SYMBIOSIS STATISTICAL INSTITUTE

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MSc. Applied Statistics

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SLDM Warm Up Task-I: Learning from Data

A Report on the Case Study titled
'Perceptions of Gender Roles in the Advertising Industry'

Submitted by:

Team No. 22

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1. INTRODUCTION

Jamie Drout's 'Perceptions of Gender Roles in the Advertising Industry' case study is focused on understanding consumer perceptions of advertising strategies. A survey comprising 10 questions seeking customers' opinions on stereotypes in marketing for health and beauty products was deployed. Jamie received 105 responses, which are enclosed within the Excel file viz., 'Drout Advertising Survey'.

Gender stereotypes, which usually exploit gender norms and are widely used in marketing for beauty products, explicitly leverage cultural beliefs of what makes a man or woman attractive, acceptable, and desirable. Men are portrayed as powerful and masculine with chiseled physical bodies, occupying substantial amounts of physical space to maintain their masculinity and power; women are portrayed as delicately feminine, strikingly beautiful, and physically flawless, occupying small amounts of physical space that typically exploit their sexuality.

In contrast, empowerment advertising strategies negate gender stereotypes and visually communicate the unique differences in each individual. In empowerment advertising, men and women are to represent the diversity in beauty, body type, and levels of perceived femininity and masculinity.

2. PROBLEM STATEMENT: To analyze the data to seek answers to the relationship between stereotype versus empowerment advertising.

3. DATA DESCRIPTION:

- **Classification of the data:** The 'Drout Advertising Survey' dataset comprises **5 categorical variables** viz., Gender, Education, Income, Reinforcing, Transform, and **5 numerical variables** viz., Age, Spending, Ad Frequency, Stereotype, and Employment Percentage.

- We introduced a numerical variable 'Stereotype Percentage' to make valid comparisons between 'Empowerment Percentage' and 'Stereotype Percentage' with an aim to find a relationship between Empowerment advertising and Stereotype advertising. The 'Stereotype Percentage' depicts the percentage of stereotypic advertisements using ad frequency and stereotype.

