac_3: 'Formación Profesional', 'Bachillerato', 'Cou'
- up_to_uni: 'Master', 'Posgrado', 'Doctorado', 'Grado/Licenciatura'

```
[24]:          recode_education2
      up_to_university_level      559
      up_to_bac_3                307
      up_to_secundaria            195
      NS/NC                       2
```

2.2.9 Recode actions

There is an issue with some subjects answering the no_action while answering other types of action at the same time

```
[27]:          total_checked_f  faf_compartira_familia_amigos  faf_publicara_redes  \
      92                      2                      False          False
      94                      2                      False          False
      97                      2                      False          False
      259                     2                      False          False
      344                     2                      False          False
      534                     2                      False          False
      588                     2                      False          False
```

| | | | |
|-----|---|-------|-------|
| 670 | 2 | False | False |
| 673 | 2 | False | False |
| 742 | 2 | False | False |
| 779 | 2 | False | False |
| 808 | 2 | False | False |
| 913 | 2 | False | False |
| 990 | 3 | True | True |

| | faf_consultara_fuentes | faf_aplicara_aprendido | faf_no_accion |
|-----|------------------------|------------------------|---------------|
| 92 | False | True | True |
| 94 | True | False | True |
| 97 | True | False | True |
| 259 | True | False | True |
| 344 | True | False | True |
| 534 | True | False | True |
| 588 | True | False | True |
| 670 | True | False | True |
| 673 | True | False | True |
| 742 | False | True | True |
| 779 | True | False | True |
| 808 | True | False | True |
| 913 | True | False | True |
| 990 | False | False | True |

[29]:

| | total_checked_t | taf_compartira_familia_amigos | taf_publicara_redes | \ |
|-----|-----------------|-------------------------------|---------------------|---|
| 79 | 2 | False | False | |
| 94 | 2 | False | False | |
| 238 | 2 | False | False | |
| 327 | 3 | False | False | |
| 332 | 2 | False | False | |
| 367 | 2 | False | False | |
| 394 | 2 | True | False | |
| 450 | 3 | False | False | |
| 508 | 2 | False | False | |
| 516 | 2 | False | False | |
| 534 | 2 | False | False | |
| 565 | 2 | False | False | |
| 593 | 2 | False | False | |
| 673 | 2 | False | False | |
| 757 | 2 | False | False | |
| 808 | 2 | False | False | |
| 956 | 2 | False | False | |

| | taf_consultara_fuentes | taf_aplicara_aprendido | taf_no_accion |
|-----|------------------------|------------------------|---------------|
| 79 | True | False | True |
| 94 | True | False | True |
| 238 | False | True | True |

| | | | |
|-----|-------|-------|------|
| 327 | True | True | True |
| 332 | False | True | True |
| 367 | False | True | True |
| 394 | False | False | True |
| 450 | True | True | True |
| 508 | True | False | True |
| 516 | False | True | True |
| 534 | True | False | True |
| 565 | False | True | True |
| 593 | True | False | True |
| 673 | True | False | True |
| 757 | True | False | True |
| 808 | True | False | True |
| 956 | True | False | True |

2.2.10 Recode justifications

2.2.11 Recode NS/NC into Np.NaN

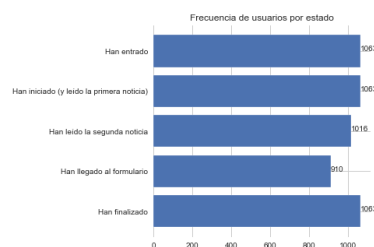
It seems the NS/NC is equal to no answer. We recoded globally accordingly. The consequence in all further analysis is that people who did not answer the question will be removed from the analysis. They are removed for the analysis they did not provide an answer, not removed from the dataset (therefore we will have different N).

2.3 Filtering

2.3.1 On survey completion

To decide which data are considered as completed, the time to reach `time_news2` is use and it is

```
[35]: Text(0.5, 1.0, 'Frecuencia de usuarios por estado')
```

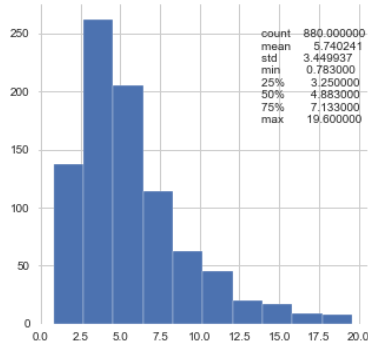


The column `Han finalizado` is inconsistent with the other counts. After inspection it is because there is no `None` value for that variable.

Size of the filtered sample: 910

2.3.2 On time completion

Estadísticas descriptivas de tiempo de completitud del experimento (minutos)



After looking at the data for the time completion, we decided to remove any subject that took less than 2 minutes to answer the survey.

[38]: 51

2.4 Final dataset

Size of the final filtered sample: 859

3 Analysis

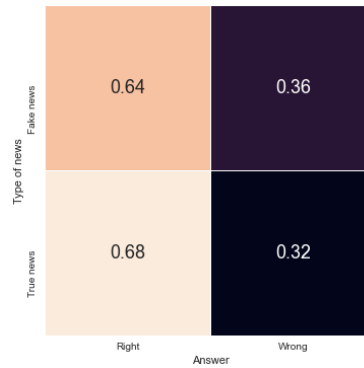
3.1 Difference in getting wrong for True News and Fake News

3.1.1 Data

```
[40]: Answer      Right  Wrong
      Type of news
      Fake news    550    309
      True news    583    276
```

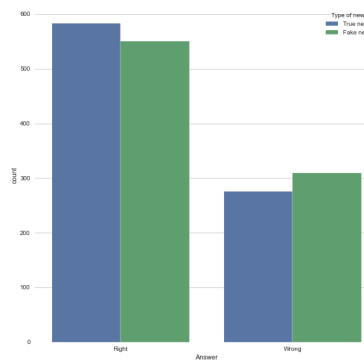
3.1.2 Heatmap

```
[41]: <AxesSubplot:xlabel='Answer', ylabel='Type of news'>
```



3.1.3 Barplot

```
[43]: <AxesSubplot:xlabel='Answer', ylabel='count'>
```



3.1.4 Chi-Square

Chi2 result of the contingency table: 2.6542225843196716, p-value: 0.10327523703986423

Post-hoc chi2 tests results:

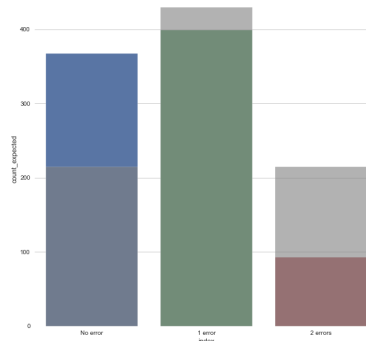
('Fake news', 'True news'): p_value: 0.103275; corrected: 0.103275 (ns) reject: False

There is no difference in the two groups. It means the subject were not more likely to get right or wrong in case of a Fake news or a True news

3.2 Number of people per number of mistakes

3.2.1 Barplot

[46]: <AxesSubplot: xlabel='index', ylabel='count_expected'>



3.2.2 Goodness of fit

[48]: (179.1303841676368, 1.2657015367292102e-39)

The distribution of the sample is different than the expected distribution. It means we have less people than expected that did two errors, while there is more people than expected that did no errors

4 Independence

The analysis about the different socio-demographic questions and their link with getting right or wrong to the different news are splitted into three majors sections. The first one is when we consider the different groups as separated into three categories (0 errors, 1 errors, 2 errors), the second one is when we consider the different groups separated by the 4 categories (TR-FR, TR-FW, TW-FR, TW-FW), and ultimately the one on the two categories (R-W).

Here we output a summary of all the tests ran with the different type of distinctions in the errors. To see the details of the analysis alongside the plots and the post-hoc tests, go to the annexes.

