Botanical Garden Report

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Qiwenli

```
data <- read.csv("~/Desktop/Stat 450 Project /AndreaByfuglien_data.csv",header = T, row.names = 1)
 summary(data)
```

```
##     Group_ID      Researcher   Condition     Walk     Education      Date
##  Min.   :  1.00   AB:155     Min.   :1.000   C : 85   C : 85    09-Jun : 29
##  1st Qu.: 50.00   CL: 81     1st Qu.:2.000   GW:169   E :167    15-Jun : 29
##  Median : 98.00   KC: 37     Median :3.000   TW:165   NE:167    19-May : 28
##  Mean   : 96.25   MB: 20     Mean   :3.017                      02-Jun : 24
##  3rd Qu.:143.00   VV:126     3rd Qu.:4.000                      05-Jul : 24
##  Max.   :184.00              Max.   :5.000                      01-Jun : 23
##                                                                 (Other):262
##       Day          Time_Started   Group_size       Weather         Valence
##  Min.   :1.000   1.45pm : 13   Min.   :1.000   Min.   :1.000   Min.   :1.000
##  1st Qu.:5.000   11.20am: 13   1st Qu.:2.000   1st Qu.:2.000   1st Qu.:7.000
##  Median :6.000   11.30am: 12   Median :2.000   Median :4.000   Median :8.000
##  Mean   :5.439   1.20pm : 10   Mean   :2.678   Mean   :3.174   Mean   :7.933
##  3rd Qu.:7.000   11.35am: 10   3rd Qu.:3.000   3rd Qu.:4.000   3rd Qu.:9.000
##  Max.   :7.000   12.30pm:  9   Max.   :5.000   Max.   :4.000   Max.   :9.000
##                  (Other):352                                   NA's   :3
##     Arousal      Donation_binary      Donate          Z_Donate
##  Min.   :1.000   Min.   :0.0000   Min.   : 0.000   Min.   :-1.78740
##  1st Qu.:4.000   1st Qu.:1.0000   1st Qu.:10.000   1st Qu.: 0.54298
##  Median :5.000   Median :1.0000   Median :10.000   Median : 0.54298
##  Mean   :5.462   Mean   :0.8353   Mean   : 7.974   Mean   : 0.07078
##  3rd Qu.:7.000   3rd Qu.:1.0000   3rd Qu.:10.000   3rd Qu.: 0.54298
##  Max.   :9.000   Max.   :1.0000   Max.   :20.000   Max.   : 2.87335
##  NA's   :3
##      Nwsltr           Volntr           Sum_NV          Sum_DNV
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.00
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.00
##  Median :0.0000   Median :0.0000   Median :0.0000   Median :1.00
##  Mean   :0.2721   Mean   :0.1527   Mean   :0.4248   Mean   :1.26
##  3rd Qu.:1.0000   3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:2.00
##  Max.   :1.0000   Max.   :1.0000   Max.   :2.0000   Max.   :3.00
##
##       Z_NV            P1_Biodiv         P2_Ineq         P3_Poverty
##  Min.   :-0.59149   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:-0.59149   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000
##  Median :-0.59149   Median :1.0000   Median :1.0000   Median :1.0000
```

```
##  Mean   : 0.05574   Mean   :0.6516   Mean   :0.5274   Mean   :0.5203
##  3rd Qu.: 0.93205   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   : 2.45560   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##
##   P4_Consrvtn         Sum_P          Env_P            S_P
##  Min.   :0.0000   Min.   :0.00   Min.   :0.000   Min.   :0.000
##  1st Qu.:0.0000   1st Qu.:0.00   1st Qu.:0.000   1st Qu.:0.000
##  Median :1.0000   Median :3.00   Median :2.000   Median :1.000
##  Mean   :0.6611   Mean   :2.36   Mean   :1.313   Mean   :1.048
##  3rd Qu.:1.0000   3rd Qu.:4.00   3rd Qu.:2.000   3rd Qu.:2.000
##  Max.   :1.0000   Max.   :4.00   Max.   :2.000   Max.   :2.000
##
##      Diff_P          Z_Petition      Raw_Beh_Score    Z_Beh_Score
##  Min.   :-2.0000   Min.   :-1.4600   Min.   :0.000   Min.   :-3.838869
##  1st Qu.: 0.0000   1st Qu.:-1.4600   1st Qu.:1.000   1st Qu.:-1.508494
##  Median : 0.0000   Median : 0.2246   Median :4.000   Median : 0.015053
##  Mean   : 0.2649   Mean   :-0.1346   Mean   :3.621   Mean   :-0.008028
##  3rd Qu.: 0.0000   3rd Qu.: 0.7861   3rd Qu.:5.000   3rd Qu.: 0.737624
##  Max.   : 2.0000   Max.   : 0.7861   Max.   :7.000   Max.   : 4.591546
##
##       Q19              Q20             Q21             Gender
##  Min.   :0.0000   Min.   :0.000   Min.   :0.0000   Min.   :1.000
##  1st Qu.:0.0000   1st Qu.:0.000   1st Qu.:1.0000   1st Qu.:1.000
##  Median :1.0000   Median :2.000   Median :1.0000   Median :2.000
##  Mean   :0.7402   Mean   :2.102   Mean   :0.8668   Mean   :1.579
##  3rd Qu.:1.0000   3rd Qu.:3.000   3rd Qu.:1.0000   3rd Qu.:2.000
##  Max.   :1.0000   Max.   :5.000   Max.   :2.0000   Max.   :4.000
##  NA's   :11       NA's   :37      NA's   :21       NA's   :3
##       Age             City         Financial        Political
##  Min.   :18.00   Min.   :1.000   Min.   : 0.000   Min.   :1.000
##  1st Qu.:26.25   1st Qu.:1.000   1st Qu.: 5.000   1st Qu.:2.000
##  Median :39.00   Median :3.000   Median : 7.000   Median :3.000
##  Mean   :42.62   Mean   :2.998   Mean   : 6.722   Mean   :2.977
##  3rd Qu.:59.00   3rd Qu.:5.000   3rd Qu.: 9.000   3rd Qu.:4.000
##  Max.   :80.00   Max.   :5.000   Max.   :10.000   Max.   :7.000
##  NA's   :13      NA's   :5       NA's   :9        NA's   :28
##     ECO_mean         NEP_mean         NR_mean
##  Min.   : 4.500   Min.   : 2.500   Min.   : 1.833
##  1st Qu.: 8.500   1st Qu.: 7.500   1st Qu.: 6.500
##  Median : 9.500   Median : 8.750   Median : 7.667
##  Mean   : 9.082   Mean   : 8.398   Mean   : 7.493
##  3rd Qu.:10.000   3rd Qu.: 9.500   3rd Qu.: 8.733
##  Max.   :10.000   Max.   :10.000   Max.   :10.000
##


##     Group_ID     Researcher   Condition     Walk     Education      Date
##  Min.   :  1.0   AB:127     Min.   :1.000   C :  0   C :  0    09-Jun : 27
##  1st Qu.: 49.5   CL: 53     1st Qu.:1.000   GW:166   E :164    19-May : 25
##  Median : 95.5   KC: 23     Median :3.000   TW:164   NE:166    15-Jun : 22
##  Mean   : 94.4   MB: 16     Mean   :2.509                      16-Jun : 19
##  3rd Qu.:138.0   VV:111     3rd Qu.:4.000                      18-May : 19
##  Max.   :184.0              Max.   :4.000                      22-Jun : 18
##                                                                (Other):200
##       Day         Time_Started   Group_size       Weather         Valence
```