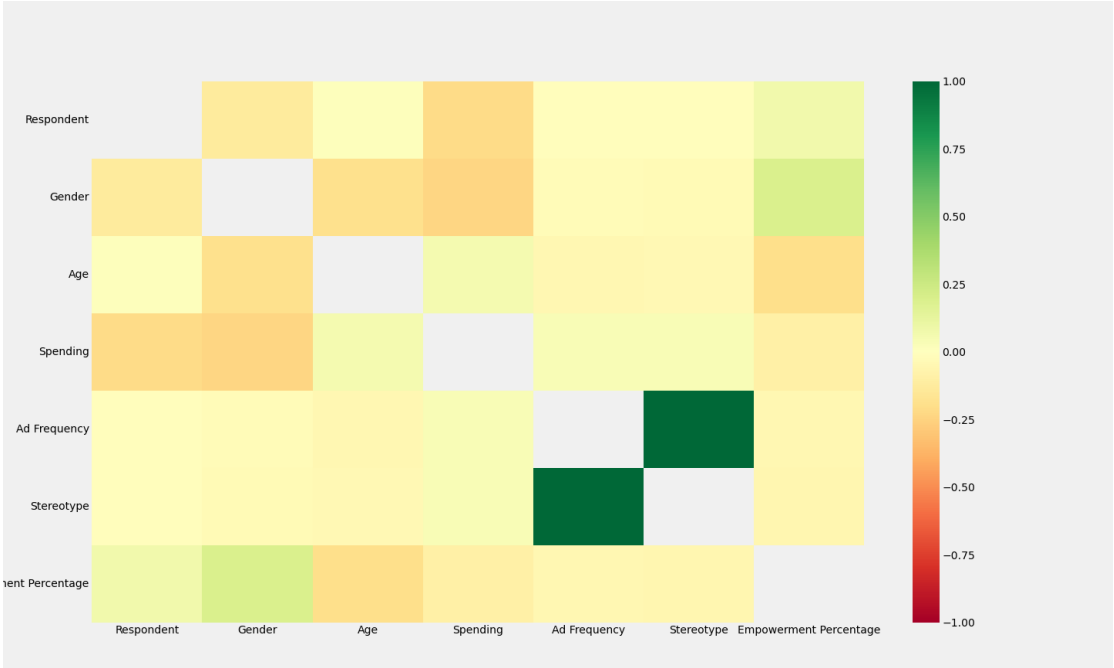
- **Descriptive Statistics:**

	Respondent	Age	Spending	Ad Frequency	Stereotype	Empowerment Percentage	Stereotype Percentage
count	105.000000	105.000000	105.000000	105.000000	105.000000	105.000000	105.000000
mean	53.000000	29.266667	649.923810	45.457143	43.380952	5.361905	92.000000
std	30.454885	11.811229	806.490756	129.694762	124.808036	6.222051	15.625423
min	1.000000	19.000000	20.000000	0.000000	0.000000	0.000000	20.000000
25%	27.000000	23.000000	200.000000	5.000000	5.000000	0.000000	90.000000
50%	53.000000	24.000000	400.000000	12.000000	10.000000	3.000000	100.000000
75%	79.000000	30.000000	600.000000	35.000000	30.000000	10.000000	100.000000
max	105.000000	68.000000	5000.000000	1100.000000	1050.000000	30.000000	100.000000

4. EXPLORATORY DATA ANALYSIS:

After data cleaning, the dataset was imported into Python to perform Exploratory Data Analysis.
For a quick and in-depth insight into the data, the 'dtale' Library in Python was used to explore the data further.

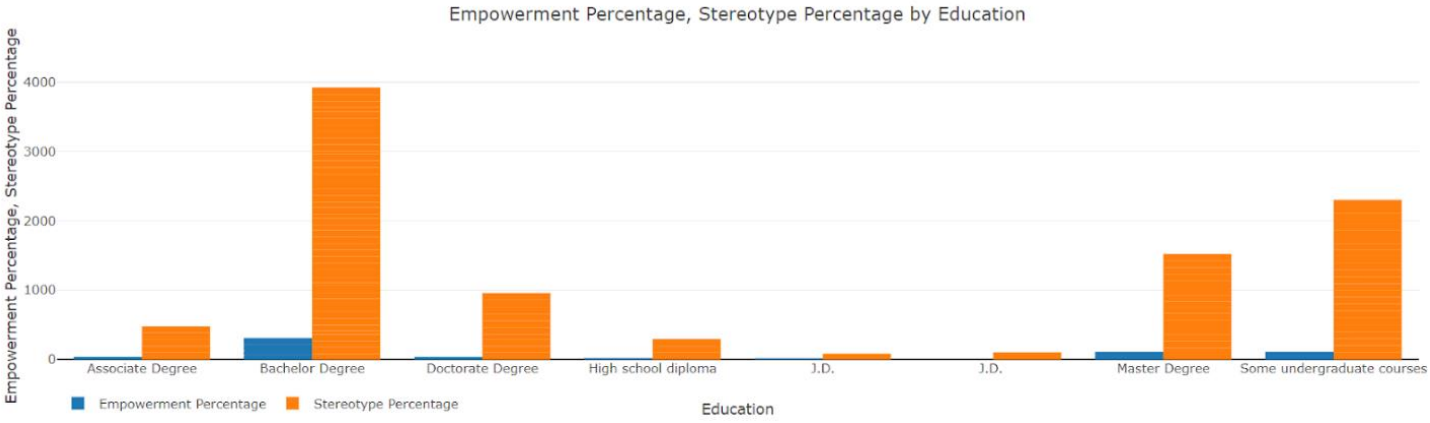
- The below Heat map provides an immediate visual summary of the relationships between the variables. As seen, there seems to be a perfect positive correlation between the 'Stereotype' and 'Ad Frequency' variables.



