Americans on Climate Change

DIGHUM 100 Theory and Methods | Vivian Kim | Jun 27, 2021

A little bit about my motivation...

It's been decades since environmentalists called for changes to preserve our planet and many changes were made in return. Yet the Trump administration, over the course of four years, succeeded in reversing close to *100* rules regarding to air/water pollution, drilling/extraction, just to name a few. My research is not about politics, but for my curiosity, I wanted to see if I can identify what kind of factors contribute to have someone stand against preserving environment and reasons behind popular and unpopular green activities and policies. The policies mentioned here are not exactly the ones the Trump administration reverted, yet the analysis still gives an idea of the sentiment people have for each policy. Besides, as a former cashier at a grocery store, I found that young men would almost never bring a reusable shopping bag. I will also see if this hypothesis holds.

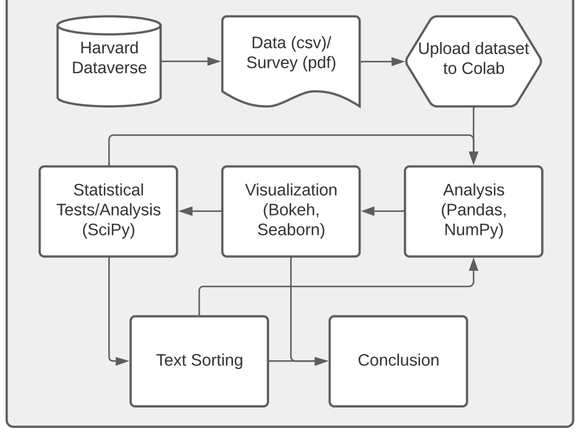
Description/Procedures

How do Americans feel about the ongoing issue of climate change? A survey was given to a sample of people around the world in 2015 asking them how much of negative emotions they connect to climate change, what they believe about climate change, how they intend to conserve energy, what kind of morals they have behind climate change, and what they believe should be done in terms of environment-related policies. Along with a short free-response about what they think the purpose of this survey is, their demographics were asked. I focused on respondents from the United States (402 respondents) to answer the following questions:

1) How do gender, age, and political view affect Americans to feel about the issue of climate change?
2) What are some of the popular and unpopular activities Americans intend to take to conserve energy?
3) What do Americans think about some of the existing or future green policies?
4) Are those people who responded "unsure" to the free-response question any different from who didn't?

The dataset is from Harvard Dataverse, and I worked in the Google Colab environment to run my Python codes. In Reference, I have links to my Google Drive and GitHub as well, where I posted the dataset, the actual survey used in this study, and the Jupyter Notebook. For packages, I used NumPy and Pandas for data manipulation and analysis, Bokeh and Seaborn for visualization, and SciPy for statistical analysis (2 sample T-test and regression analysis). For details of the statistical tests and conditions, check my Jupyter Notebook. The roadmap shows the steps I took to create this research project in chronological order. For each question, its statistical analysis follows.

Roadmap



Question 2

A section of the survey asks what kind of actions are they intend to take to conserve energy and lists of 11 activities: using energy efficient bulbs (**Bulbs**), setting heater to 65° F or below in winter (**Winter**), setting AC to 75° F or above in summer (**Summer**), waiting for a full load before using a washing machine (**Washing**), using a clothesline and not a dryer (**Dryer**), recycling (**Recycling**), buying recycled paper (**Paper**), drinking tap water to reduce plastic (**Water**), using reusable/recycled shopping bags (**Bags**), driving less or not at all (**Drive**), and voting for politicians with environmental policies (**Vote**). I took the average in each category and sorted them from the lowest to highest (1 = *no intention*, 7 = *definitely*). The least popular activities are giving up on using a dryer and driving less/not at all. The most popular activities are waiting to use a washing machine until a full load and recycling. The table shows activities in order from the least popular to most popular.