[50]:

| | Dep variable | Ind variable | Ind column | N | method \ |
|----|--------------|-------------------------|-------------------|-----|-----------|
| 0 | R-W | age | recode_age | 859 | chisquare |
| 1 | R-W | gender | dm_genero | 859 | chisquare |
| 2 | R-W | uni-notuni | recode_education | 858 | chisquare |
| 3 | R-W | edu_levels | recode_education2 | 858 | chisquare |
| 4 | R-W | politics | recode_politics | 665 | chisquare |
| 5 | R-W | religious_belief | recode_religion | 772 | chisquare |
| 6 | R-W | technological_knowledge | dm_tecnologia | 856 | chisquare |
| 7 | count_error | age | recode_age | 859 | kruskal |
| 8 | count_error | gender | dm_genero | 859 | kruskal |
| 9 | count_error | uni-notuni | recode_education | 858 | kruskal |
| 10 | count_error | edu_levels | recode_education2 | 858 | kruskal |

| | | | | | |
|----|-------------|-------------------------|-------------------|-----|-----------|
| 11 | count_error | politics | recode_politics | 665 | kruskal |
| 12 | count_error | religious_belief | recode_religion | 772 | kruskal |
| 13 | count_error | technological_knowledge | dm_tecnologia | 856 | kruskal |
| 14 | cat_tf_rw | age | recode_age | 859 | chisquare |
| 15 | cat_tf_rw | gender | dm_genero | 859 | chisquare |
| 16 | cat_tf_rw | uni-notuni | recode_education | 858 | chisquare |
| 17 | cat_tf_rw | edu_levels | recode_education2 | 858 | chisquare |
| 18 | cat_tf_rw | politics | recode_politics | 665 | chisquare |
| 19 | cat_tf_rw | religious_belief | recode_religion | 772 | chisquare |
| 20 | cat_tf_rw | technological_knowledge | dm_tecnologia | 856 | chisquare |

| | stat | p_value | Sign. |
|----|-----------|----------|-------|
| 0 | 0.049936 | 0.975341 | ns |
| 1 | 1.789204 | 0.181023 | ns |
| 2 | 11.291120 | 0.000779 | *** |
| 3 | 12.605829 | 0.001831 | ** |
| 4 | 10.695501 | 0.004759 | ** |
| 5 | 16.240164 | 0.000056 | **** |
| 6 | 8.791611 | 0.012329 | * |
| 7 | 8.791611 | 0.810437 | ns |
| 8 | 8.791611 | 0.251450 | ns |
| 9 | 8.791611 | 0.000956 | *** |
| 10 | 8.791611 | 0.003670 | ** |
| 11 | 8.791611 | 0.003433 | ** |
| 12 | 8.791611 | 0.000121 | *** |
| 13 | 8.791611 | 0.026016 | * |
| 14 | 8.453574 | 0.206720 | ns |
| 15 | 3.111049 | 0.374819 | ns |
| 16 | 11.886196 | 0.007783 | ** |
| 17 | 13.708984 | 0.033061 | * |
| 18 | 15.688725 | 0.015526 | * |
| 19 | 18.339212 | 0.000374 | *** |
| 20 | 11.851090 | 0.065374 | ns |

The significative tests are given by the p_values and considered as significative if $p < .05$. The Sign. column indicate the level of significance. The different tests have a post-hoc analysis. In case of Kruskal wallis, the variable is ordinal, therefore the interpretation takes into account the "increase in error". In case of the chi-square, it is an independent test and the interpretation is in terms of difference in the two groups. The analysis of the Adjusted residuals gives information in which group it is significant and in which direction.

5 Annexes

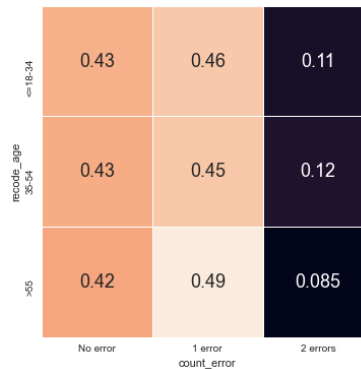
5.1 Difference for being better informed with the age

```
[51]: count_error  No error  1 error  2 errors
      recode_age
      <=18-34      89      94      23
      35-54      184     195     51
      >55         94     110     19
```

Size of N for that test: 859

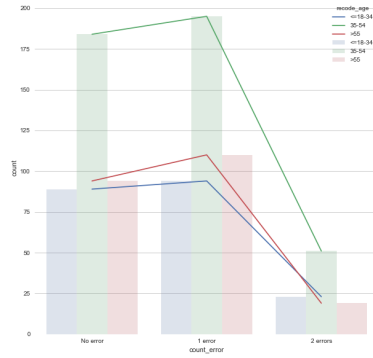
```
[53]: count_error  No error  1 error  2 errors
      recode_age
      <=18-34      0.432039  0.456311  0.111650
      35-54      0.427907  0.453488  0.118605
      >55         0.421525  0.493274  0.085202
```

5.1.1 Heatmap



5.1.2 Barplot

```
[55]: recode_age count_error  count
      0      35-54      1 error   195
      1      35-54    No error   184
      2       >55      1 error   110
      3 <=18-34      1 error    94
      4       >55    No error    94
      5 <=18-34    No error    89
      6      35-54      2 errors   51
      7 <=18-34      2 errors   23
      8       >55      2 errors   19
```



5.1.3 Kruskal-Wallis H test

[58]: `KruskalResult(statistic=0.4203637268658092, pvalue=0.8104368437405006)`

5.1.4 Post-hoc: Dunn test

[59]:

| | | | |
|---------|---------|-------|-----|
| | <=18-34 | 35-54 | >55 |
| <=18-34 | 1.0 | 1.0 | 1.0 |
| 35-54 | 1.0 | 1.0 | 1.0 |
| >55 | 1.0 | 1.0 | 1.0 |

There is no difference due to age in getting more or less errors

5.2 Difference due to gender

[60]:

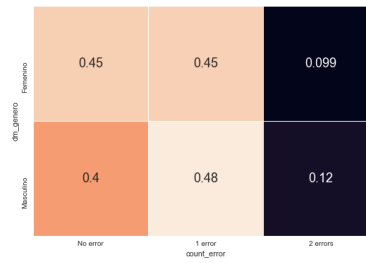
| | | | |
|-------------|----------|---------|----------|
| count_error | No error | 1 error | 2 errors |
| dm_genero | | | |
| Femenino | 205 | 206 | 45 |
| Masculino | 162 | 193 | 48 |

Size of N for that test: 859

[62]:

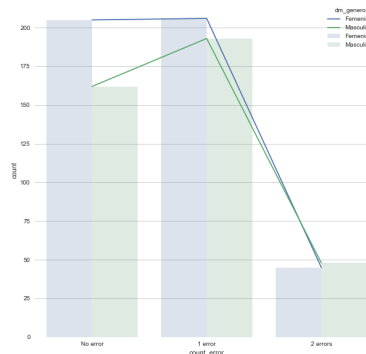
| | | | |
|-------------|----------|----------|----------|
| count_error | No error | 1 error | 2 errors |
| dm_genero | | | |
| Femenino | 0.449561 | 0.451754 | 0.098684 |
| Masculino | 0.401985 | 0.478908 | 0.119107 |

5.2.1 Heatmap



5.2.2 Barplot

```
[64]: dm_genero count_error count
0    Femenino      1 error    206
1    Femenino    No error    205
2    Masculino      1 error    193
3    Masculino    No error    162
4    Masculino      2 errors     48
5    Femenino      2 errors     45
```



5.2.3 Kruskal-Wallis H test

```
[67]: KruskalResult(statistic=1.3152295278596062, pvalue=0.2514499992068521)
```

5.2.4 Post-hoc: Dunn test

```
[68]:          Femenino  Masculino
Femenino  1.000000    0.130334
Masculino  0.130334    1.000000
```