- To get the exact correlation between the different variables, we used below Pearson's correlation matrix:

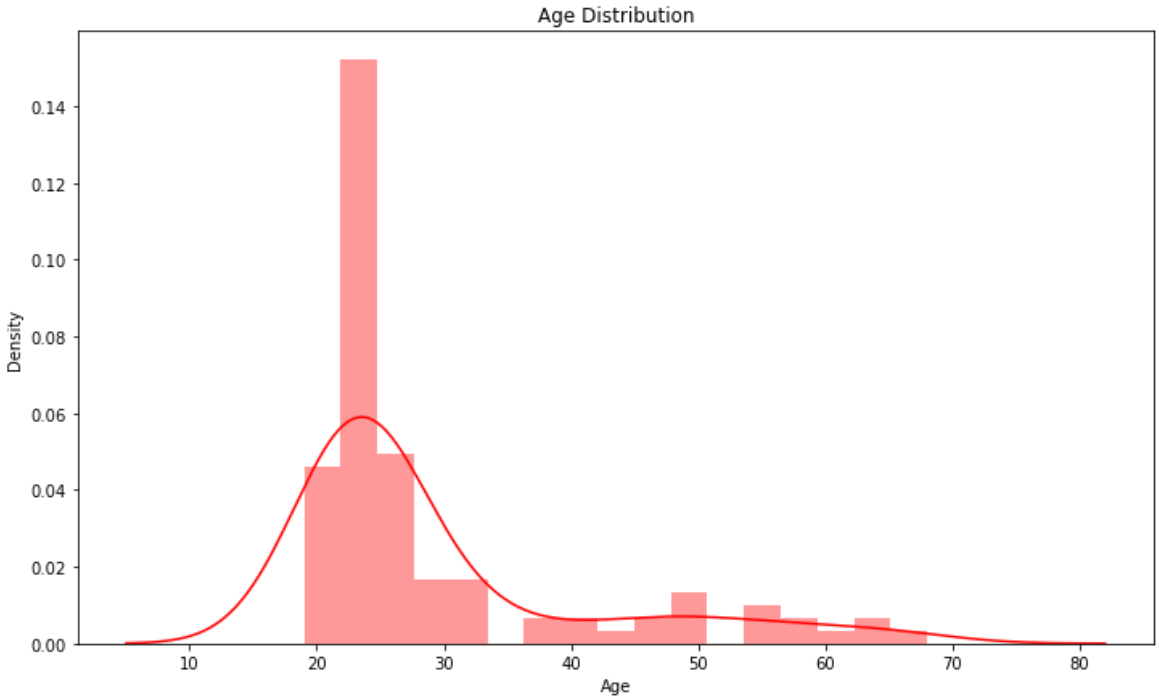
	Ad Frequency	Age	Empowerment Per...	Respondent	Spending	Stereotype	Stereotype Perc...
Respondent	-0.01	0.01	0.07	N/A	-0.21	-0.01	0.08
Age	-0.05	N/A	-0.20	0.01	0.05	-0.05	0.13
Spending	0.03	0.05	-0.09	-0.21	N/A	0.04	0.18
Ad Frequency	N/A	-0.05	-0.05	-0.01	0.03	1.00	0.07
Stereotype	1.00	-0.05	-0.06	-0.01	0.04	N/A	0.10
Empowerment Per...	-0.05	-0.20	N/A	0.07	-0.09	-0.06	-0.30
Stereotype Perc...	0.07	0.13	-0.30	0.08	0.18	0.10	N/A

- Empowerment Percentage, Stereotype Percentage by Education:



