E-News Express A/B Testing Analysis

Project: Business Statistics
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Executive Summary

Electronic News (e-news), an online news portal, has taken a proactive approach to address a decline in monthly subscribers over the past year. The executive team recognized issues with their current webpage, which they believe lacks user engagement and is driving visitors away without subscribing. To tackle this problem, the marketing department was tasked with creating a new landing page and conducting an A/B test to evaluate its effectiveness in increasing conversion rates. The study involved a sample of 100 users, randomly divided into a control group (old page) and a treatment group (new page). The analysis of the A/B test yielded significant results that provide clear recommendations:

- The new landing page is performing well; users, are spending more time on the page and resulting in an increase in conversion rates (subscribers).
- Users are spending an increased amount of time and an increase in conversion rates was realized regardless of users preferred language. This suggests the users are finding the content relevant and are finding value demonstrated by the increase in conversion rates(subscribers) without a dependency on preferred language.

Based on these findings, E-News Express should shelf the old page and implement the new landing page, as it has proven to attract more traffic and engage users effectively. In addition, e-news should allocate additional resources to optimize the new landing page, enhance the existing website, and develop a subscription campaign to further increase conversion rates. In addition, the company should consider adding more languages to its domain to reach a wider audience and, consequently, boost conversion rates, leading to more subscribers.

In conclusion, this comprehensive analysis of the A/B test results provides a clear path forward for E-News Express to improve its online presence, engage its audience, and ultimately drive growth in its subscriber base.

Business Problem Overview and Solution Approach

- Electronic News (e-news), an online news portal, is expanding its business to acquire new subscribers. The executive team is concerned that there has been a decline in monthly subscribers over the past year. They believe the current webpage is not designed well and is lacking engagement; thus, leading users to leave the website before making a decision to subscribe.   The executive team has directed the marketing department to develop a new landing page with a new outline and more relevant content. They have requested an A/B test to determine if the old page is indeed the root cause to a decline in new subscribers.

- The marketing team will create a new webpage, randomly select a sample of 100 users and conduct an A/B test of the old webpage and new webpage. The sample well be divided into two equal groups (control group (old) and treatment group (new)). The data team will utilize the data from the A/B test, explore the data and perform a statistical analysis to determine the effectiveness of the new landing page and determine is there is an increase in conversion rates (new subscribers).

A/B TEST QUESTIONS

1. Do users spend more time on the new landing page than on the existing landing page?
2. Is the conversion rate for the new page greater than the conversion rate for the old page?
3. Does the converted status depend on the preferred language?
4. Is the time spent on the new page the same for the different language users?

Data Overview

Data Dictionary

user_id	Unique user ID of the person visiting the website
group	Whether the user belongs to the first group (control) or the second group (treatment)
landing_page	Whether the landing page is new or old
time_spent_on_the_page	Time (in minutes) spent by the user on the landing page
converted	Whether the user gets converted to a subscriber of the news portal or not
language_preferred	Language chosen by the user to view the landing page

Rows	Columns
100	6

Column	Dtype
user_id	int64
group	object
landing_page	object
time_spent_on_the_page	float64
converted	object
language_preferred	object

Data Overview, Cont...

Other Notable Observations:

- There are three (3) datatypes in the dataset:
  - object (4)
  - int64 (1)
  - float64 (1)
- There are NO missing values in the data.
- There are NO duplicated values in the data.
- The sample size is 100 users.
- It appears there is a normal distribution of data among the A/B test of a 100 users.