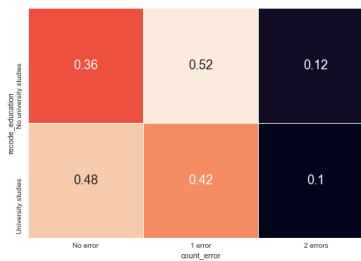
5.3 Difference due to Uni - None Uni

```
[69]: count_error      No error  1 error  2 errors
      recode_education
      No university studies      145      206      47
      University studies        221      193      46
```

Size of N for that test: 858

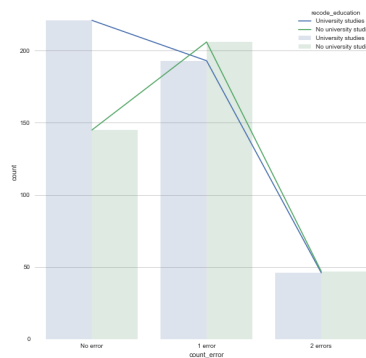
```
[71]: count_error      No error   1 error  2 errors
      recode_education
      No university studies 0.364322 0.517588 0.11809
      University studies    0.480435 0.419565 0.10000
```

5.3.1 Heatmap



5.3.2 Barplot

```
[73]: count_error      recode_education  count
      0      No error      University studies      221
      1      1 error      No university studies      206
      2      1 error      University studies      193
      3      No error      No university studies      145
      4      2 errors      No university studies      47
      5      2 errors      University studies      46
```



5.3.3 Kruskal-Wallis H test

[76]: `KruskalResult(statistic=10.910010837261137, pvalue=0.000956459660105906)`

5.3.4 Post-hoc: Dunn test

[77]:

| | No university studies | University studies |
|-----------------------|-----------------------|--------------------|
| No university studies | 1.000000 | 0.001475 |
| University studies | 0.001475 | 1.000000 |

5.4 Difference due to edu level

[78]:

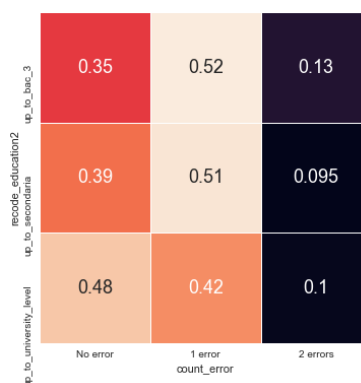
| count_error | No error | 1 error | 2 errors |
|------------------------|----------|---------|----------|
| recode_education2 | | | |
| up_to_bac_3 | 83 | 125 | 32 |
| up_to_secondaria | 62 | 81 | 15 |
| up_to_university_level | 221 | 193 | 46 |

Size of N for that test: 858

[80]:

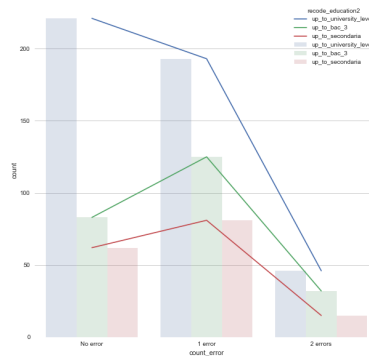
| count_error | No error | 1 error | 2 errors |
|------------------------|----------|----------|----------|
| recode_education2 | | | |
| up_to_bac_3 | 0.345833 | 0.520833 | 0.133333 |
| up_to_secondaria | 0.392405 | 0.512658 | 0.094937 |
| up_to_university_level | 0.480435 | 0.419565 | 0.100000 |

5.4.1 Heatmap



5.4.2 Barplot

```
[82]: count_error      recode_education2  count
      0    No error  up_to_university_level  221
      1     1 error  up_to_university_level  193
      2     1 error           up_to_bac_3    125
      3    No error           up_to_bac_3     83
      4     1 error  up_to_secondaria      81
      5    No error  up_to_secondaria      62
      6     2 errors  up_to_university_level  46
      7     2 errors           up_to_bac_3    32
      8     2 errors  up_to_secondaria     15
```



5.4.3 Kruskal-Wallis H test

```
[85]: KruskalResult(statistic=11.21490252861373, pvalue=0.003670412357238546)
```

5.4.4 Post-hoc: Dunn test

```
[86]:          up_to_bac_3  up_to_secondaria  up_to_university_level
up_to_bac_3          1.000000          0.707764          0.002523
up_to_secondaria      0.707764          1.000000          0.351760
up_to_university_level 0.002523          0.351760          1.000000
```

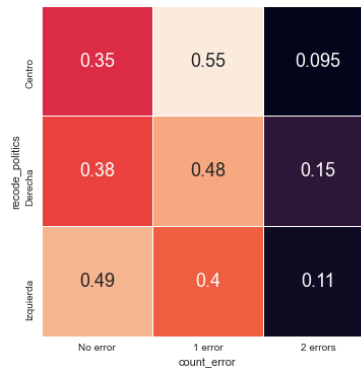
5.5 Difference with the political parties

```
[87]: count_error      No error  1 error  2 errors
      recode_politics
Centro          48          76          13
Derecha         63          80          25
Izquierda       176         144          40
```

Size of N for that test: 665

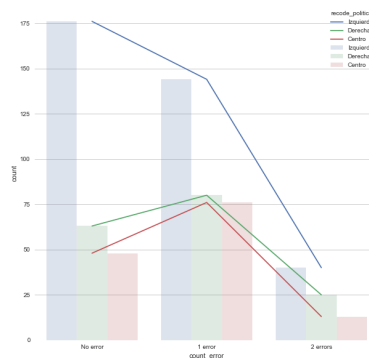

```
[89]: count_error      No error   1 error   2 errors
      recode_politics
      Centro          0.350365  0.554745  0.094891
      Derecha         0.375000  0.476190  0.148810
      Izquierda        0.488889  0.400000  0.111111
```

5.5.1 Heatmap



5.5.2 Barplot

```
[91]: recode_politics count_error count
      0      Izquierda   No error   176
      1      Izquierda    1 error   144
      2      Derecha     1 error    80
      3      Centro      1 error    76
      4      Derecha     No error    63
      5      Centro      No error    48
      6      Izquierda    2 errors   40
      7      Derecha     2 errors   25
      8      Centro      2 errors   13
```



5.5.3 Kruskal-Wallis H test

```
[94]: KruskalResult(statistic=11.34863304181378, pvalue=0.003433014568308653)
```

5.5.4 Post-hoc: Dunn test

```
[95]:
```

| | Centro | Derecha | Izquierda |
|-----------|----------|----------|-----------|
| Centro | 1.000000 | 1.000000 | 0.095985 |
| Derecha | 1.000000 | 1.000000 | 0.038821 |
| Izquierda | 0.095985 | 0.038821 | 1.000000 |

5.6 Difference with the religious believes

```
[96]:
```

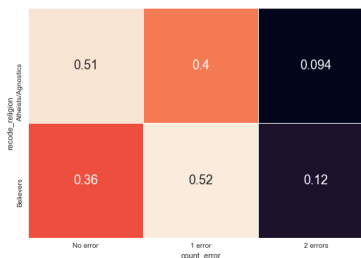
| count_error | No error | 1 error | 2 errors |
|--------------------|----------|---------|----------|
| recode_religion | | | |
| Atheists/Agnostics | 172 | 135 | 32 |
| Believers | 156 | 223 | 54 |

Size of N for that test: 772

```
[98]:
```

| count_error | No error | 1 error | 2 errors |
|--------------------|----------|----------|----------|
| recode_religion | | | |
| Atheists/Agnostics | 0.507375 | 0.398230 | 0.094395 |
| Believers | 0.360277 | 0.515012 | 0.124711 |

