Satisfaction with Netflix Recommendations

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ABSTRACT
This paper is to examine if people were satisfied with their Netflix recommendations. The recommendation system used by Netflix is one of a kind and its reach is unprecedented. We are using the data we collected of 102 university students. We ran both simple and multiple linear regression. We are going to use the analysis to check for the satisfaction level with Netflix recommendations.

Keyword
Netflix Recommendations; Multiple Linear Regression; Linear Regression

INTRODUCTION
As a part of this study we are will be constructing simple and multiple linear regression models to identify the statistically significant independent variable. We will use this to confirm or bust the myth. The myth we were trying to analyze here is "Netflix recommendations are based on our tastes." This myth was personal to us as we are long-time Netflix users and have not been satisfied with our recommendations. Let's start by defining the hypotheses.

*Null Hypothesis***:** On average, Netflix recommendations are based on one's taste.

Alternate Hypothesis: On average, Netflix recommendations are not based on one's taste.

We expected to find that Netflix does not typically provide recommendations based on our tastes. The results of our statistical test will be valuable because millions of people use Netflix and they are likely interested in knowing if their Netflix recommendations are worth looking at. Our analysis may inform people whether they need to consult outside sources for appealing Netflix content.

STUDY DESIGN
Our independent variable is the length of time people have used their Netflix profiles. The dependent variable is how often people feel Netflix recommendations are related to their viewing history. Both variables are ordinal. We used a Likert scale for the dependent variable.

The population for this analysis is made of students in higher education who use Netflix. Our sample are students at the University of Maryland. We collected our data with a Google Form Survey. This is an observational study. Potential sources of bias are non-response bias and convenience sampling bias. Potential confounding variables are algorithm changes at Netflix.

This is an observational study where we have asked all the people in our sample questions regarding their age, gender, degree, presence of Netflix account, hours spend on Netflix every day and weekly, years they are using their Netflix account, if Netflix recommendations reflect diversity of their interest, if Netflix recommendations related to their viewing history and how often are they interested in their recommendations.

The sample observations in our experiment are independent and consist of less than 10% of the population.

VARIABLES SCALES OF MEASURMENT
As a part of this study we asked 11 questions to gather data. Now that we have declared our hypothesis, we will declare crucial parameters.

1. Do you have a Netflix account or profile? Yes, I have a Netflix account and profile, I do not have an account but I do have a profile, I do not have a Netflix account or profile
2. Age: Text field
3. Gender: Male, Female, prefer not to say
4. Which degree are you pursuing right now? Undergraduate, Graduate and Doctorate
5. How many hours do you spend on Netflix every day?(in hours): 0, 0-2, 2-4, 4-6, 6-8, 8+
6. We kept 6 options to avoid people going with the convenient middle option.
7. How many hours have you spent on Netflix in the past week? (in hours): 0, 0-5, 5-10, 10-15, 15-20, 20+
8. For how many years have you been using current Netflix profile? 0, 1,2,3,4,5+
9. Do your Netflix recommendations reflect the diversity of your viewing interests? Never, Almost Never, Sometimes, Often, Always
10. How often are your Netflix recommendations related to your viewing history? Never, Almost Never, Sometimes, Often, Always
11. How often are you interested in your Netflix recommendations? Never, Almost Never, Sometimes, Often, Always

DATA COLLECTION
There are ten variables in this data set. The independent variables are "How many hours do you spend on Netflix everyday ? (in hours)," "How many hours have you spent on Netflix in the past week? (in hours)," and "For how many years have you been using your current Netflix profile?" The dependent variable is "Do your Netflix recommendations reflect the diversity of your viewing interests?" We have 102 observations. Here is our survey.

A source of bias that originally came up in our data collection was the non-response bias. We originally asked friends to complete the survey. Not everyone opted to fill out the survey, meaning there could be a meaningful difference between those who completed the survey and those who did not. To gather more observations, we posted the survey on Reddit. We got around 70 observations from that Reddit post. Though we got more observations, this introduced a convenience sampling bias. The majority of our responses come from the University of Maryland subreddit (reddit.com/r/umd) and may not be representative of our intended population of students in higher education who use Netflix.