```
##  Min.   :1.000   11.35am: 10   Min.   :1.000   Min.   :1.000   Min.   :1.000
##  1st Qu.:5.000   1.45pm :  9   1st Qu.:2.000   1st Qu.:2.000   1st Qu.:7.000
##  Median :6.000   11.30am:  9   Median :3.000   Median :4.000   Median :8.000
##  Mean   :5.524   1.20pm :  8   Mean   :2.767   Mean   :3.176   Mean   :7.903
##  3rd Qu.:7.000   11.55am:  8   3rd Qu.:4.000   3rd Qu.:4.000   3rd Qu.:9.000
##  Max.   :7.000   1.30pm :  7   Max.   :5.000   Max.   :4.000   Max.   :9.000
##                  (Other):279
##     Arousal      Donation_binary      Donate          Z_Donate
##  Min.   :1.000   Min.   :0.0000   Min.   : 0.000   Min.   :-1.78740
##  1st Qu.:4.000   1st Qu.:1.0000   1st Qu.: 6.000   1st Qu.:-0.38917
##  Median :6.000   Median :1.0000   Median :10.000   Median : 0.54298
##  Mean   :5.606   Mean   :0.8303   Mean   : 7.861   Mean   : 0.04442
##  3rd Qu.:7.000   3rd Qu.:1.0000   3rd Qu.:10.000   3rd Qu.: 0.54298
##  Max.   :9.000   Max.   :1.0000   Max.   :20.000   Max.   : 2.87335
##
##      Nwsltr           Volntr           Sum_NV          Sum_DNV
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.000
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.000
##  Median :0.0000   Median :0.0000   Median :0.0000   Median :1.000
##  Mean   :0.2727   Mean   :0.1455   Mean   :0.4182   Mean   :1.248
##  3rd Qu.:1.0000   3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:2.000
##  Max.   :1.0000   Max.   :1.0000   Max.   :2.0000   Max.   :3.000
##
##       Z_NV            P1_Biodiv         P2_Ineq         P3_Poverty
##  Min.   :-0.59149   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:-0.59149   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000
##  Median :-0.59149   Median :1.0000   Median :1.0000   Median :1.0000
##  Mean   : 0.04562   Mean   :0.6727   Mean   :0.5636   Mean   :0.5545
##  3rd Qu.: 0.93205   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   : 2.45560   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##
##   P4_Consrvtn         Sum_P           Env_P            S_P
##  Min.   :0.0000   Min.   :0.000   Min.   :0.000   Min.   :0.000
##  1st Qu.:0.0000   1st Qu.:0.000   1st Qu.:0.000   1st Qu.:0.000
##  Median :1.0000   Median :4.000   Median :2.000   Median :2.000
##  Mean   :0.6758   Mean   :2.467   Mean   :1.348   Mean   :1.118
##  3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:2.000   3rd Qu.:2.000
##  Max.   :1.0000   Max.   :4.000   Max.   :2.000   Max.   :2.000
##
##      Diff_P          Z_Petition       Raw_Beh_Score    Z_Beh_Score
##  Min.   :-2.0000   Min.   :-1.45998   Min.   :0.000   Min.   :-3.83887
##  1st Qu.: 0.0000   1st Qu.:-1.45998   1st Qu.:2.000   1st Qu.:-1.50849
##  Median : 0.0000   Median : 0.78614   Median :4.000   Median : 0.09557
##  Mean   : 0.2303   Mean   :-0.07487   Mean   :3.715   Mean   : 0.01517
##  3rd Qu.: 0.0000   3rd Qu.: 0.78614   3rd Qu.:5.000   3rd Qu.: 0.73762
##  Max.   : 2.0000   Max.   : 0.78614   Max.   :7.000   Max.   : 3.78472
##
##       Q19              Q20              Q21            Gender
##  Min.   :0.0000   Min.   :0.000   Min.   :0.000   Min.   :1.000
##  1st Qu.:1.0000   1st Qu.:0.000   1st Qu.:1.000   1st Qu.:1.000
##  Median :1.0000   Median :2.000   Median :1.000   Median :2.000
##  Mean   :0.7515   Mean   :2.175   Mean   :0.877   Mean   :1.564
##  3rd Qu.:1.0000   3rd Qu.:3.000   3rd Qu.:1.000   3rd Qu.:2.000
##  Max.   :1.0000   Max.   :5.000   Max.   :2.000   Max.   :4.000
```

```
##  NA's   :4        NA's   :28      NA's   :13
##       Age             City         Financial        Political
##  Min.   :18.00   Min.   :1.000   Min.   : 0.000   Min.   :1.000
##  1st Qu.:27.00   1st Qu.:1.000   1st Qu.: 5.000   1st Qu.:2.000
##  Median :40.00   Median :2.000   Median : 7.000   Median :3.000
##  Mean   :42.64   Mean   :2.927   Mean   : 6.724   Mean   :2.952
##  3rd Qu.:59.00   3rd Qu.:5.000   3rd Qu.: 9.000   3rd Qu.:4.000
##  Max.   :75.00   Max.   :5.000   Max.   :10.000   Max.   :7.000
##                  NA's   :1
##     ECO_mean         NEP_mean         NR_mean
##  Min.   : 4.500   Min.   : 2.500   Min.   : 1.833
##  1st Qu.: 8.500   1st Qu.: 7.500   1st Qu.: 6.500
##  Median : 9.500   Median : 8.625   Median : 7.750
##  Mean   : 9.091   Mean   : 8.377   Mean   : 7.490
##  3rd Qu.:10.000   3rd Qu.: 9.500   3rd Qu.: 8.667
##  Max.   :10.000   Max.   :10.000   Max.   :10.000
##
```

```
library(tidyverse)
```

```
## Warning: package 'readr' was built under R version 3.4.4
```

```
## Warning: package 'stringr' was built under R version 3.4.4
```

```
## Warning: package 'forcats' was built under R version 3.4.4
```

```
library(ggplot2)
library(broom)
```