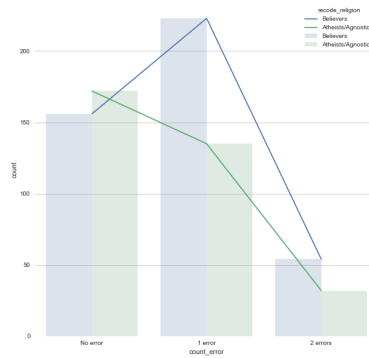
5.6.1 Heatmap



5.6.2 Barplot

```
[100]:
```

| | recode_religion | count_error | count |
|---|--------------------|-------------|-------|
| 0 | Believers | 1 error | 223 |
| 1 | Atheists/Agnostics | No error | 172 |
| 2 | Believers | No error | 156 |
| 3 | Atheists/Agnostics | 1 error | 135 |
| 4 | Believers | 2 errors | 54 |
| 5 | Atheists/Agnostics | 2 errors | 32 |



5.6.3 Kruskal-Wallis H test

[103]: `KruskalResult(statistic=14.779004795671312, pvalue=0.00012087380971051312)`

5.6.4 Post-hoc: Dunn test

[104]:

| | Atheists/Agnostics | Believers |
|--------------------|--------------------|-----------|
| Atheists/Agnostics | 1.000000 | 0.000096 |
| Believers | 0.000096 | 1.000000 |

5.7 Difference due to level of technology knowledge

[105]:

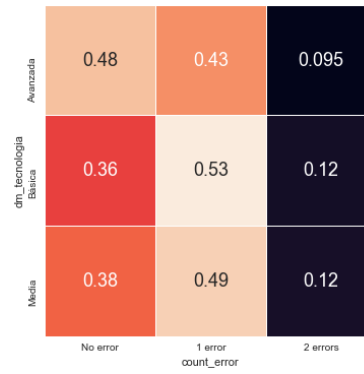
| count_error | No error | 1 error | 2 errors |
|---------------|----------|---------|----------|
| dm_tecnologia | | | |
| Avanzada | 196 | 175 | 39 |
| Básica | 27 | 40 | 9 |
| Media | 142 | 183 | 45 |

Size of N for that test: 856

[107]:

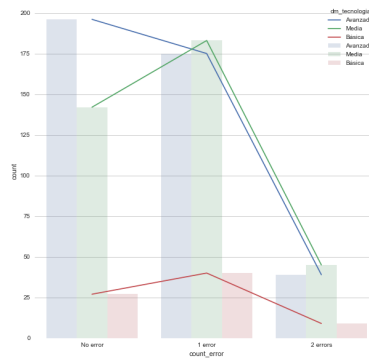
| count_error | No error | 1 error | 2 errors |
|---------------|----------|----------|----------|
| dm_tecnologia | | | |
| Avanzada | 0.478049 | 0.426829 | 0.095122 |
| Básica | 0.355263 | 0.526316 | 0.118421 |
| Media | 0.383784 | 0.494595 | 0.121622 |

5.7.1 Heatmap



5.7.2 Barplot

```
[109]: dm_tecnologia count_error count
0      Avanzada      No error    196
1      Media         1 error     183
2      Avanzada      1 error     175
3      Media         No error    142
4      Media         2 errors     45
5      Básica        1 error     40
6      Avanzada      2 errors     39
7      Básica        No error     27
8      Básica        2 errors      9
```



5.7.3 Kruskal-Wallis H test

```
[112]: KruskalResult(statistic=7.298091720263974, pvalue=0.026015939785640943)
```

5.7.4 Post-hoc: Dunn test

```
[113]:
```

| | Avanzada | Básica | Media |
|----------|----------|----------|----------|
| Avanzada | 1.000000 | 0.180719 | 0.024571 |
| Básica | 0.180719 | 1.000000 | 1.000000 |
| Media | 0.024571 | 1.000000 | 1.000000 |

5.8 Analysis of 4 categories

Here I redo the analysis using the fourth categories created by María del Carmen

5.8.1 Difference with age

```
[115]:
```

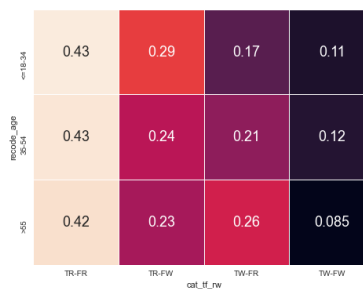
| cat_tf_rw | TR-FR | TR-FW | TW-FR | TW-FW |
|------------|-------|-------|-------|-------|
| recode_age | | | | |
| <=18-34 | 89 | 60 | 34 | 23 |
| 35-54 | 184 | 105 | 90 | 51 |
| >55 | 94 | 51 | 59 | 19 |

Size of N for that test: 856

```
[117]:
```

| cat_tf_rw | TR-FR | TR-FW | TW-FR | TW-FW |
|------------|----------|----------|----------|----------|
| recode_age | | | | |
| <=18-34 | 0.432039 | 0.291262 | 0.165049 | 0.111650 |
| 35-54 | 0.427907 | 0.244186 | 0.209302 | 0.118605 |
| >55 | 0.421525 | 0.228700 | 0.264574 | 0.085202 |

Heatmap

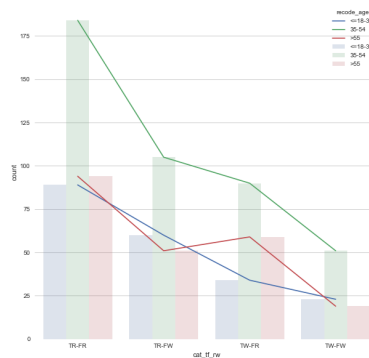


Barplot

```
[119]:
```

| | recode_age | cat_tf_rw | count |
|---|------------|-----------|-------|
| 0 | 35-54 | TR-FR | 184 |
| 1 | 35-54 | TR-FW | 105 |
| 2 | >55 | TR-FR | 94 |
| 3 | 35-54 | TW-FR | 90 |
| 4 | <=18-34 | TR-FR | 89 |

| | | | |
|----|---------|-------|----|
| 5 | <=18-34 | TR-FW | 60 |
| 6 | >55 | TW-FR | 59 |
| 7 | 35-54 | TW-FW | 51 |
| 8 | >55 | TR-FW | 51 |
| 9 | <=18-34 | TW-FR | 34 |
| 10 | <=18-34 | TW-FW | 23 |
| 11 | >55 | TW-FW | 19 |



Chisquare of independence test

Chi2 result of the contingency table: 8.453573758574958, p-value:
0.20671991477672064

| | | | | | | | |
|--------|------------|-----------|-----------|----------|-------------------|--------|---|
| [121]: | recode_age | cat_tf_rw | Adj. Res. | p_value | p_value_corrected | reject | \ |
| 0 | <=18-34 | TR-FR | 0.159661 | 0.873148 | 1.000000 | False | |
| 1 | <=18-34 | TR-FW | 1.510405 | 0.130940 | 1.000000 | False | |
| 2 | <=18-34 | TW-FR | -1.929379 | 0.053684 | 0.644206 | False | |
| 3 | <=18-34 | TW-FW | 0.179340 | 0.857671 | 1.000000 | False | |
| 4 | 35-54 | TR-FR | 0.039505 | 0.968488 | 1.000000 | False | |
| 5 | 35-54 | TR-FW | -0.491638 | 0.622975 | 1.000000 | False | |
| 6 | 35-54 | TW-FR | -0.267740 | 0.788899 | 1.000000 | False | |
| 7 | 35-54 | TW-FW | 0.976399 | 0.328867 | 1.000000 | False | |
| 8 | >55 | TR-FR | -0.200546 | 0.841054 | 1.000000 | False | |
| 9 | >55 | TR-FW | -0.910270 | 0.362680 | 1.000000 | False | |
| 10 | >55 | TW-FR | 2.184348 | 0.028937 | 0.347240 | False | |
| 11 | >55 | TW-FW | -1.288206 | 0.197674 | 1.000000 | False | |

asterisques

| | |
|---|----|
| 0 | ns |
| 1 | ns |
| 2 | ns |
| 3 | ns |
| 4 | ns |

| | |
|----|----|
| 5 | ns |
| 6 | ns |
| 7 | ns |
| 8 | ns |
| 9 | ns |
| 10 | ns |
| 11 | ns |