DATA ANALYSIS
We initially used simple linear regression tests. We chose this statistical test because we wanted to find out how much of the variation in our dependent variable could be explained by the independent variables. With our number of independent variables, we should have used multiple linear regression. However, we did not know how to do this test when we initially performed our analysis.

DESCRIPTIVE STATISTICS FOR VARIABLES
"Do you have a Netflix account or profile?" The mode for this variable is "Yes, I have a Netflix account and profile." The mean is 2.69, which is between "I do not have an account but I do have a profile" and "Yes, I have a Netflix account and profile." The standard deviation is 0.56.

"Age." The mean age for respondents is 22 and the standard deviation is 3.69. The youngest age is 18 and the oldest age of the respondents is 33.

"Gender." Most respondents are female. 58 of the respondents identify as female and 44 identify as male.

"Which degree are you pursuing right now?" The mode for this variable is "Undergraduate." The median is 1, which is the "Undergraduate" response, and the IQR is 1.

"How many hours do you spend on Netflix everyday?" The mode for this variable is 0-2 hours. The mean is 2.14, which is between the 0-2 hours and 2-4 hours responses. The standard deviation is 0.65.

**How Many Hours Respondents Spend
on Netflix Per Day**
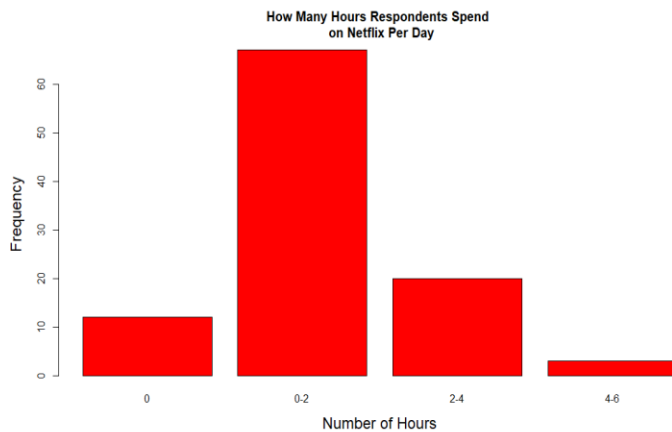
"How many hours have you spent on Netflix in the past week?" The mode for this variable is 0-5 hours. The mean for this variable is 2.61, which is between the 0-5 hours and 5-10 hours responses. The standard deviation is 1.22.

**How Many Hours Respondents Spent
on Netflix in a Week**
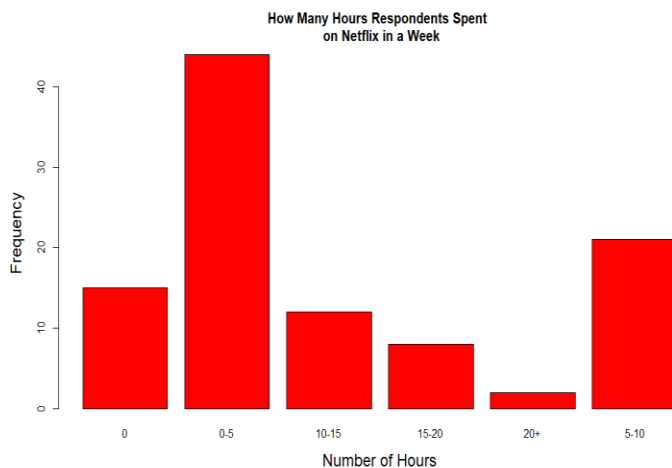
"For how many years have you been using your current Netflix profile?" The median for this variable is 4, which is 3 years. The IQR is 4. The mode for this variable is 5+ years.