EDA _ Univariate Analysis

- Statistical Summary of Numerical Variables

index	user-id	time_spent_on_the_page
count	100	100
mean	546517.00	5.377800
std	52.295779	2.378166
min	546443.00	0.190000
25%	546467.75	3.880000
50%	546492.50	5.415000
75%	546567.25	7.022500
Max	546592.00	10.710000

Observations:

- Average time spent on the page is 5.38 Minutes with a standard deviation of 2.38 minutes
- 50% of the users spent 5.42 minutes on the page
- Minimum time on the page is .19 minutes
- Maximum time on the page is 10.71 minutes

EDA _ Univariate Analysis

- Statistical Summary of Categorical Variables

| Index	group	landing_page	converted	language_preferred
count	100	100	100	100
unique	2	2	2	3
top	control	old	yes	Spanish
freq	50	50	54	34

- The group variable has two unique values (control and treatment), with 50 entries each
- The landing_page variable has two unique values (old and new) with 50 entries each
- The converted variable has two unique values (yes and no) with 54 and 46 entries
- The language_preferred variable has three unique values (Spanish, French, English) with a count of 34, 34, 32 entries respectively

Link to Appendix slide on data background check

EDA _ Bivariate Analysis

- It appears that users on the new landing page are spending a significant more time on the new landing page.
- It appears that users on the new landing page are significantly more likely to convert to a new subscriber.
- The preferred language of the user does not appear to effect time spent on the page.
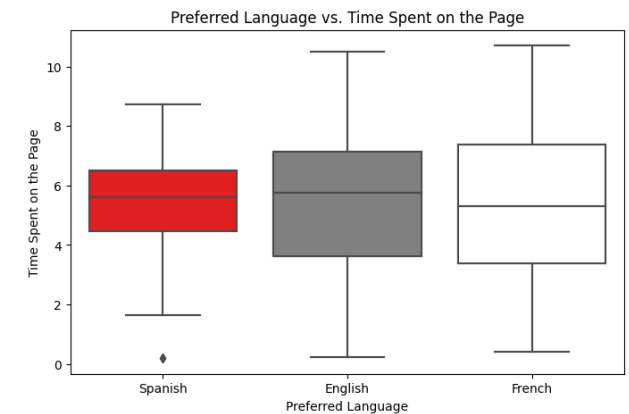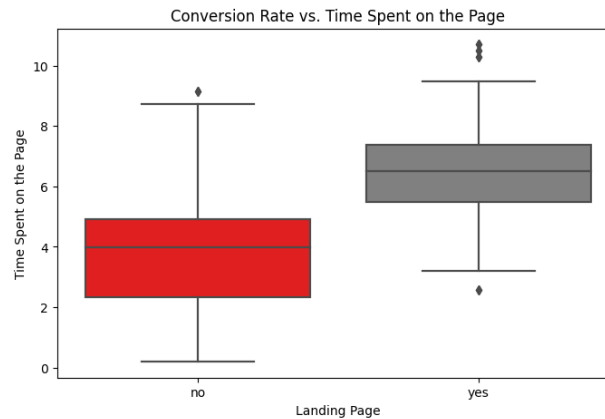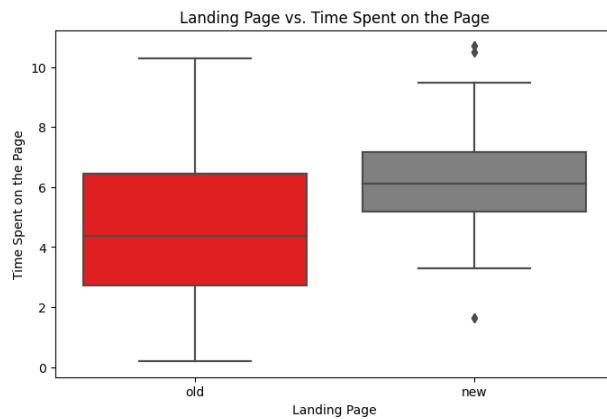
Link to Appendix slide on data background check
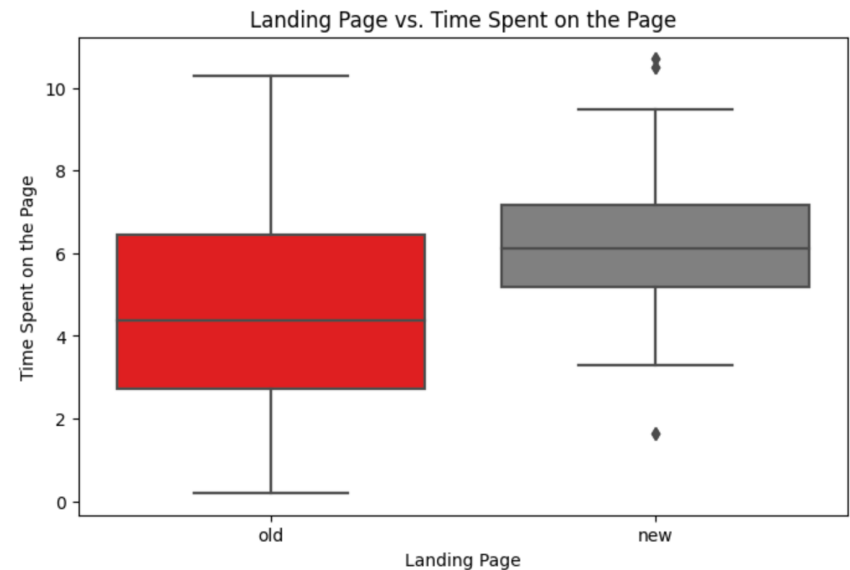
Hypothesis Tested and Results