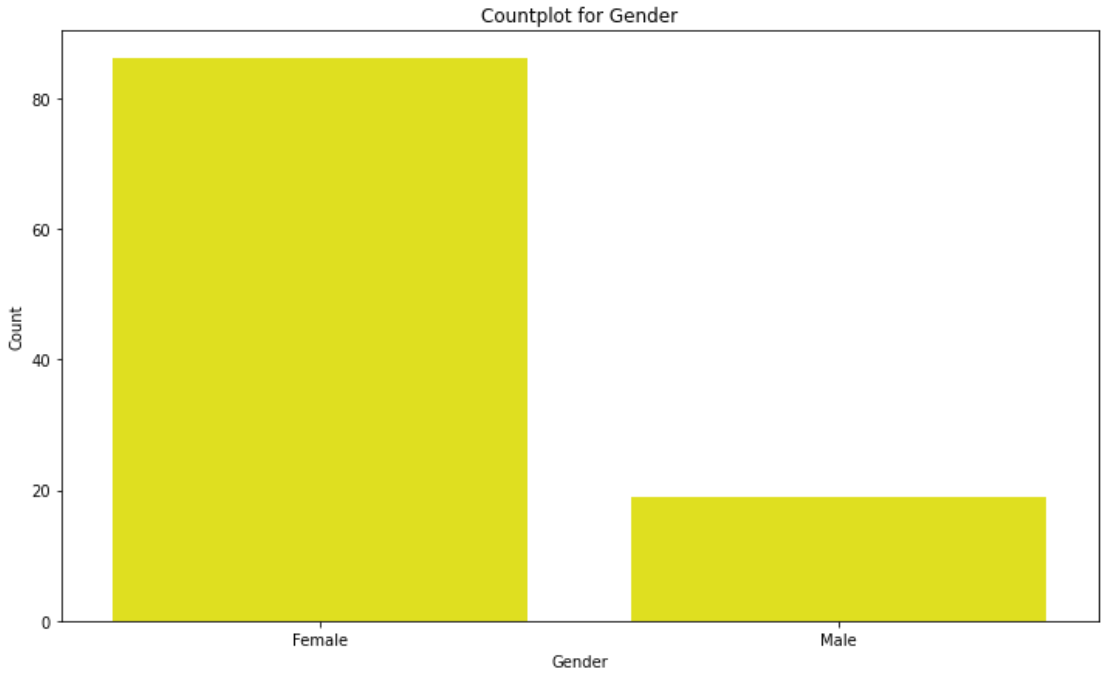
  - As observed in the graph above, respondents with a bachelor's degree tend to view or hear more percentage of empowerment or stereotypical advertisements.

- Age Distribution:



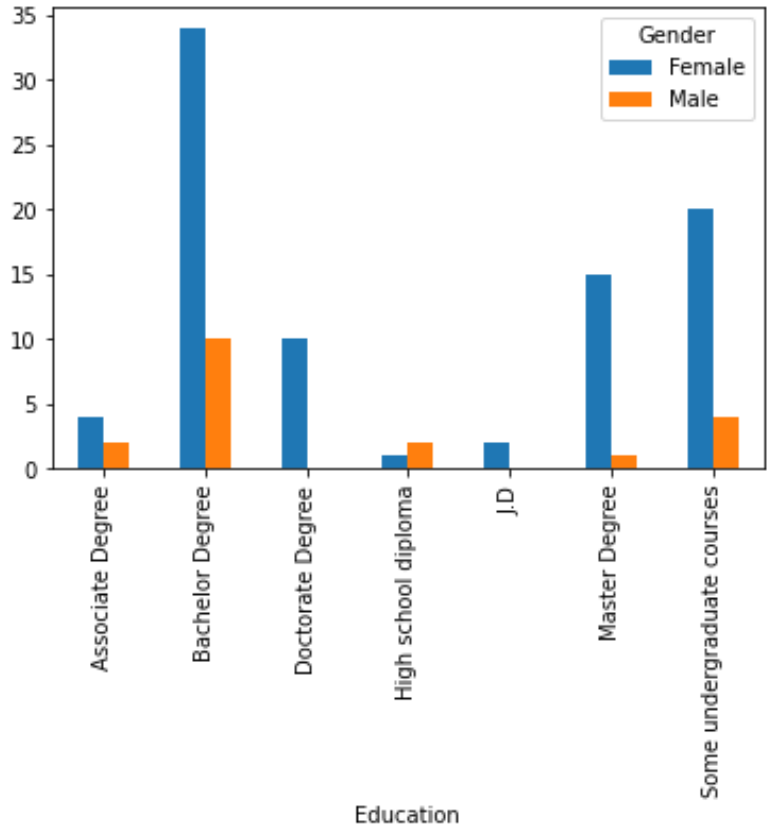
- As seen in the graph above, the age range of the respondents is 19-68. 54.28% of respondents fall in the 20-25 age group, 14.28% fall in the 25-30 age group while the remaining respondents are distributed in the other age groups.
- As observed, the majority of respondents fall within the 20-30 age group.
- The age distribution is skewed to the right.