**How Many Years Respondents Have
Used Their Current Netflix Profile**
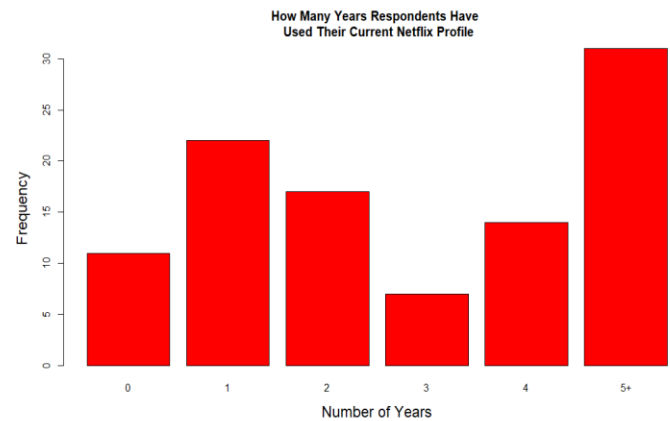
"Do your Netflix recommendations reflect the diversity of your viewing interests?" The mode for this variable is "Sometimes." The mean is 3.78, which is between "Not Often" and "Sometimes." The standard deviation is 1.17.

**Whether Netflix Recommendations Reflect the
Viewing Interests of Respondents**
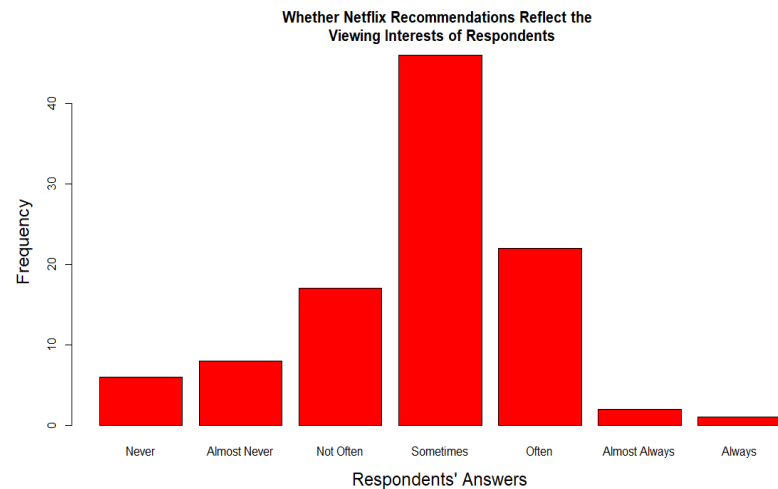
"How often are your Netflix recommendations related to your viewing history?" The modes for this variable are "Sometimes" and "Often." When turned into a continuous variable, the mean is 5.29, which is between "Often" and "Almost Always." The standard deviation is 2.

"How often are you interested in your Netflix recommendations?" The mode for this variable is "Sometimes." The mean is 3.48, which is between "Not Often" and "Sometimes." The standard deviation is 1.18.

REGRESSION MODELS
"DV" refers to the dependent variable "Do your Netflix recommendations reflect the diversity of your viewing interests?"

Linear regression for "How many hours do you spend on Netflix every day?" and DV: The result of this test is not statistically significant as the p-value is more than 0.05. One rank change in the hours spent on Netflix every day corresponds to an average of 0.21 rank increases in the DV. The variables are positively correlated but have a very weak relationship.

```
Call:
lm(formula = as.numeric(reflect) ~ hoursday)

Residuals:
    Min     1Q Median     3Q    Max
-2.9612 -0.7444  0.2556  0.4724  3.2556

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.3107     0.4020   8.236 7.48e-13 ***
hoursday      0.2168     0.1809   1.199    0.233
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.163 on 99 degrees of freedom
Multiple R-squared:  0.01431,   Adjusted R-squared:  0.004354
F-statistic: 1.437 on 1 and 99 DF,  p-value: 0.2334
```

FIG1 : SCREENSHOT OF THE SUMMARY OUTPUT FOR LINEAR REGRESSION FOR "HOW MANY HOURS DO YOU SPEND ON NETFLIX EVERY DAY?" AND DV

Linear regression for "How many hours have you spent on Netflix in the past week?" and DV: This test is not statistically significant as the p-value is more than 0.05. The variables are negatively correlated. One rank change in the hours per week spent on Netflix corresponds to an average of 0.01 rank decreases in the DV. These variables appear to have nearly no relationship.

```
Call:
lm(formula = as.numeric(reflect) ~ hoursweek)

Residuals:
    Min     1Q Median     3Q    Max
-2.7968 -0.7724  0.2154  0.2642  3.2276

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.80902    0.23188  16.427   <2e-16 ***
hoursweek    -0.01221    0.06661  -0.183    0.855
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.171 on 99 degrees of freedom
Multiple R-squared:  0.0003392, Adjusted R-squared:  -0.009758
F-statistic: 0.03359 on 1 and 99 DF,  p-value: 0.8549
```