HYPOTHESIS: Do users spend more time on the new landing page than the existing landing page?

Observations: Users seems to spend more time on the new page that the old page.

Test Result and inference: There is significant evidence that the average time spent on the new page is greater than the average time spent on the old page.

We reject the null hypothesis.

Landing Page vs. Time Spent on the Page

Link to Appendix slide on details of the test performed

Hypothesis Tested and Results

HYPOTHESIS: Is the conversion rate for the new page greater than the conversion rate for the old page?

Observations: It appears the new page is converting more visitors into subscribers than the old page.

Test Result and inference: There is significant evidence the conversion rate is greater on the new landing page than the conversion rate on the old landing page.

We reject the null hypothesis.
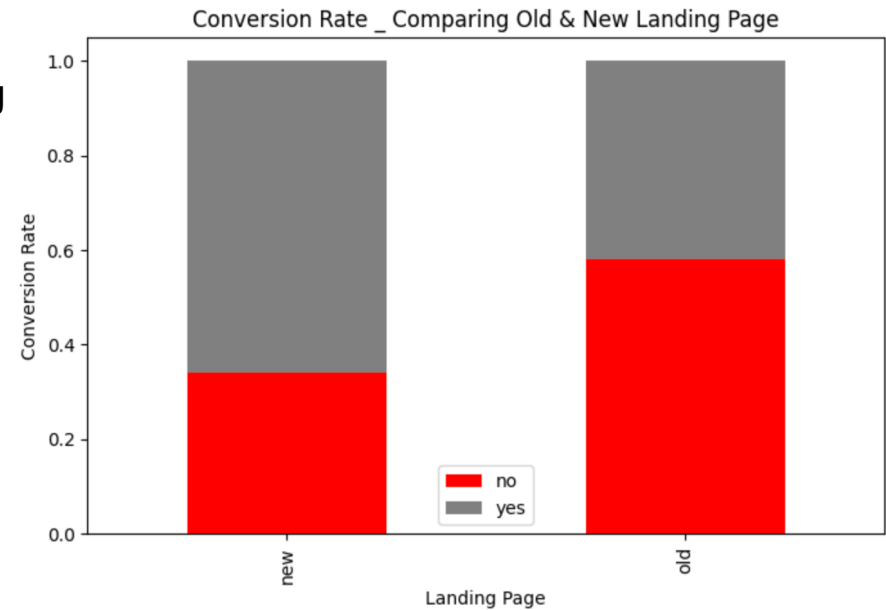
Hypothesis Tested and Results

HYPOTHESIS: Is the conversion status and preferred language independent or related?