➢ Gender Distribution:



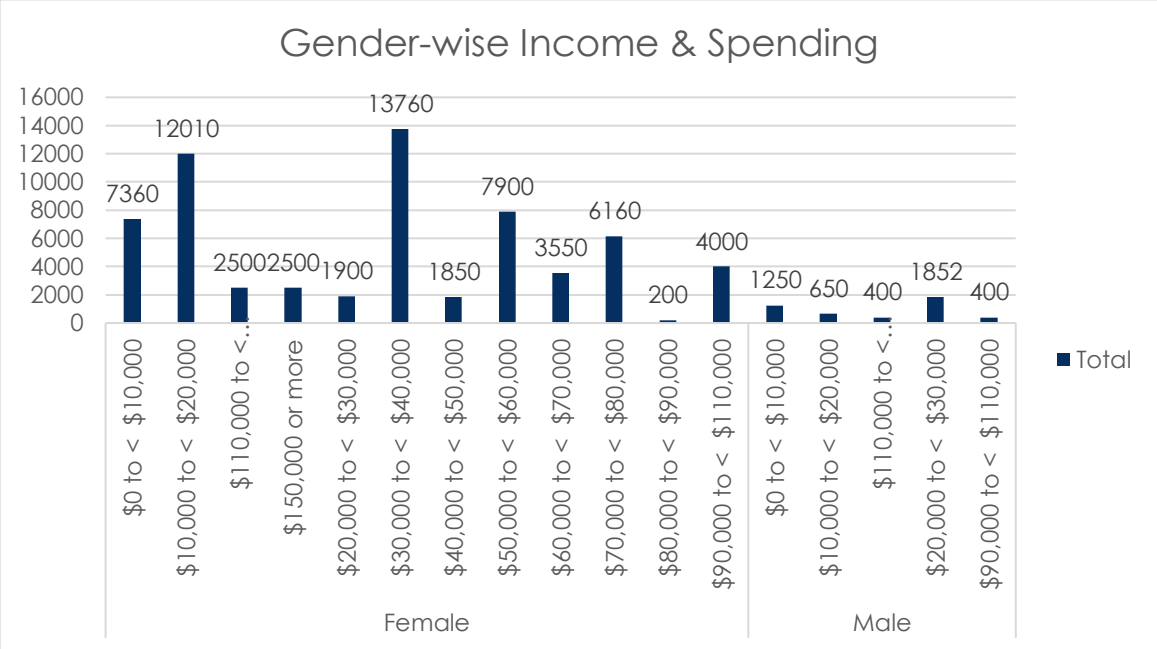
- In the above bar graph, we observe an underrepresentation of male respondents. Out of the 105 respondents, there were 86 females and only 19 males. i.e., 81.9% were female and only 18.09% of respondents were male.
- Since less than 20% of responses were from men, thus there may not be enough data to make certain statements about how men perceive gender roles in advertising. Therefore, we believe it is important to study trends both with and without consideration of the gender variable.

- Gender-wise Education Distribution of Respondents:



  - It is observed that the majority of male and female respondents are individuals who have pursued their bachelor's degree

- Gender-wise Income and Spending Distribution:



From the above we can infer that Females spend more than the Male.

Female in the income group of $30,000 to $40,000 spend the most on beauty products.

5. HYPOTHESIS TESTING

5.1 THE CHI-SQUARE TEST OF INDEPENDENCE:

5.1.A) To test the relationship between Gender and Reinforcing variables:

H_0: There is no significant relationship between the gender of the respondents and their feelings towards advertisements reinforcing gender stereotypes. i.e., Gender and Reinforcing are independent categorical variables.

H_1: There is a significant relationship between the gender of the respondents and their feelings towards advertisements reinforcing gender stereotypes. i.e., Gender and Reinforcing are dependent categorical variables.

```
> adve_data = table(data_1$Gender,data_1$Reinforcing)
> print(adve_data)

        Drastic Influential Limited Trivial
  Female      32          52       2       0
  Male         3          10       3       3
> # applying chisq.test() function for Gender and Reinforcing
> chisq.test(adve_data, simulate.p.value = TRUE)

        Pearson's Chi-squared test with simulated p-value (based on 2000 replicates)

data:  adve_data
X-squared = 21.807, df = NA, p-value = 0.0004998
```

Result: Since the p-value is less than the level of significance at 95% confidence level, i.e., 0.0004998 < 0.05; We reject the null hypothesis.