Summary

Different variables have been related to pro-environmental behaviour, including valence (feeling positive and/or negative emotions), arousal (the state of being physiologically alert and attentive) and educational interventions.

An experiment was conducted at the UBC Botanical Garden to investigate how valence, arousal and education affect pro-environmental behaviour.

In this report, we try to explore roles of valence, arousal and education in pro-environmental behaviour. We use linear regression models to model the survey data and hypothesis tests to evaluate these effects.

Introduction

In this report, we will explore the relationship between arousal, education, valence and Z_Beh_Score (the standardized sum of response variables of donation, newsletters, volunteering and petitions). Arousal, education, valence as explanatory variables, and Z_Beh_Score as a response variable.

We use linear regression to fit the models, and we use hypothesis tests to determine if the variable has a significant linear relationship.

Moreover, we will remove the control group observations and then analyze walk and education separately; we will keep the control group observations and analyze the condition group; seeing if they give significantly different results.

To further explore, we will add age, gender, political views, and financial status as our explanatory variables, standardized donation, a standardized sum of newsletters and volunteering, standardized petitions, mean of ECO, mean of NEP, and mean of NR as our dependent variables, to fit full models and find the relationship between explanatory variables and dependent variables.

Data Description

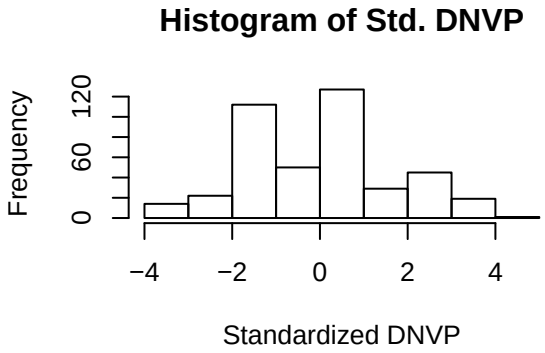
In this report, we will use walk, education, (or condition: the combination of walk and education) and valence as explanatory variables, and Z_Beh_Score as the dependent variable, which is the standardized sum of response variables of donation, newsletters, volunteering and petitions.