Observations: It appears that the conversion rate is not significant among French and Spanish language users. However, English language users appear to convert better on the new page.

Test Result and inference: The conversion rate is independent of the preferred language of the user.

We fail to reject the null hypothesis.
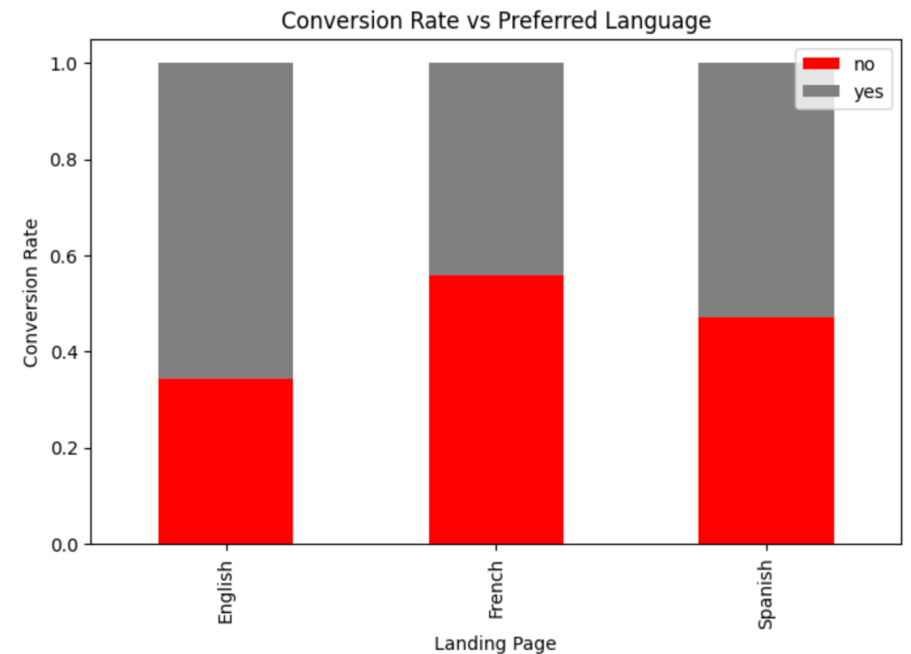
Conversion Rate vs Preferred Language

Link to Appendix slide on details of the test performed

Hypothesis Tested and Results

HYPOTHESIS: Is the time spent on the new page same for the different language users?

Observations: The time spent on the new page seems relativity neutral regardless of preferred language.

Test Result and inference: The average time spent on the new page is similar regardless of the users preferred language.

We fail to reject the null hypothesis.
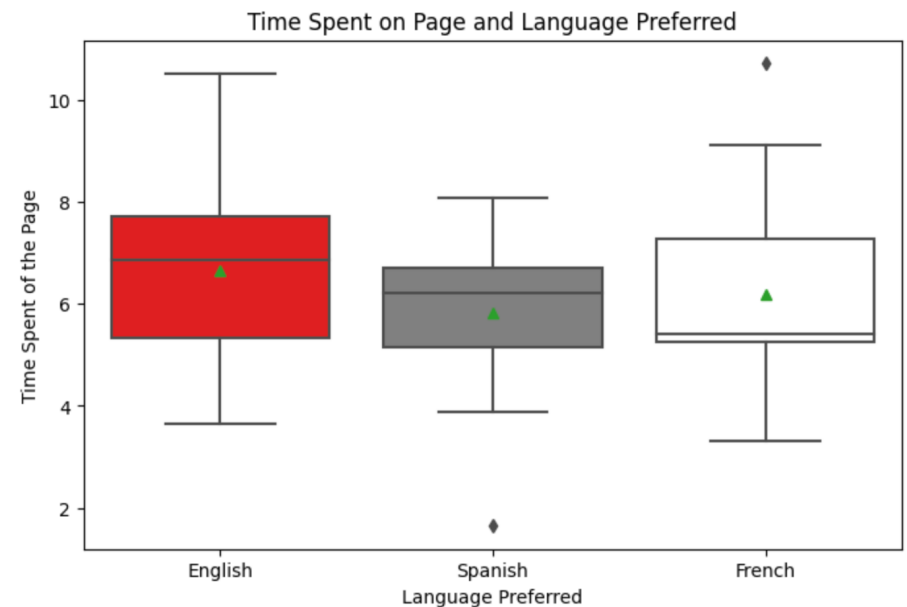
Link to Appendix slide on details of the test performed