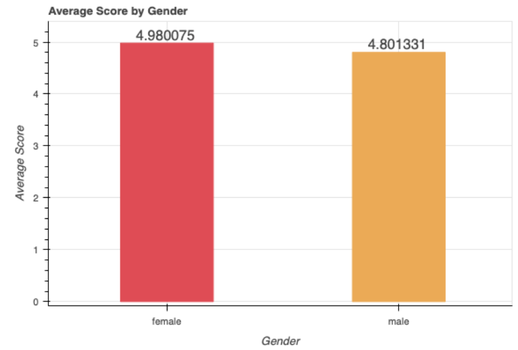
Activities	Average Score
Dryer	3.353234
Drive	3.850746
Winter	4.427861
Summer	4.664179
Paper	4.796020
Vote	5.014963
Bags	5.019900
Water	5.268657
Bulbs	5.485075
Recycling	5.743781
Washing	5.791045

Question 1

This is my most anticipated section of the research! I grouped the dataset by gender, age, and political standpoint and got the average of the sentiment scores, which are in a scale of *1* to *7* with 1 being apathetic and 7 being mindful of climate change. I conducted statistical tests to further explore the relationships of given variables.

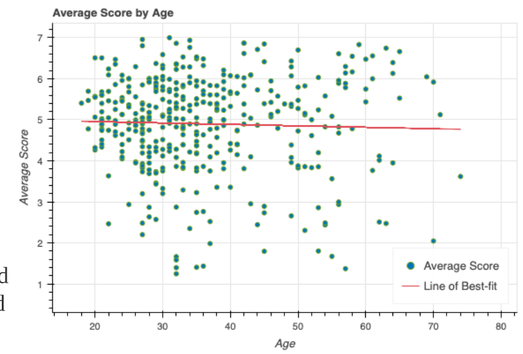
Gender

From the graph, we can see that the average scores for women and men are about 4.980 and 4.801 respectively, which doesn't seem too far off from each other. Women in this sample answered slightly more empathetic about environmental issues. To see if their difference hold any statistical meanings, I conducted a 2 sample T-test. I first checked if conditions were met (2 SRS's with their distributions in a similar shape), I proceeded to use `ttest_ind` in the `stats` function of SciPy. The null hypothesis would be that the two means are equal whereas the alternative hypothesis would say their difference is statistically significant, or they are not equal. The resulting P-value is 0.1315, which at 5% level, I failed to reject the null hypothesis. Their difference in means is not significant and gives evidence that the two means are equal.



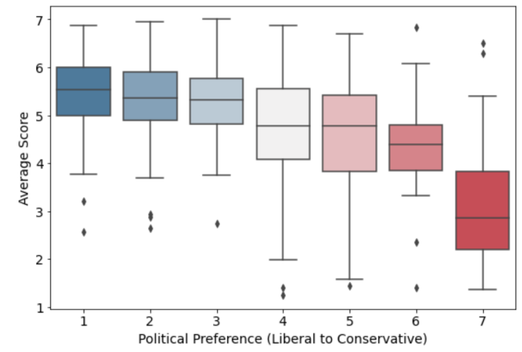
Age

The graph shows individuals' scores based on their age. We can see that data points in the upper left corner is more clustered than the rest, meaning that younger people (around the age 20 to 40) scored higher than the older people. Interesting to note that the data points are more widely spread in older age groups, yet still more data points in the upper half than the lower half (halfpoint is at 4). The regression line is also obtained using `linregress` in `stats` function of SciPy then plotted: `y = -0.0035x + 5.026`. The R-value is -0.0346, meaning the relationship between age and the average score is very weak and they are almost uncorrelated. To see how much of data this regression line represents, I computed the R-square value of 0.0012. Less than 1% of the data is explained by the regression line! This is due to how widely spread the data points are and their linear relationship is inconclusive.



Political Preference

Similar to the gender graph, I used a bar plot to show the seven political groups from 1 to 7, with 1 being strongly liberal to 7 being strongly conservative. To better show this on the graph, I used a box plot of Seaborn and each box represents a group in order. The boxes are also shown in different colors: blue and red for democratic and republican parties respectively. Due to different number of sample sizes and standard deviations for each group, I used a non-parametric version (compares the medians instead of means) of the one-way ANOVA (Analysis of Variance), called *Kruskal-Wallis* test. For such a task, I used `stats.kruskal` from SciPy. The obtained P-value is 8.344e-13, which is much smaller than 0.05, at 5% level. However, this just means that not all the medians in the group are equal and their difference is not due to a random chance. I would have to conduct further analysis to see how different each group is to another, yet I conducted a feature correlation analysis instead in the next page.