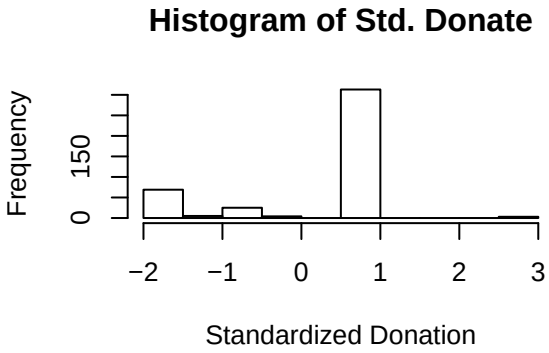
For the explanatory variables of walk, there are 85 participants in the control group, 169 participants in the ground walk group, 165 in the tree walk group.

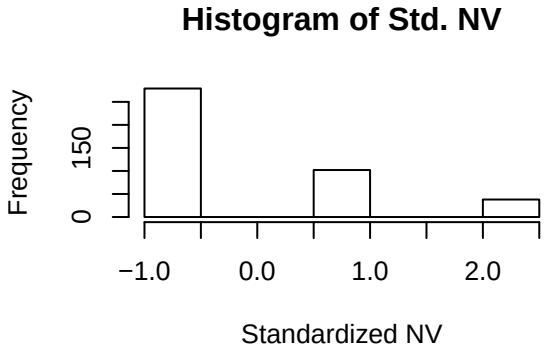
For the explanatory variables of education, there are 85 participants in the control group, 167 participants in the education group, 165 in the non-education group.

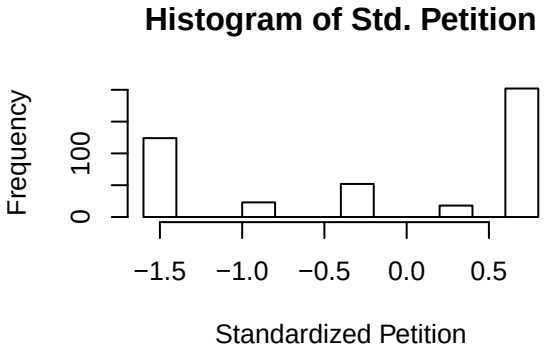
In the missing values, the number of age (missing 13 values), political views (missing 28 values), and financial status (missing 9 values) are large. Thus, we simply use the median of the rest data to substitute the missing value in the age, political views and financial status.

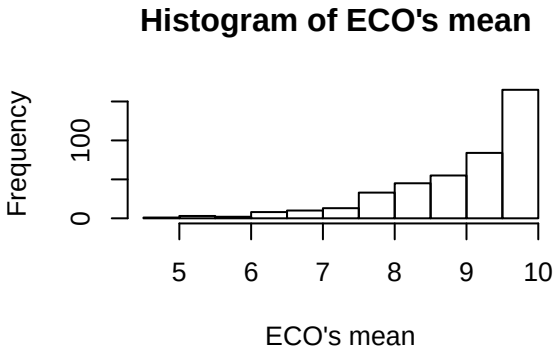
Also, the number of valence (missing 3 values), arousal (missing 3 values) and gender (missing 3 values) are not much; so we simply filter the participants corresponding to these missing values.