Conclusions

- In order to answer the first question, *Do users spend more time on the new landing page than the existing landing page,* a two-sample independent t-test was performed. The p-value was determined to be 0.0001 which was significantly less than the level of significance of 5%. As a result, the null hypothesis was rejected. It was determined that there is significant evidence that the average time spent by users on the new page is greater than the average time spent by the users on the old page.
- In order to answer the second question, *Is the conversion rate for the new page greater than the conversion rate for the old page,* a two-proportion z-test was performed. The p-value was determined to be 0.008 which was significantly less than the level of significance of 5%. As a result, the null hypothesis was rejected. It was determined that there is significant evidence that the conversion rate on the new landing page was greater then the conversion rate on the old page.
- In order to answer the third question, *Does the converted status depend on the preferred language,* chi-square test for independence was performed. The p-value was determined to be 0.213 which was more than the level of significance of 5%. As a result, the null hypothesis failed to be rejected. It was determined conversion results and the preferred language of the landing page are independent of each other.
- In order to answer the forth question, *Is the time spent on the new page the same for the different language users,* a one-way ANOVA test was performed. The p-value was determined to be 0.432which was more than the level of significance of 5%. As a result, the null hypothesis failed to be rejected. It was determined average time spent by users on the new page is similar regardless of the users preferred language.