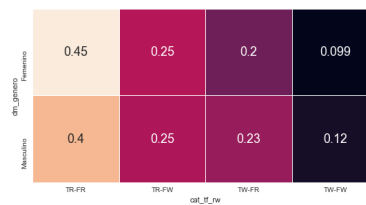
5.8.2 Difference with gender

```
[122]: cat_tf_rw  TR-FR  TR-FW  TW-FR  TW-FW
dm_genero
Femenino      205    116    90    45
Masculino     162    100    93    48
```

Size of N for that test: 856

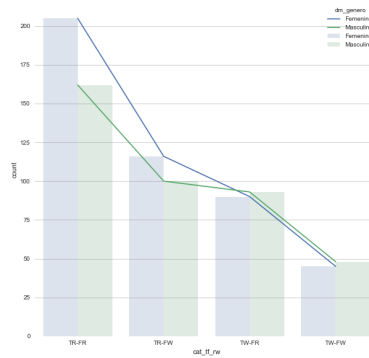
```
[124]: cat_tf_rw      TR-FR      TR-FW      TW-FR      TW-FW
dm_genero
Femenino  0.449561  0.254386  0.197368  0.098684
Masculino  0.401985  0.248139  0.230769  0.119107
```

Heatmap



Barplot

```
[126]: dm_genero cat_tf_rw  count
0  Femenino    TR-FR    205
1  Masculino   TR-FR    162
2  Femenino    TR-FW    116
3  Masculino   TR-FW    100
4  Masculino   TW-FR     93
5  Femenino    TW-FR     90
6  Masculino   TW-FW     48
7  Femenino    TW-FW     45
```



Chisquare of independence test

Chi2 result of the contingency table: 3.111048641349182, p-value:
0.3748185398656928

```
[128]:  dm_genero cat_tf_rw Adj. Res.  p_value  p_value_corrected  reject  \
0   Femenino   TR-FR    1.406716  0.159512                1.0   False
1   Femenino   TR-FW    0.210606  0.833195                1.0   False
2   Femenino   TW-FR   -1.193135  0.232816                1.0   False
3   Femenino   TW-FW   -0.961356  0.336373                1.0   False
4  Masculino   TR-FR   -1.406716  0.159512                1.0   False
5  Masculino   TR-FW   -0.210606  0.833195                1.0   False
6  Masculino   TW-FR    1.193135  0.232816                1.0   False
7  Masculino   TW-FW    0.961356  0.336373                1.0   False
```

asterisques

```
0      ns
1      ns
2      ns
3      ns
4      ns
5      ns
6      ns
7      ns
```

5.8.3 Difference with Uni vs Non Uni

```
[129]: cat_tf_rw      TR-FR  TR-FW  TW-FR  TW-FW
recode_education
No university studies  145    113    93    47
University studies    221    103    90    46
```

Size of N for that test: 856

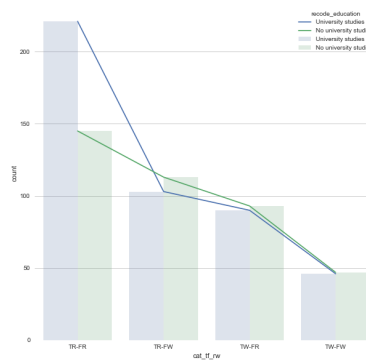

```
[131]: cat_tf_rw      TR-FR      TR-FW      TW-FR      TW-FW
recode_education
No university studies  0.364322  0.283920  0.233668  0.11809
University studies     0.480435  0.223913  0.195652  0.10000
```

Heatmap



Barplot

```
[133]: recode_education cat_tf_rw count
0      University studies TR-FR      221
1      No university studies TR-FR      145
2      No university studies TR-FW      113
3      University studies TR-FW      103
4      No university studies TW-FR      93
5      University studies TW-FR      90
6      No university studies TW-FW      47
7      University studies TW-FW      46
```



Chisquare of independence test

Chi2 result of the contingency table: 11.886195968364882, p-value: 0.007783348266488882

```
[135]:      recode_education cat_tf_rw Adj. Res.  p_value  p_value_corrected \
0  No university studies    TR-FR -3.429434  0.000605          0.004839
1  No university studies    TR-FW  2.019614  0.043423          0.347387
2  No university studies    TW-FR  1.355673  0.175203          1.000000
3  No university studies    TW-FW  0.850044  0.395301          1.000000
4   University studies    TR-FR  3.429434  0.000605          0.004839
5   University studies    TR-FW -2.019614  0.043423          0.347387
6   University studies    TW-FR -1.355673  0.175203          1.000000
7   University studies    TW-FW -0.850044  0.395301          1.000000

      reject asterisques
0     True             **
1    False             ns
2    False             ns
3    False             ns
4     True             **
5    False             ns
6    False             ns
7    False             ns
```

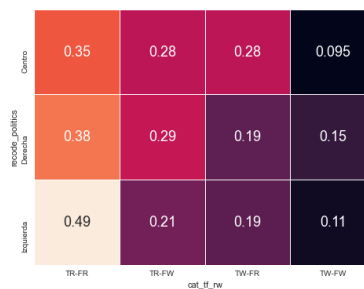
5.8.4 Difference with political parties

```
[136]: cat_tf_rw      TR-FR  TR-FW  TW-FR  TW-FW
recode_politics
Centro           48      38      38      13
Derecha          63      48      32      25
Izquierda        176      76      68      40
```

Size of N for that test: 856

```
[138]: cat_tf_rw      TR-FR      TR-FW      TW-FR      TW-FW
recode_politics
Centro          0.350365  0.277372  0.277372  0.094891
Derecha         0.375000  0.285714  0.190476  0.148810
Izquierda       0.488889  0.211111  0.188889  0.111111
```

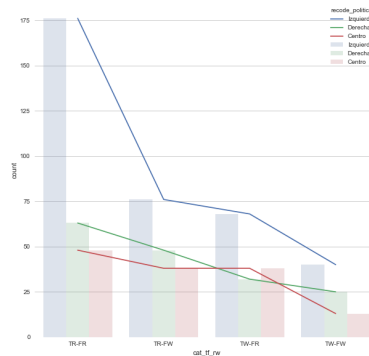
Heatmap



Barplot

```
[140]:
```

| | recode_politics | cat_tf_rw | count |
|----|-----------------|-----------|-------|
| 0 | Izquierda | TR-FR | 176 |
| 1 | Izquierda | TR-FW | 76 |
| 2 | Izquierda | TW-FR | 68 |
| 3 | Derecha | TR-FR | 63 |
| 4 | Centro | TR-FR | 48 |
| 5 | Derecha | TR-FW | 48 |
| 6 | Izquierda | TW-FW | 40 |
| 7 | Centro | TR-FW | 38 |
| 8 | Centro | TW-FR | 38 |
| 9 | Derecha | TW-FR | 32 |
| 10 | Derecha | TW-FW | 25 |
| 11 | Centro | TW-FW | 13 |