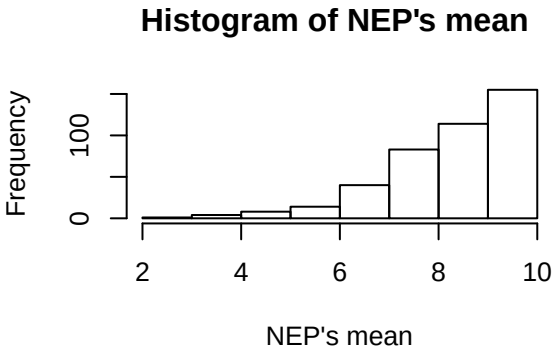


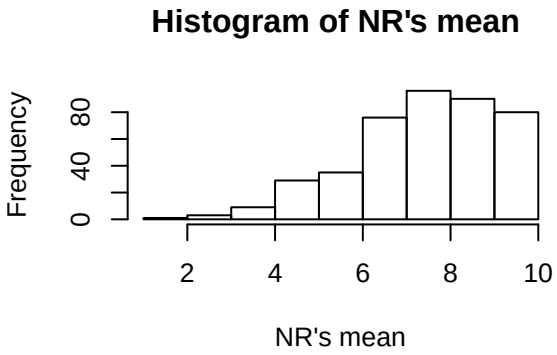




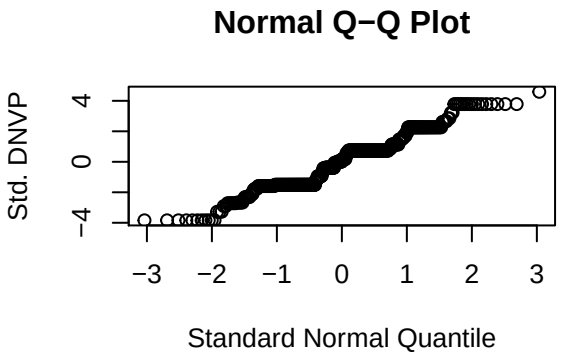


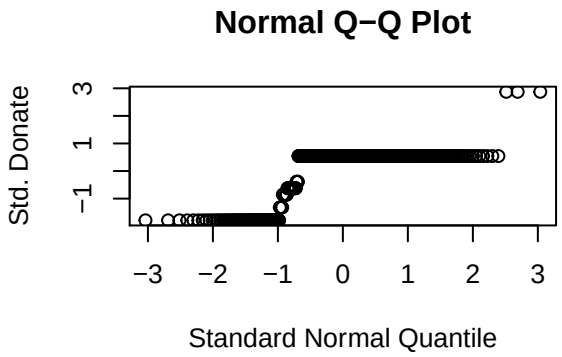


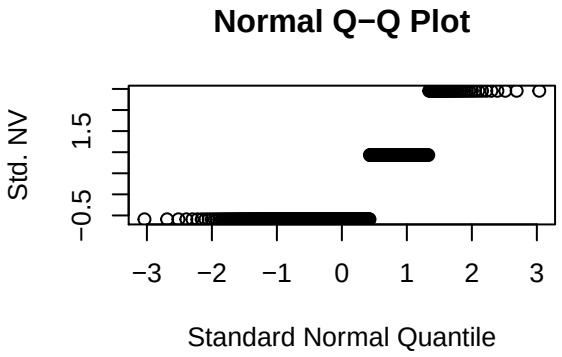


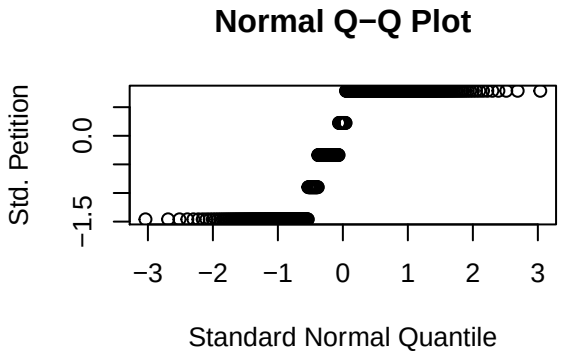


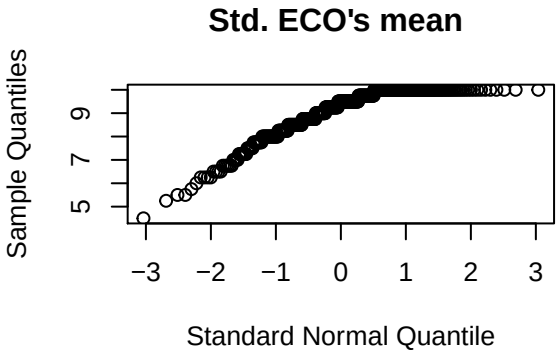
In the Figures above, we see that the histograms of the response variables (standardized sum of response variables of donation, newsletters, volunteering and petitions, standardized donation, standardized newsletters and volunteering, standardized petitions, mean of ECO, mean of NEP, and mean of NR) are not bell-shaped.