Recommendations

- E-News Express should implement the new landing page as it appears to capture more traffic than the old landing page. The time spent on the new landing page is greater than the time spent on the old landing page demonstrating evidence that users prefer the new page.
- It is recommended to replace the old page with the new landing page as it has proven to engage the user more effectively and has resulted in an increased conversion rate.
- It is recommend to allocate more resources towards the new landing page to continue optimizing the new landing page, existing website, drive traffic, and build a subscription campaign to increase the conversion rate.
- Keep the new landing page incorporating the existing preferred language. As there does not appear to be any significant difference between the average time spent on the new page across the preferred languages.
- Perhaps consider adding more languages to the domain to reach a wider audience and to increase conversion rates resulting in more subscribers.
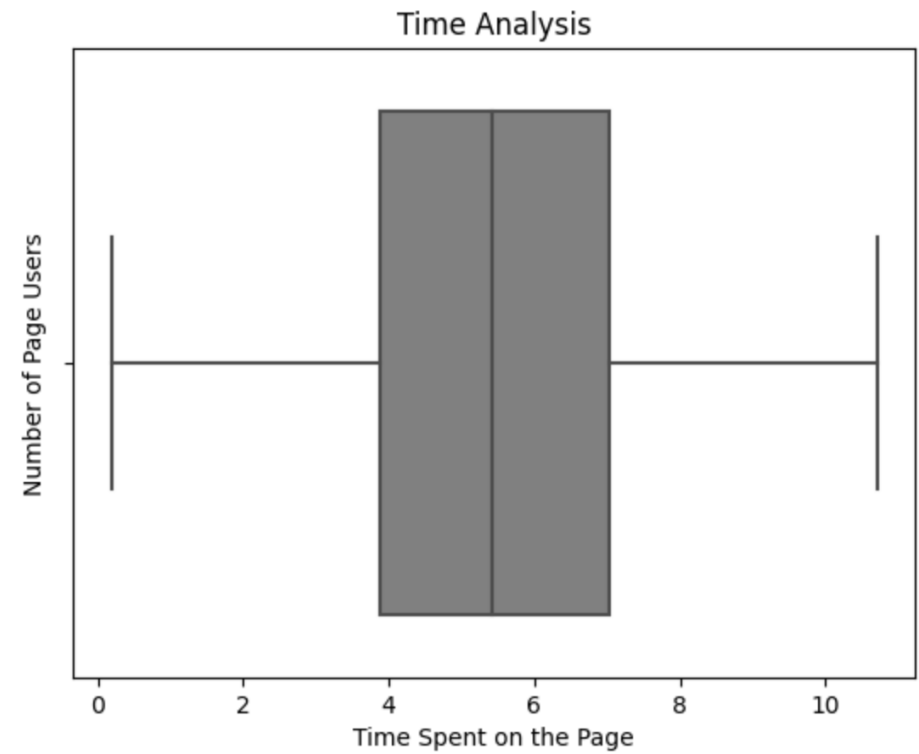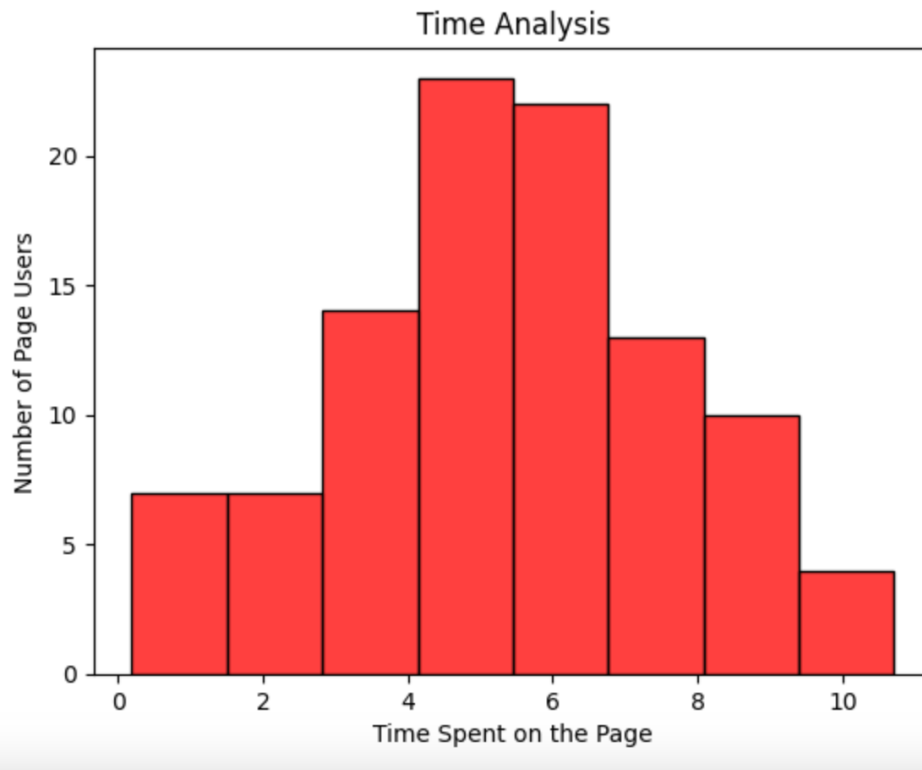
APPENDIX