Question 1 (continued)

I continued a similar process of 2 sample T-test to see if young male respondents are any different from the rest. After I analyzed the three variables (gender, age, political preference) in the previous page, I wanted to compare those three this time as I found the result "uncorrelated" not satisfying. Yes, uncorrelated, but by *how much*? The analysis follows.

Feature Comparison

I compared the three features (gender, age, and political preference) using the built-in function `corr` of Pandas and the `heatmap` from Seaborn for visualization. The `corr` evaluates pairwise correlations of columns and `heatmap` gives each combination block a color, depending on the correlation value. This way, I can easily compare the correlations of the features. These correlations might be *different* from what I obtained in the previous section because these are the correlations of each data point, not the average. Nonetheless, they all are either strongly or weakly *negatively* correlated which is what we expected. In exact values, correlations of `total_avg` follows: with gender (`Gender`), -0.075; with age (`Age`), -0.035; with political preference (`LibCon`), -0.430. Notice the correlation is multiples larger for political preference compared to the other three variables. Though gender has a slightly larger correlation, both gender and age have very small correlations. The closer correlation is to 0, the more uncorrelated the two variables are.

Young Men vs. the Rest

To answer my hypothesis that young men buys paper bags from grocery stores more often than bringing reusable ones, I compared their average scores to the rest. I thought of comparing their responses to one of the statements in Question 2 asking for intentions, yet the *intention* is not what I could observe as a cashier. Hence I compared the average scores again. I selected males between the age of 18 to 35 from the dataset. Their average was 4.805 and the rest had the average score of 4.934. I, once again, used `stats.ttest_ind` of SciPy after meeting all conditions to see if their difference was statistically significant and the resulting P-value of 0.3364 pointed to "*No*."

Further Questions

1) How can we convince more people to participate in ensuring environmental sustainability?
2) What can we do to promote green activities more effectively?
3) Can policies be used as a tool to motivate people to do more environmentally-friendly activities?
4) How can we restrain politicians from threatening out environment for political reasons?
5) What other factors contribute to a person's environmental-unfriendliness? (ie. level of education, income, etc.)

Question 4

Upon manually checking the responses to the free-response question asking if they can guess what the purpose of the survey is, I figured most people guessed something along the lines of environment. Some respondents guessed it was a psychological research to see how they answer to the questions after reading the first intro page (which it was, actually). However, about 3.98% of the people responded "unsure" to this question. There are 16 respondents in this group and I compared their mean score (4.850 for "unsure") to the rest (4.903 for "sure") who responded not "unsure." Though I believe some responded this way out of pure laziness, I thought it would still worth to find out if the difference in their scores has a significant meaning statistically. I, again, conducted a 2 sample T-test. It was a bit trickier than Question 1, since the "unsure" group is much smaller than the "sure" group. However, the sample size of 16 is considered large enough, I proceeded to use `stats.ttest_ind` of `SciPy`. The P-value is evaluated to be 0.8628, which, at 5% level, I fail to reject the null hypothesis of their means being equal. The table on Question 4 has the list of the people and their demographics in the "unsure" group and their actual responses to the question.

Gender	age	LibCon	Purpose
male	31	3	I don't know
male	21	1	I can't even begin to guess.
female	19	2	no idea
male	24	3	Not sure
female	21	1	I'm not sure
male	34	1	I am not sure.
male	23	4	unsure
male	43	4	I'm not sure.
female	34	2	unsure
female	24	4	not sure
male	23	1	not sure really
male	32	1	i have no idea
male	29	1	I AM UNSURE
female	27	6	\I am not sure"
female	29	4	I really dont know
female	28	3	i'm not sure

Question 3

Part 7 of the survey is about whether or not respondents agreed or disagreed to a certain policy. These questions are answered in *Yes* or *No* (1 = *Yes*, 2 = *No*). The policies mentioned follows: a fee for a disposable plastic shopping bag (**Plastic**), a rebate for a reusable shopping bag (**Reuse**), a rebate for a reusable cup (**Cup**), a commuter tax for driving a car alone during rush hour (**Commute**), tax credits for hybrid/electric cars (**Hybrid**), a fee for owning a car with a low fuel efficiency (**MPG**), and extra paid time off for carpooling employees (**Carpool**). I computed the average value for each policy and the table on the right shows the least popular to the most popular in order. The popular policies are a rebate for a reusable shopping bag and tax credits on hybrid vehicles, and the unpopular ones are a fee for fuel-inefficient cars and a commuter tax for people driving during the rush hour.