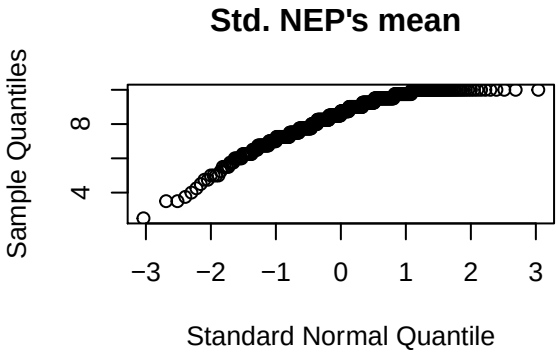

Normal Q−Q Plot
Std. DNVP
−4
0
4
−3
−2
−1
0
1
2
3
Standard Normal Quantile

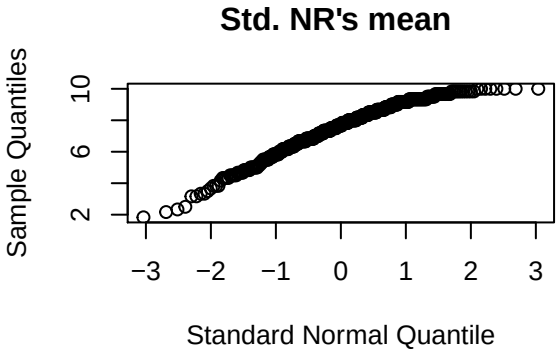

Normal Q−Q Plot
Std. Donate
−1
1
3
−3
−2
−1
0
1
2
3
Standard Normal Quantile


Normal Q−Q Plot
Std. NV
−0.5
1.5
−3
−2
−1
0
1
2
3
Standard Normal Quantile

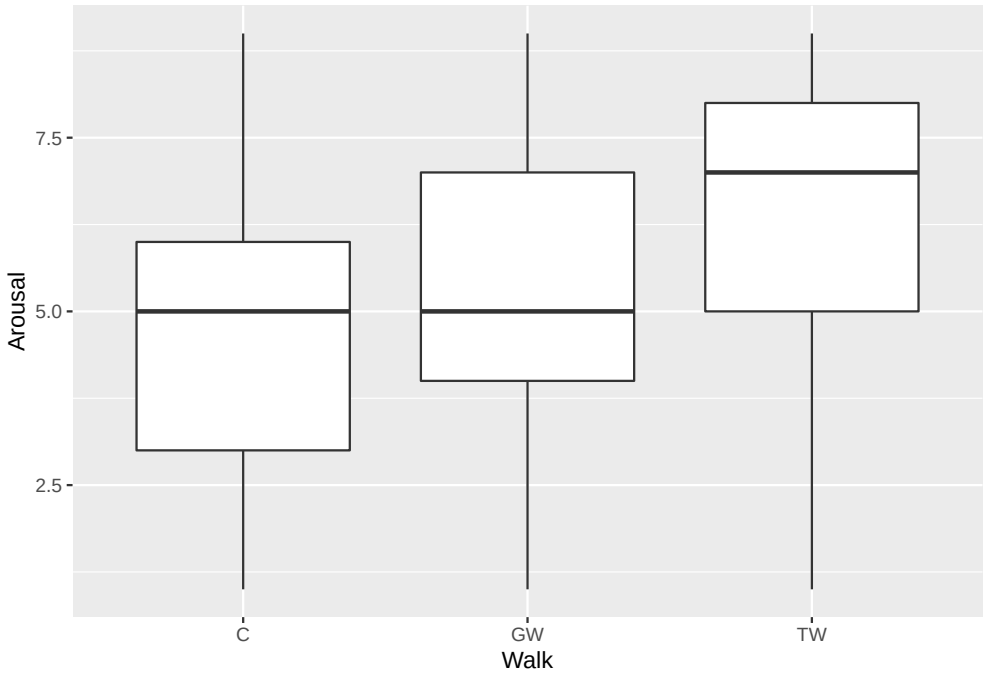

Normal Q−Q Plot
Std. Petition
−1.5
0.0
−3
−2
−1
0
1
2
3
Standard Normal Quantile







Furthermore, in Figures above, we use Q-Q plot to show that the dependent variables (standardized sum of response variables of donation, newsletters, volunteering and petitions, standardized donation, standardized newsletters and volunteering, standardized petitions, mean of ECO, mean of NEP, and mean of NR) are not normally distributed.



As shown in the above figure, different walks will affect the levels of arousal. For the control group, the level of arousal is the lowest; for the tree walk group, the level of arousal is the highest; for the ground walk group, the level of arousal is between the control group and tree walk group.

Methods

We use linear regression models to analyze the relationship between the dependent variable and explanatory variables.

For the dependent variables, we focus on the Z_Beh_Score (the standardized sum of response variables of donation, newsletters, volunteering, and petitions). We fit the linear regression model with explanatory variables: walk, education, and valence.

Meanwhile, we will remove control group observations and analyze walk and education separately; we will keep the control group observations and analyze the condition group; seeing if they give significantly different results.

To further our discussion, we add the mediator measures, including age, gender, political views, and financial status as our explanatory variables; and we add a standardized donation, a standardized sum of newsletters and volunteering, standardized petitions, mean of ECO, mean of NEP, and mean of NR as our dependent variables.

We simply use hypothesis tests to test our linear regression models, that is we test if the coefficients for each dependent variable are significant in the linear regression model. By doing so, we can evaluate the effect of the dependent variables, walk, education, and valence.

Results

We fitted four models for explanatory variables which are walk, education (or condition) and valence with the control group or without the control group.

1. For the linear regression model for three explanatory variables which are walk, education, and valence with the control group, valence is significant, the residual standard error is 1.731, and the adjusted R-squared is 0.01307. All the values of non-education are NA.

2. For the linear regression model for two explanatory variables which are condition and valence with the control group, valence is significant, the residual standard error is 1.733, and the adjusted R-squared is 0.01079.

3. For the linear regression model for three explanatory variables which are walk, education, and valence without the control group, valence is significant, the residual standard error is 1.728, and the adjusted R-squared is 0.002195.

4. For the linear regression model for two explanatory variables which are condition and valence without the control group, valence is significant, the residual standard error is 1.731, and the adjusted R-squared is -0.0006652.

5. For the full linear regression model for walk, education and the rest of explanatory variables with the control group, valence and political are significant, the residual standard error is 1.715, and the adjusted R-squared is 0.03047. All the values of non-education are NA.

6. For the full linear regression model for condition and the rest of explanatory variables with the control group, valence and political are significant, the residual standard error is 1.717, and the adjusted R-squared is 0.02807.

7. For the full linear regression model for walk, education and the rest of explanatory variables without the control group, political is significant, the residual standard error is 1.713, and the adjusted R-squared is 0.02013.

8. For the full linear regression model for condition and the rest of the explanatory variables without the control group, political is significant, the residual standard error is 1.715, and the adjusted R-squared is 0.01708.

We can find that in the full linear regression model, political is a significant explanatory variable for Z_Beh_Score.