Chisquare of independence test

Chi2 result of the contingency table: 15.688724720518637, p-value: 0.015525893634485515

```
[142]:
```

| | recode_politics | cat_tf_rw | Adj. Res. | p_value | p_value_corrected | reject | \ |
|---|-----------------|-----------|-----------|----------|-------------------|--------|---|
| 0 | Centro | TR-FR | -2.153871 | 0.031250 | 0.375003 | False | |
| 1 | Centro | TR-FW | 1.033186 | 0.301517 | 1.000000 | False | |
| 2 | Centro | TW-FR | 2.262658 | 0.023657 | 0.283881 | False | |
| 3 | Centro | TW-FW | -0.914556 | 0.360425 | 1.000000 | False | |
| 4 | Derecha | TR-FR | -1.712683 | 0.086771 | 1.000000 | False | |
| 5 | Derecha | TR-FW | 1.470631 | 0.141391 | 1.000000 | False | |
| 6 | Derecha | TW-FR | -0.630086 | 0.528638 | 1.000000 | False | |
| 7 | Derecha | TW-FW | 1.468513 | 0.141965 | 1.000000 | False | |
| 8 | Izquierda | TR-FR | 3.241731 | 0.001188 | 0.014257 | True | |
| 9 | Izquierda | TR-FW | -2.121035 | 0.033919 | 0.407027 | False | |

| | | | | | | |
|----|-----------|-------|-----------|----------|----------|-------|
| 10 | Izquierda | TW-FR | -1.287063 | 0.198072 | 1.000000 | False |
| 11 | Izquierda | TW-FW | -0.538276 | 0.590387 | 1.000000 | False |

```

    asterisques
0      ns
1      ns
2      ns
3      ns
4      ns
5      ns
6      ns
7      ns
8      *
9      ns
10     ns
11     ns

```

5.8.5 Difference with Religious belief

```

[143]: cat_tf_rw      TR-FR  TR-FW  TW-FR  TW-FW
       recode_religion
Atheists/Agnostics    172    80    55    32
Believers              156   117   106   54

```

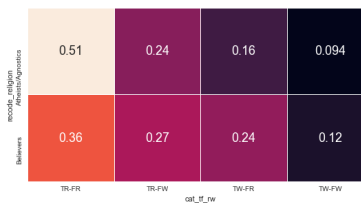
Size of N for that test: 856

```

[145]: cat_tf_rw      TR-FR      TR-FW      TW-FR      TW-FW
       recode_religion
Atheists/Agnostics  0.507375  0.235988  0.162242  0.094395
Believers           0.360277  0.270208  0.244804  0.124711

```

Heatmap



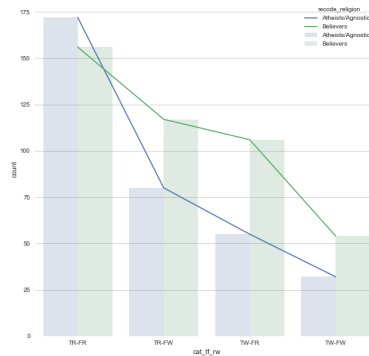
Barplot

```

[147]: recode_religion cat_tf_rw  count
0  Atheists/Agnostics    TR-FR    172
1      Believers         TR-FR    156
2      Believers         TR-FW    117

```

| | | | |
|---|--------------------|-------|-----|
| 3 | Believers | TW-FR | 106 |
| 4 | Atheists/Agnostics | TR-FW | 80 |
| 5 | Atheists/Agnostics | TW-FR | 55 |
| 6 | Believers | TW-FW | 54 |
| 7 | Atheists/Agnostics | TW-FW | 32 |



Chisquare of independence test

Chi2 result of the contingency table: 18.339212362105243, p-value: 0.0003743805774755582

```
[149]:      recode_religion cat_tf_fw Adj. Res.   p_value p_value_corrected \
0  Atheists/Agnostics   TR-FR    4.103263  0.000041      0.000326
1  Atheists/Agnostics   TR-FW   -1.082333  0.279104      1.000000
2  Atheists/Agnostics   TW-FR   -2.802193  0.005076      0.040605
3  Atheists/Agnostics   TW-FW   -1.328659  0.183960      1.000000
4      Believers        TR-FR   -4.103263  0.000041      0.000326
5      Believers        TR-FW    1.082333  0.279104      1.000000
6      Believers        TW-FR    2.802193  0.005076      0.040605
7      Believers        TW-FW    1.328659  0.183960      1.000000
```

```
reject asterisques
0   True      ***
1  False      ns
2   True      *
3  False      ns
4   True      ***
5  False      ns
6   True      *
7  False      ns
```

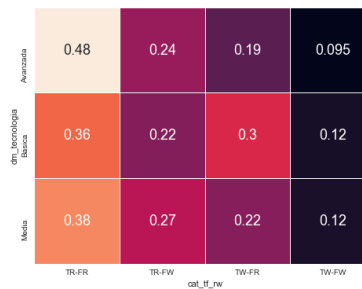
5.8.6 Difference with technological knowledge

```
[150]: cat_tf_rw      TR-FR  TR-FW  TW-FR  TW-FW
dm_tecnologia
Avanzada          196     99     76     39
Básica             27     17     23     9
Media             142    100     83    45
```

Size of N for that test: 856

```
[152]: cat_tf_rw      TR-FR      TR-FW      TW-FR      TW-FW
dm_tecnologia
Avanzada      0.478049  0.241463  0.185366  0.095122
Básica        0.355263  0.223684  0.302632  0.118421
Media         0.383784  0.270270  0.224324  0.121622
```

Heatmap



Barplot

```
[154]: dm_tecnologia cat_tf_rw count
0      Avanzada      TR-FR    196
1      Media         TR-FR    142
2      Media         TR-FW    100
3      Avanzada      TR-FW     99
4      Media         TW-FR     83
5      Avanzada      TW-FR     76
6      Media         TW-FW     45
7      Avanzada      TW-FW     39
8      Básica        TR-FR     27
9      Básica        TW-FR     23
10     Básica        TR-FW     17
11     Básica        TW-FW      9
```



Chisquare of independence test

Chi2 result of the contingency table: 11.851089969249614, p-value: 0.06537445362063155

| | | | | | | |
|--------|---------------|-----------|-----------|----------|-------------------|----------|
| [156]: | dm_tecnologia | cat_tf_rw | Adj. Res. | p_value | p_value_corrected | reject \ |
| 0 | Avanzada | TR-FR | 2.929492 | 0.003395 | 0.040742 | True |
| 1 | Avanzada | TR-FW | -0.702213 | 0.482546 | 1.000000 | False |
| 2 | Avanzada | TW-FR | -1.868321 | 0.061717 | 0.740608 | False |
| 3 | Avanzada | TW-FW | -1.218994 | 0.222847 | 1.000000 | False |
| 4 | Básica | TR-FR | -1.313678 | 0.188955 | 1.000000 | False |
| 5 | Básica | TR-FW | -0.602437 | 0.546883 | 1.000000 | False |
| 6 | Básica | TW-FR | 2.009177 | 0.044518 | 0.534220 | False |
| 7 | Básica | TW-FW | 0.286904 | 0.774186 | 1.000000 | False |
| 8 | Media | TR-FR | -2.199886 | 0.027815 | 0.333780 | False |
| 9 | Media | TR-FW | 1.054021 | 0.291873 | 1.000000 | False |
| 10 | Media | TW-FR | 0.730452 | 0.465114 | 1.000000 | False |
| 11 | Media | TW-FW | 1.064525 | 0.287091 | 1.000000 | False |

asterisques

| | |
|----|----|
| 0 | * |
| 1 | ns |
| 2 | ns |
| 3 | ns |
| 4 | ns |
| 5 | ns |
| 6 | ns |
| 7 | ns |
| 8 | ns |
| 9 | ns |
| 10 | ns |
| 11 | ns |