Hence, we infer that there exists a significant relationship between the gender of the respondents and their feelings towards advertisements reinforcing gender stereotypes. i.e., Gender and Reinforcing are dependent categorical variables.

We also infer that, males and females have different perceptions of advertisements reinforcing gender stereotypes.

5.1.B) To test the relationship between Gender and Transform variables:

H_0: There is no significant relationship between the respondents' gender and their belief that empowerment advertising helps transform cultural gender stereotypes. i.e., Gender and Transform are independent categorical variables.

H_1: There is a significant relationship between the respondents' gender and their belief that empowerment advertising helps transform cultural gender stereotypes. i.e., Gender and Transform are dependent categorical variables.

```
> print(adv_data)

        Agree Disagree Neutral Somewhat Agree Somewhat Disagree Strongly Agree
  Female    25        0       5              26                 1             29
  Male       5        1       1               9                 0              3
> # applying chisq.test() function
> chisq.test(adv_data, simulate.p.value = TRUE)

        Pearson's Chi-squared test with simulated p-value (based on 2000 replicates)

data:  adv_data
X-squared = 7.8095, df = NA, p-value = 0.1914
```

Result: Since the p-value is greater than the level of significance at 95% confidence level, i.e., 0.1914 > 0.05; We do not reject the null hypothesis.

Hence, we infer that there is no significant relationship between the respondents' gender and their belief that empowerment advertising helps transform cultural gender stereotypes. i.e., Gender and Transform are independent categorical variables.

5.1.C) To test the relationship between Transform and Education variables:

H_0: There is no significant relationship between the respondents' education and their belief that empowerment advertising helps transform cultural gender stereotypes. i.e., Education and Transform are independent categorical variables.

H_1: There is a relationship between the respondents' education and their belief that empowerment advertising helps transform cultural gender stereotypes. i.e., Education and Transform are dependent categorical variables.

```
> # applying chisq.test() function
> chisq.test(adv_data, simulate.p.value = TRUE)

        Pearson's Chi-squared test with simulated p-value (based
        on 2000 replicates)

data:  adv_data
X-squared = 139.52, df = NA, p-value = 0.005997
```

Result: Since the p-value is less than the level of significance at 95% confidence level, i.e., 0.005997 < 0.05; We reject the null hypothesis.

Hence, we infer that there is a relationship between the respondents' education and their belief that empowerment advertising helps transform cultural gender stereotypes. i.e., Education and Transform are dependent categorical variables.

5.2 Two-way ANOVA

5.2.A) To test the relationship of Gender and Age on Empowerment Percentage:

H_{01}: There is no significant gender-wise difference in the average percentage of empowerment advertisements that the respondents view or hear per day.

v/s

H_{11}: There exists a significant gender-wise difference in the average percentage of empowerment advertisements that the respondents view or hear per day.

H_{02}: There is no significant age-wise difference in the average percentage of empowerment advertisements that the respondents view or hear per day.

v/s

H_{12}: There is a significant age-wise difference in the average percentage of empowerment advertisements that the respondents view or hear per day.

H_{03}: There is no significant interaction between gender and age on the average percentage of empowerment advertisements that the respondents view or hear per day.