Table 1: Linear Regression Model

term	estimate	std.error	statistic	p.value
(Intercept)	-1.2172423	0.6575164	-1.8512729	0.0650345
as.factor(Walk)TW	0.0230911	0.1913663	0.1206643	0.9040312
as.factor(Education)NE	0.0947822	0.1908368	0.4966662	0.6197592
Valence	0.1484571	0.0785163	1.8907809	0.0595402

Table 2: ANOVA for Linear Regression Model

term	df	sumsq	meansq	statistic	p.value
as.factor(Walk)	1	0.0192928	0.0192928	0.0064591	0.9359936
as.factor(Education)	1	0.4252874	0.4252874	0.1423826	0.7061694
Valence	1	10.6784497	10.6784497	3.5750525	0.0595402
Residuals	326	973.7408332	2.9869351	NA	NA

Table 3: Linear Regression Model

term	estimate	std.error	statistic	p.value
(Intercept)	-1.2172423	0.6575164	-1.8512729	0.0650345
as.factor(Walk)TW	0.0230911	0.1913663	0.1206643	0.9040312
as.factor(Education)NE	0.0947822	0.1908368	0.4966662	0.6197592
Valence	0.1484571	0.0785163	1.8907809	0.0595402

Table 4: Linear Regression Model

term	estimate	std.error	statistic	p.value
(Intercept)	-0.9471583	0.7536062	-1.2568345	0.2097273
as.factor(Condition)2	0.0993787	0.2693256	0.3689908	0.7123779
as.factor(Condition)3	-0.0371960	0.2720420	-0.1367289	0.8913308
as.factor(Condition)4	0.0640833	0.2622807	0.2443311	0.8071305
Valence	0.1257692	0.0790588	1.5908309	0.1126320
Age	-0.0070778	0.0057503	-1.2308592	0.2192766
Gender	0.1134584	0.1787364	0.6347806	0.5260237
Political	-0.1482386	0.0639983	-2.3162899	0.0211719
Financial	0.0741401	0.0422406	1.7551844	0.0801817

Table 5: ANOVA for Linear Regression Model

term	df	sumsq	meansq	statistic	p.value
as.factor(Condition)	3	0.7056568	0.2352189	0.0799429	0.9708679
Valence	1	10.6212275	10.6212275	3.6097924	0.0583362
Age	1	3.4151892	3.4151892	1.1607062	0.2821281
Gender	1	2.0149906	2.0149906	0.6848265	0.4085445
Political	1	14.5520966	14.5520966	4.9457606	0.0268502
Financial	1	9.0643770	9.0643770	3.0806721	0.0801817
Residuals	321	944.4903256	2.9423375	NA	NA

Table 6: Linear Regression Model

term	estimate	std.error	statistic	p.value
(Intercept)	-0.9471583	0.7536062	-1.2568345	0.2097273
as.factor(Condition)2	0.0993787	0.2693256	0.3689908	0.7123779
as.factor(Condition)3	-0.0371960	0.2720420	-0.1367289	0.8913308
as.factor(Condition)4	0.0640833	0.2622807	0.2443311	0.8071305
Valence	0.1257692	0.0790588	1.5908309	0.1126320
Age	-0.0070778	0.0057503	-1.2308592	0.2192766
Gender	0.1134584	0.1787364	0.6347806	0.5260237
Political	-0.1482386	0.0639983	-2.3162899	0.0211719
Financial	0.0741401	0.0422406	1.7551844	0.0801817

Table 7: Linear Regression Model

term	estimate	std.error	statistic	p.value
(Intercept)	-0.9471583	0.7536062	-1.2568345	0.2097273
as.factor(Condition)2	0.0993787	0.2693256	0.3689908	0.7123779
as.factor(Condition)3	-0.0371960	0.2720420	-0.1367289	0.8913308
as.factor(Condition)4	0.0640833	0.2622807	0.2443311	0.8071305
Valence	0.1257692	0.0790588	1.5908309	0.1126320
Age	-0.0070778	0.0057503	-1.2308592	0.2192766
Gender	0.1134584	0.1787364	0.6347806	0.5260237
Political	-0.1482386	0.0639983	-2.3162899	0.0211719
Financial	0.0741401	0.0422406	1.7551844	0.0801817

Table 8: Linear Regression Model

term	estimate	std.error	statistic	p.value
(Intercept)	-0.9471583	0.7536062	-1.2568345	0.2097273
as.factor(Condition)2	0.0993787	0.2693256	0.3689908	0.7123779
as.factor(Condition)3	-0.0371960	0.2720420	-0.1367289	0.8913308
as.factor(Condition)4	0.0640833	0.2622807	0.2443311	0.8071305
Valence	0.1257692	0.0790588	1.5908309	0.1126320
Age	-0.0070778	0.0057503	-1.2308592	0.2192766
Gender	0.1134584	0.1787364	0.6347806	0.5260237
Political	-0.1482386	0.0639983	-2.3162899	0.0211719
Financial	0.0741401	0.0422406	1.7551844	0.0801817

We have the linear regression model using a standardized sum of response variables of donation, newsletters, volunteering and petitions as our dependent variable, and condition, valence, age, gender, political, financial as our explanatory variables.