5.9 Analysis using Right-Wrong distinction

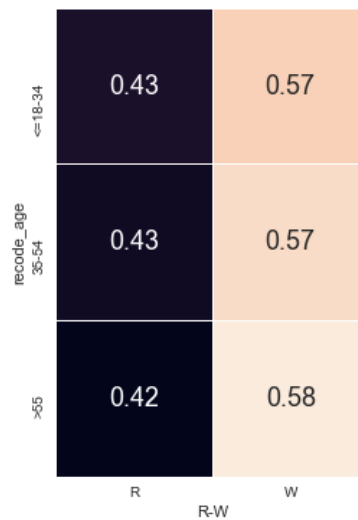
5.9.1 Difference with age

```
[158]: R-W          R      W
       recode_age
<=18-34      89   117
35-54       184   246
>55          94   129
```

Size of N for that test: 856

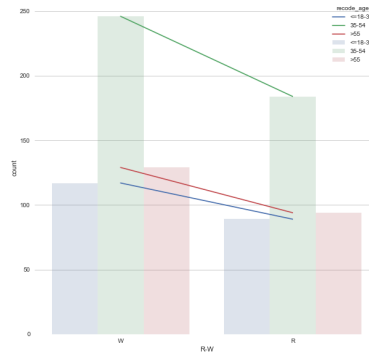
```
[160]: R-W          R          W
       recode_age
<=18-34      0.432039  0.567961
35-54       0.427907  0.572093
>55         0.421525  0.578475
```

Heatmap



Barplot

```
[162]: recode_age R-W  count
0      35-54    W    246
1      35-54    R    184
2       >55    W    129
3    <=18-34    W    117
4       >55    R     94
5    <=18-34    R     89
```

Chisquare of independence test

Chi2 result of the contingency table: 0.04993554964597885, p-value:
0.9753413420693046

| | | | | | | | |
|--------|------------|-----|-----------|----------|-------------------|--------|-------------|
| [164]: | recode_age | R-W | Adj. Res. | p_value | p_value_corrected | reject | asterisques |
| 0 | <=18-34 | R | 0.159661 | 0.873148 | 1.0 | False | ns |
| 1 | <=18-34 | W | -0.159661 | 0.873148 | 1.0 | False | ns |
| 2 | 35-54 | R | 0.039505 | 0.968488 | 1.0 | False | ns |
| 3 | 35-54 | W | -0.039505 | 0.968488 | 1.0 | False | ns |
| 4 | >55 | R | -0.200546 | 0.841054 | 1.0 | False | ns |
| 5 | >55 | W | 0.200546 | 0.841054 | 1.0 | False | ns |

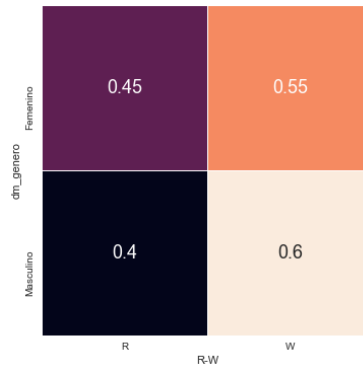
5.9.2 Difference with gender

| | | | |
|--------|-----------|-----|-----|
| [165]: | R-W | R | W |
| | dm_genero | | |
| | Femenino | 205 | 251 |
| | Masculino | 162 | 241 |

Size of N for that test: 856

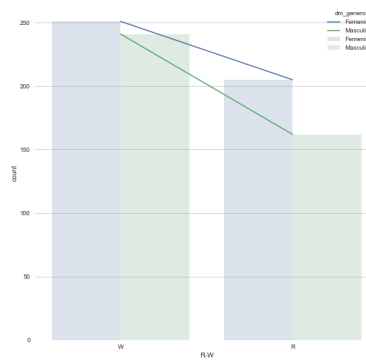
| | | | |
|--------|-----------|----------|----------|
| [167]: | R-W | R | W |
| | dm_genero | | |
| | Femenino | 0.449561 | 0.550439 |
| | Masculino | 0.401985 | 0.598015 |

Heatmap



Barplot

```
[169]: dm_genero R-W count
0 Femenino W 251
1 Masculino W 241
2 Femenino R 205
3 Masculino R 162
```



Chisquare of independence test

Chi2 result of the contingency table: 1.7892042052701642, p-value: 0.1810231526560922

```
[171]: dm_genero R-W Adj. Res. p_value p_value_corrected reject asterisques
0 Femenino R 1.406716 0.159512 0.638046 False ns
1 Femenino W -1.406716 0.159512 0.638046 False ns
2 Masculino R -1.406716 0.159512 0.638046 False ns
3 Masculino W 1.406716 0.159512 0.638046 False ns
```

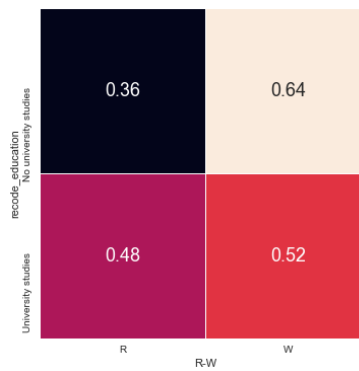
5.9.3 Difference with Uni vs Non Uni

```
[172]: R-W
recode_education
No university studies  145  253
University studies     221  239
```

Size of N for that test: 856

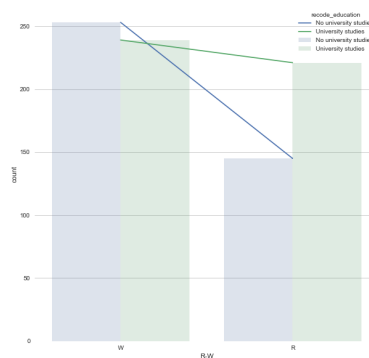
```
[174]: R-W
recode_education
No university studies  0.364322  0.635678
University studies    0.480435  0.519565
```

Heatmap



Barplot

```
[176]: recode_education R-W count
0 No university studies W 253
1 University studies W 239
2 University studies R 221
3 No university studies R 145
```



Chisquare of independence test

Chi2 result of the contingency table: 11.29112033414732, p-value:
0.0007787867192997264

```
[178]:      recode_education R-W Adj. Res.   p_value p_value_corrected reject \
0  No university studies  R  -3.429434 0.000605          0.002419   True
1  No university studies  W   3.429434 0.000605          0.002419   True
2   University studies   R   3.429434 0.000605          0.002419   True
3   University studies   W  -3.429434 0.000605          0.002419   True

      asterisques
0              **
1              **
2              **
3              **
```

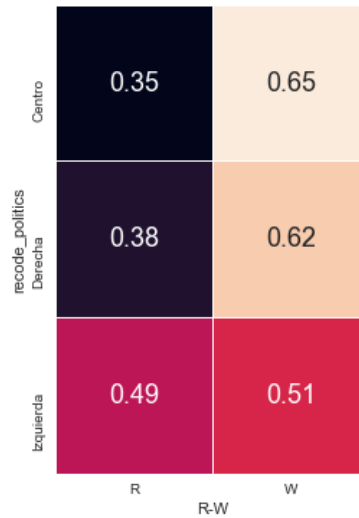
5.9.4 Difference with political parties

```
[179]: R-W      R      W
      recode_politics
Centro      48     89
Derecha     63    105
Izquierda   176   184
```

Size of N for that test: 856

```
[181]: R-W      R      W
      recode_politics
Centro    0.350365 0.649635
Derecha   0.375000 0.625000
Izquierda 0.488889 0.511111
```

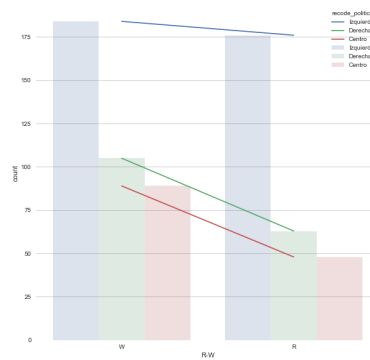
Heatmap



Barplot

[183]:

| | recode_politics | R-W | count |
|---|-----------------|-----|-------|
| 0 | Izquierda | W | 184 |
| 1 | Izquierda | R | 176 |
| 2 | Derecha | W | 105 |
| 3 | Centro | W | 89 |
| 4 | Derecha | R | 63 |
| 5 | Centro | R | 48 |