v/s

H_{13}: There is a significant interaction effect between gender and age on the average percentage of empowerment advertisements that the respondents view or hear per day.

```
> two.way<- aov(Empowerment.Percentage ~ Gender * Age, data = data_1)
> two.way <- aov(Empowerment.Percentage ~ Gender + Age + Gender:Age, data = data_1)
> summary(two.way)
             Df Sum Sq Mean Sq F value  Pr(>F)
Gender        1 0.0149 0.01488   4.375 0.03898 *
Age           1 0.0113 0.01125   3.308 0.07190 .
Gender:Age    1 0.0329 0.03293   9.680 0.00242 **
Residuals   101 0.3436 0.00340
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Results: From the two-way ANOVA, we infer the following:

- The p-value of gender is lesser than the level of significance i.e., 0.03898 < 0.05.
  Hence, we reject the null hypothesis and conclude that there exists a significant gender-wise difference in the average percentage of empowerment advertisements that the respondents view or hear per day.
- The p-value of age is lesser than the level of significance i.e., 0.07190 > 0.05.
  Hence, we do not reject the null hypothesis and conclude that there is no significant age-wise difference in the average percentage of empowerment advertisements that the respondents view or hear per day.
- The p-value for the interaction between gender and age is lesser than the level of significance i.e., 0.00242 < 0.05.
  Hence, we reject the null hypothesis and conclude that there is a significant interaction effect between gender and age on the average percentage of empowerment advertisements that the respondents view or hear per day.

5.2.B)

H_{01}: There is no significant gender-wise difference in the average spending for beauty and hygiene products or services per year.

v/s

H_{11}: There is a significant gender-wise difference in average spending for beauty and hygiene products or services per year.

H_{02}: There is no significant age-wise difference in average spending for beauty and hygiene products or services per year.

v/s

H_{12}: There is a significant age-wise difference in average spending for beauty and hygiene products or services per year.

H_{03}: There is no significant interaction between gender and age on the average spending for beauty and hygiene products or services per year.

v/s

H_{13}: There is a significant interaction effect between gender and age on the average spending for beauty and hygiene products or services per year.

```
> two.way<- aov(Spending ~ Gender * Age, data = data_1)
> two.way <- aov(Spending ~ Gender + Age + Gender:Age, data = data_1)
> summary(two.way)
             Df   Sum Sq Mean Sq F value Pr(>F)
Gender        1  3906092 3906092   6.191 0.0145 *
Age           1     5977    5977   0.009 0.9227
Gender:Age    1    11828   11828   0.019 0.8914
Residuals   101 63720547  630897
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Results: From the two-way ANOVA, we infer the following:

- The p-value of gender is lesser than the level of significance i.e., 0.0145 < 0.05.
  Hence, we reject the null hypothesis and conclude that there is a significant gender-wise difference in average spending for beauty and hygiene products or services per year.
- The p-value of age is lesser than the level of significance i.e., 0.9227 > 0.05.
  Hence, we do not reject the null hypothesis and conclude that there is no significant age-wise difference in average spending for beauty and hygiene products or services per year.
- The p-value for the interaction between gender and age is greater than the level of significance i.e., 0.8914 > 0.05.
  Hence, we do not reject the null hypothesis and conclude that there is no significant interaction effect between gender and age on the average spending for beauty and hygiene products or services per year.

6. CONCLUSION

- Several important findings about the participant demography and their experiences with advertisements reinforcing gender stereotypes have been made because of the analysis of the data gathered for this study. More than 75 percent of participants identified as female, and the average age of responders was 29.

- Nearly 93% of participants believe that advertising plays a significant or significant impact in the media's reinforcement of gender roles and stereotypes. 92% agree that advertising that encourages empowerment can change conventional notions and stereotypes. Participants also estimated that less than 6% of the daily advertisements they view use empowerment measures. Men estimated that close to 8% of advertisements used

empowerment advertising, whilst women believed that the number was closer to 5%. Younger respondents tend to feel more advertisers use empowerment

- According to the analysis, women often spend more on beauty products than men do. Therefore, expenditure is dependent on the respondent's gender but not on their age.

- The data in this study does not provide evidence to suggest gender plays a role in whether a respondent feels empowerment advertising can help transform gender stereotypes. However, there is evidence to suggest gender affects whether a respondent will perceive gender stereotypes within current advertising. Additionally, gender and age together influence the proportion of empowerment advertisements people view each day.

- In general, women reported a higher ratio of advertisements reinforcing traditional roles when compared to the number of ads they experience daily.

- We can see that respondents' perceptions of how empowerment advertisements change gender stereotypes are associated to their level of education. So, Education might play a significant role to eradicate gender stereotype.

- In general, women reported a higher ratio of advertisements reinforcing traditional roles when compared to the number of ads they experience daily.

7. LIMITATIONS

The data given has a lot of female respondents than male respondents therefore the results obtained from analyzing this data cannot be generalized to the whole population.

8. FUTURE SCOPE/RECOMMENDATIONS

A larger sample size is recommended as it would reduce calculation error for estimates on gender, highest level of education completed, and improve current estimates.
We see that in the analysis women prefer to view empowering advertisements. This will increase spending on beauty and hygiene products.