From Table 1-3

Table 1-2: the linear regression model for two explanatory variables which are condition and valence without the control group

Table 3: the linear regression model for three explanatory variables which are walk, education and valence without the control group

If we choose our significant level 0.05, the only p-values for valence are smaller than the significant level. Since we have the condition as a categorical variable, we can then perform the ANOVA test on this linear regression model. Based on the result of the ANOVA, the only valence shows a significant linear relationship to the standardized Beh_Score in our models. The estimated coefficient for valence is positive, which means that the valence has a positive linear relationship to the dependent variable.

From Table 4-8

Table 4-5: the linear regression model for three explanatory variables which are walk, education and valence with the control group;

Table 6: the linear regression model for two explanatory variables which are condition and valence with the control group

Table 7: the linear regression model for three explanatory variables which are walk, education and valence without the control group

Table 8: the linear regression model for two explanatory variables which are condition and valence without the control group

If we choose our significant level 0.05, the only p-values for political are smaller than the significant level.

Since we have the condition as a categorical variable, we can then perform the ANOVA test on this linear regression model. Based on the result of the ANOVA, only political shows a significant linear relationship to the standardized Beh_Score in our models. The estimated coefficient for political is negative, which means that the political has a negative linear relationship to the dependent variable.

Conclusions

In the reduced linear regression model with explanatory variables which are walk, education, and valence, valence is a significant explanatory variable for Z_Beh_Score. Valence shows a positive effect on motivating people to take action on climate change and sustainable development.

In the full linear regression model with explanatory variables which are walk, education and valence age, gender, political views and financial status, political is a significant explanatory variable for Z_Beh_Score. Political shows a positive effect on motivating people to take action on climate change and sustainable development.

```
##
## Call:
## lm(formula = Z_Beh_Score ~ as.factor(Walk) + as.factor(Education) +
##     Valence, data = data_bot)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.0640 -1.4258  0.0664  0.9554  4.4533
##
## Coefficients: (1 not defined because of singularities)
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)             -1.85503    0.61932  -2.995  0.00291 **
## as.factor(Walk)GW        0.15245    0.24901   0.612  0.54073
## as.factor(Walk)TW        0.19292    0.25369   0.760  0.44741
## as.factor(Education)E   -0.10605    0.19105  -0.555  0.57911
## as.factor(Education)NE       NA         NA      NA       NA
## Valence                  0.22148    0.07318   3.026  0.00263 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.731 on 409 degrees of freedom
## Multiple R-squared:  0.02263,    Adjusted R-squared:  0.01307
## F-statistic: 2.367 on 4 and 409 DF,  p-value: 0.05218
```

```
##
## Call:
## lm(formula = ECO_mean ~ as.factor(Walk) + as.factor(Education) +
##     Valence, data = data_bot)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -4.3170 -0.5238  0.3438  0.7917  1.3048
##
## Coefficients: (1 not defined because of singularities)
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)              8.06004    0.36322  22.191  < 2e-16 ***
## as.factor(Walk)GW        0.08532    0.14604   0.584  0.55938
## as.factor(Walk)TW        0.14798    0.14878   0.995  0.32050
## as.factor(Education)E   -0.09589    0.11204  -0.856  0.39259
## as.factor(Education)NE        NA         NA      NA       NA
## Valence                  0.12180    0.04292   2.838  0.00477 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.015 on 409 degrees of freedom
## Multiple R-squared:  0.02097,    Adjusted R-squared:  0.0114
## F-statistic: 2.191 on 4 and 409 DF,  p-value: 0.0693

##
## Call:
## lm(formula = Z_Beh_Score ~ as.factor(Walk) + as.factor(Education) +
##     Valence, data = data_bot_no_control)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.9808 -1.5020  0.0599  0.8926  4.1649
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)             -1.21724    0.65752  -1.851   0.0650 .
## as.factor(Walk)TW        0.02309    0.19137   0.121   0.9040
## as.factor(Education)NE   0.09478    0.19084   0.497   0.6198
## Valence                  0.14846    0.07852   1.891   0.0595 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.728 on 326 degrees of freedom
## Multiple R-squared:  0.01129,    Adjusted R-squared:  0.002195
## F-statistic: 1.241 on 3 and 326 DF,  p-value: 0.2947

##
## Call:
## lm(formula = NR_mean ~ as.factor(Condition) + Valence + Age +
##     Gender + Political + Financial, data = data_bot_no_control)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.5579 -0.9428  0.2703  1.1526  3.6357
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)             4.584120   0.669471   6.847 3.84e-11 ***
## as.factor(Condition)2 -0.103783   0.239257  -0.434  0.66475
## as.factor(Condition)3 -0.605475   0.241670  -2.505  0.01273 *
## as.factor(Condition)4  0.016537   0.232999   0.071  0.94346
```

```
## Valence                0.180240   0.070232   2.566  0.01073 *
## Age                    0.028266   0.005108   5.533 6.53e-08 ***
## Gender                 0.460228   0.158782   2.899  0.00401 **
## Political             -0.075627   0.056853  -1.330  0.18439
## Financial             -0.008195   0.037525  -0.218  0.82727
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.524 on 321 degrees of freedom
## Multiple R-squared:  0.1522, Adjusted R-squared:  0.1311
## F-statistic: 7.205 on 8 and 321 DF,  p-value: 8.634e-09
```