Chisquare of independence test

Chi2 result of the contingency table: 10.69550058757548, p-value: 0.004758844968845993

```
[185]: recode_politics R-W Adj. Res.  p_value  p_value_corrected  reject  \
0      Centro      R  -2.153871  0.031250          0.187502   False
1      Centro      W   2.153871  0.031250          0.187502   False
2      Derecha     R  -1.712683  0.086771          0.520625   False
3      Derecha     W   1.712683  0.086771          0.520625   False
4      Izquierda   R   3.241731  0.001188          0.007128    True
5      Izquierda   W  -3.241731  0.001188          0.007128    True
```

```

    asterisques
0      ns
1      ns
2      ns
3      ns
4      **
5      **
```

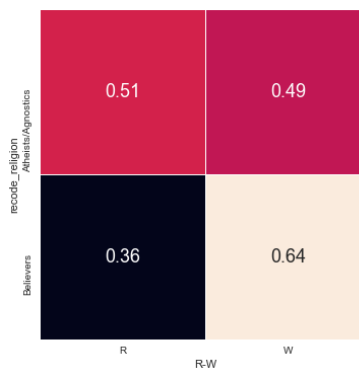
5.9.5 Difference with Religious belief

```
[186]: R-W      R      W
recode_religion
Atheists/Agnostics  172  167
Believers           156  277
```

Size of N for that test: 856

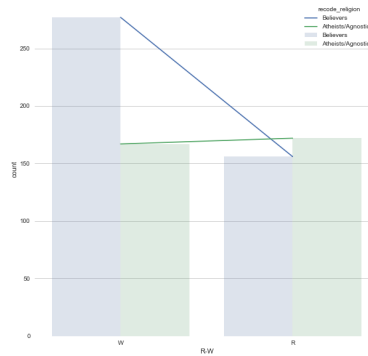
```
[188]: R-W      R      W
recode_religion
Atheists/Agnostics  0.507375  0.492625
Believers           0.360277  0.639723
```

Heatmap



Barplot

```
[190]:      recode_religion R-W count
0      Believers      W    277
1 Atheists/Agnostics  R    172
2 Atheists/Agnostics  W    167
3      Believers      R    156
```



Chisquare of independence test

Chi2 result of the contingency table: 16.240163830976343, p-value: 5.5798529961421525e-05

```
[192]:      recode_religion R-W Adj. Res.    p_value p_value_corrected reject \
0 Atheists/Agnostics  R    4.103263  0.000041      0.000163    True  \
1 Atheists/Agnostics  W   -4.103263  0.000041      0.000163    True  \
2      Believers      R   -4.103263  0.000041      0.000163    True  \
3      Believers      W    4.103263  0.000041      0.000163    True  \
```

```
      asterisques
0      ***
1      ***
2      ***
3      ***
```

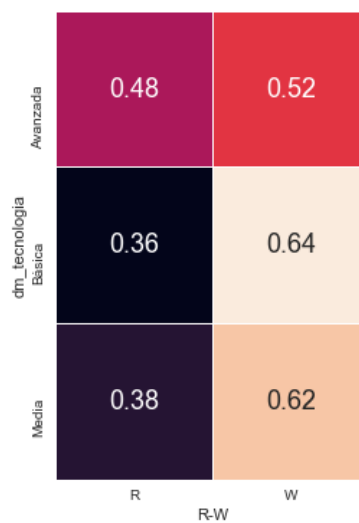
5.9.6 Difference with technological knowledge

```
[193]: R-W      R      W
dm_tecnologia
Avanzada      196    214
Básica         27     49
Media         142    228
```

Size of N for that test: 856

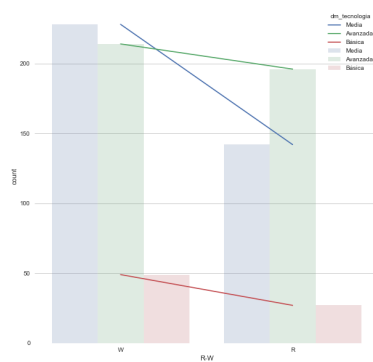
```
[195]: R-W          R          W
dm_tecnologia
Avanzada 0.478049 0.521951
Básica   0.355263 0.644737
Media    0.383784 0.616216
```

Heatmap



Barplot

```
[197]: dm_tecnologia R-W count
0      Media      W      228
1      Avanzada   W      214
2      Avanzada   R      196
3      Media      R      142
4      Básica     W       49
5      Básica     R       27
```



Chisquare of independence test

Chi2 result of the contingency table: 8.791610710945442, p-value:
0.01232894714104229

```
[199]: dm_tecnologia R-W Adj. Res.  p_value  p_value_corrected  reject  \
0      Avanzada    R    2.929492  0.003395          0.020371    True
1      Avanzada    W   -2.929492  0.003395          0.020371    True
2      Básica      R   -1.313678  0.188955          1.000000    False
3      Básica      W    1.313678  0.188955          1.000000    False
4      Media       R   -2.199886  0.027815          0.166890    False
5      Media       W    2.199886  0.027815          0.166890    False
```

```
asterisques
0          *
1          *
2          ns
3          ns
4          ns
5          ns
```

5.10 Analysis of actions

TODO

6 References

6.1 Packages

- mord: <https://github.com/fabianp/mord> > Pedregosa, Fabian, Francis Bach, and Alexandre Gramfort. "On the consistency of ordinal regression methods." The Journal of Machine Learning Research 18.1 (2017) JMLR.
- pingouin: <https://pingouin-stats.org/> > Vallat, R. (2018). Pingouin: statistics in Python. Journal of Open Source Software, 3(31), 1026, <https://doi.org/10.21105/joss.01026>
- statsmodels: <https://www.statsmodels.org> > @inproceedings{seabold2010statsmodels,title={statsmodels: Econometric and statistical modeling with python}, author={Seabold, Skipper and Perktold, Josef}, booktitle={9th Python in Science Conference},year={2010},}
- scipy: <https://www.scipy.org> > @ARTICLE{2020SciPy-NMeth, author = {Virtanen, Pauli and Gommers, Ralf and Oliphant, Travis E. and Haberland, Matt and Reddy, Tyler and Cournapeau, David and Burovski, Evgeni and Peterson, Pearu and Weckesser, Warren and Bright, Jonathan and {van der Walt}, St{\'e}fan J. and Brett, Matthew and Wilson, Joshua and Millman, K. Jarrod and Mayorov, Nikolay and Nelson, Andrew R. J. and Jones, Eric and Kern, Robert and Larson, Eric and Carey, C J and Polat, {I}lhan and Feng, Yu and Moore, Eric W. and {VanderPlas}, Jake and Laxalde, Denis and Perktold, Josef and Cimrman, Robert

and Henriksen, Ian and Quintero, E. A. and Harris, Charles R. and Archibald, Anne M. and Ribeiro, Ant{^o}nio H. and Pedregosa, Fabian and {van Mulbregt}, Paul and {SciPy 1.0 Contributors}},title = {{{SciPy} 1.0: Fundamental Algorithms for Scientific Computing in Python}}, journal = {Nature Methods}, year = {2020}, volume = {17}, pages = {261–272}, adsurl = {https://rdcu.be/b08Wh}, doi = {10.1038/s41592-019-0686-2},}

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6.2 Articles

- Bürkner, P.-C., & Vuorre, M. (2019). Ordinal Regression Models in Psychology: A Tutorial. Advances in Methods and Practices in Psychological Science, 77–101. <https://doi.org/10.1177/2515245918823199>