Policies	Average Score
Reuse	1.136816
Hybrid	1.166667
Cup	1.194030
Carpool	1.417910
Plastic	1.509950
MPG	1.554726
Commute	1.788557

Interpretation

1) Based on my personal observation made as a cashier at a local grocery store, my hypothesis was that young men (age 18 to 35) would have a lower average sentiment score. However, after conducing 2 sample T-tests on two gender groups, it's found that gender does *not* play a significant role in deciding whether or not the person cares and actively participates in cherishing our environment. Similarly, the age and average score are analyzed to be *uncorrelated*. Thus my hypothesis was **rejected**. I would have been disappointed to find no linkage among my chosen features, yet I was able to find a relationship between the political preference and average score. I observed that the *more* conservative someone is, he/she is *more* likely to be indifferent to protecting environment. Thought the Kruskal-Wallis test requires a further analysis to conclude relationships among political preference groups, it was beyond my level of knowledge. Instead, I compared the correlations of features and found that political preference and the average score had its correlation much *higher* than the rest. It would have been better to have other information about the respondents such as their education level, income, location, etc. to further inspect different contributions and draw a clearer conclusion.
2) I analyzed the most popular and least popular intended environmental activities. From the most to least in order, the list goes like this (see previous page for which activity each word represents): washing, recycling, bulbs, water, bags, vote, paper, summer, winter, drive, and dryer. Perhaps geographically and culturally it's harder for Americans to give up on driving due various reasons like safety or underdeveloped public transportation, yet other activities such as giving up on using a dryer or setting an A/C or heater to a certain temperature can be easily achieved. I can see we have a room for improvement.
3) The most supported to least supported policies follows (refer to Question 3 for which policy each word represents): reuse, hybrid, cup, carpool, plastic, MPG, and commute. It's clear that people support *rewards* more than *punishments*.
4) In my opinion, the people who could not guess are a *bigger* threat than the ones who incorrectly guessed because it may have mean that the attempt to educate people on this matter was *insufficient*. However, when I conducted a 2 sample T-test to compare the difference in their average scores ("unsure" group and "sure" group), I saw that their difference is statistically **insignificant**. I planned to analyze further about this "unsure" group, but since the result of the T-test showed that they are no different, I stopped here.

Conclusion

The fundamental question I wanted to find an answer was, "what makes a person not interested or feel indifferent to saving our planet?" It was not the generation gap or gender difference, but *other humans*. We all call this planet as our home and indubitably, it *must* be our job to protect our home as much as we can. This also means that we shall **NOT** use, or even worse, *threaten* our home to gain political support. Having political preference as the biggest contributor also brings up an important point that we have to educate children the severity of global warming and climate change but also how to detach *facts* from *beliefs*. From the result regarding to green activities, how these activities get promoted and exposed to the public is the key, especially when there is an alternative method already available. For example, it might not be so clear that opting out of using a dryer cuts over a ton of greenhouse gas and synthetic fibers per year, whereas we most likely can connect recycling as an environmentally-friendly activity from how recycling has been advertised. As for policies, it's obvious that people want to get paid instead of getting fined. Using this logic of rewarding those who participate, green policies can be enforced more effectively by motivating people and not only relying on volunteers. On a brighter note, people *can* change their beliefs, opinions, and political views. It might take some time, yet as a community we must continue to raise awareness about environmental issues and reward those who engage in such activities while *penalizing* those purposely harming our home for "personal" reasons.

References

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Images: https://www.nursingcenter.com/ncblog/november-2019/climate-change
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