FIG2 : SCREENSHOT OF THE SUMMARY OUTPUT FOR LINEAR REGRESSION FOR "HOW MANY HOURS HAVE YOU SPENT ON NETFLIX IN THE PAST WEEK?" AND DV

Linear regression for "For how many years have you been using your current Netflix profile?" and DV: The result for this test is statistically significant as the p-value is less than 0.05. However, the effect size is 0.04, so it is small. The power is only 0.51. One rank change in the years of using the Netflix profile corresponds to an average of 0.14 rank increases in the DV. The variables are positively correlated but have a weak relationship.

```
Call:
lm(formula = as.numeric(reflect) ~ yearsused)

Residuals:
     Min      1Q  Median      3Q     Max
-2.65347 -0.65347  0.06419  0.62886  2.92303

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.22997    0.26508  12.185   <2e-16 ***
yearsused    0.14117    0.06234   2.264   0.0257 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.142 on 99 degrees of freedom
Multiple R-squared:  0.04924,   Adjusted R-squared:  0.03964
F-statistic: 5.127 on 1 and 99 DF,  p-value: 0.02573
```

FIG3 : SCREENSHOT OF THE SUMMARY OUTPUT FOR LINEAR REGRESSION FOR "FOR HOW MANY YEARS HAVE YOU BEEN USING YOUR CURRENT NETFLIX PROFILE?" AND DV

We incorporated the feedback we received after our presentation and performed multiple linear regression. This test has low power, a small effect size, and the number of years on the profile is still the only statically significant variable.

```
Call:
lm(formula = as.numeric(reflect) ~ hoursweek + hoursday + numyears)

Residuals:
     Min      1Q  Median      3Q     Max
-2.57971 -0.57971  0.07989  0.60492  2.96781

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.98746    0.44381   6.731 1.18e-09 ***
hoursweek   -0.03736    0.06865  -0.544   0.5876
hoursday     0.18463    0.19041   0.970   0.3346
numyears     0.13126    0.06360   2.064   0.0417 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.148 on 97 degrees of freedom
Multiple R-squared:  0.05901,   Adjusted R-squared:  0.02991
F-statistic: 2.028 on 3 and 97 DF,  p-value: 0.1151
```

FIG4 : SCREENSHOT OF THE SUMMARY OUTPUT FOR MULTIPLE LINEAR REGRESSION

The power of the multiple linear regression came out to be 0.3586. The effect size for this test was 0.04.

CONCLUSION

We do not reject our null hypothesis. Based on our analysis, we cannot conclude that Netflix recommendations are not based on one's tastes. Our only statistically significant variable, "For how many years have you been using your current Netflix profile?" has a positive correlation with our DV. This means that on average, using a Netflix profile for a longer period of time is associated with more accurate recommendations. The results of our analysis lead us to conclude that we chose poor independent variables. Very little of the variation in our DV is explained by our IVs, which are all related to time spent on Netflix. While students may feel Netflix recommendations do not reflect the diversity of their viewing interests, we cannot conclude that time spent on Netflix is the reason why.

WEAKNESSES

We have several weaknesses with our analysis. We did not include a response option in our survey for people who are not enrolled in higher education. For our variables "How many hours do you spend on Netflix everyday?" and "How many hours have you spent on Netflix in the past week?" we mistakenly wrote the response options as "0" and "0-2" or "0-5." We meant for the choices to be "0" and "1-2" or "1-5." This may have confused respondents and people who meant to answer 0 may have selected the option where the minimum was supposed to be 1. This may make the results of our statistical tests incorrect. We also did not include any independent variables in our hypotheses. We did not make it clear what IVs we predicted would influence our DV.

The most important weakness for our analysis is our selection of independent variables. We should have considered other possible influences on how one feels about their recommendations, instead of only focusing on how much and how long they have been using Netflix.

REFERENCES
1. Multiple (Linear) Regression in R
   https://www.statmethods.net/stats/regression.html