Univariate Analysis Supporting Graphs
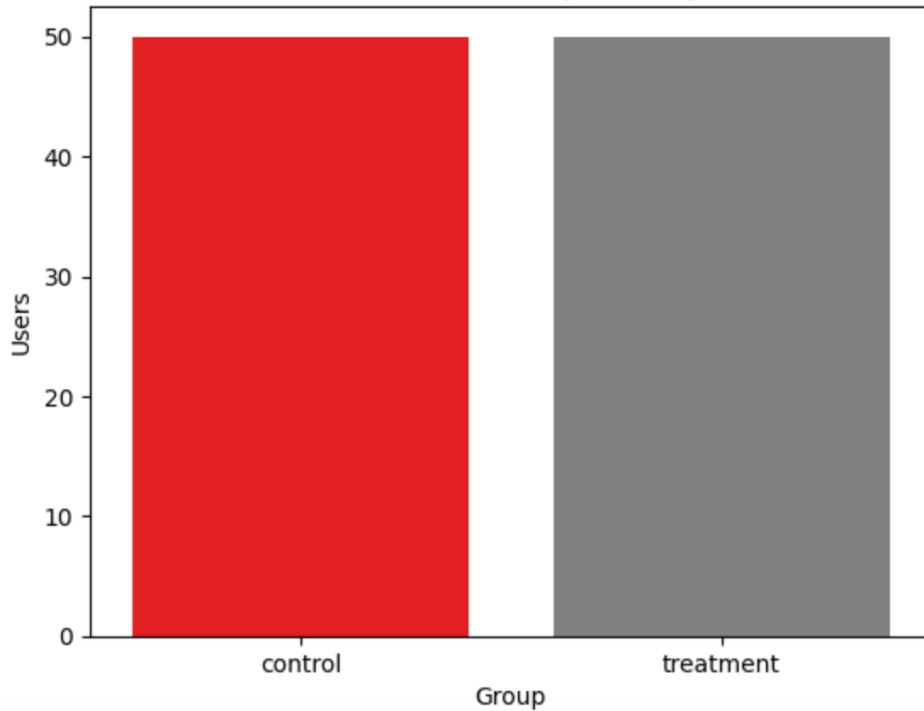
- Time Spent on Page

Univariate Analysis Supporting Graphs

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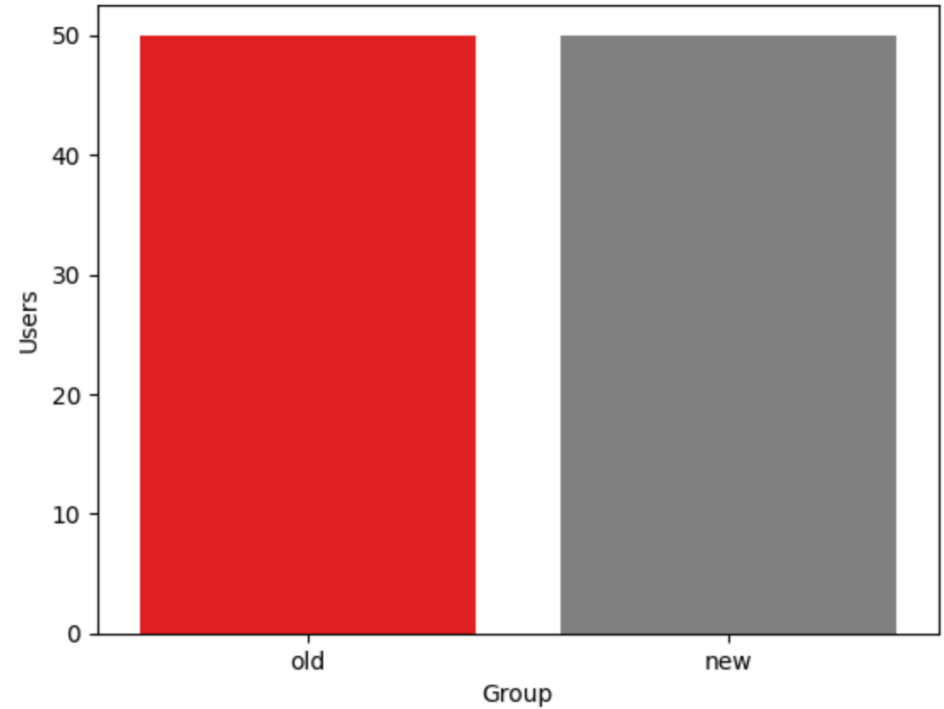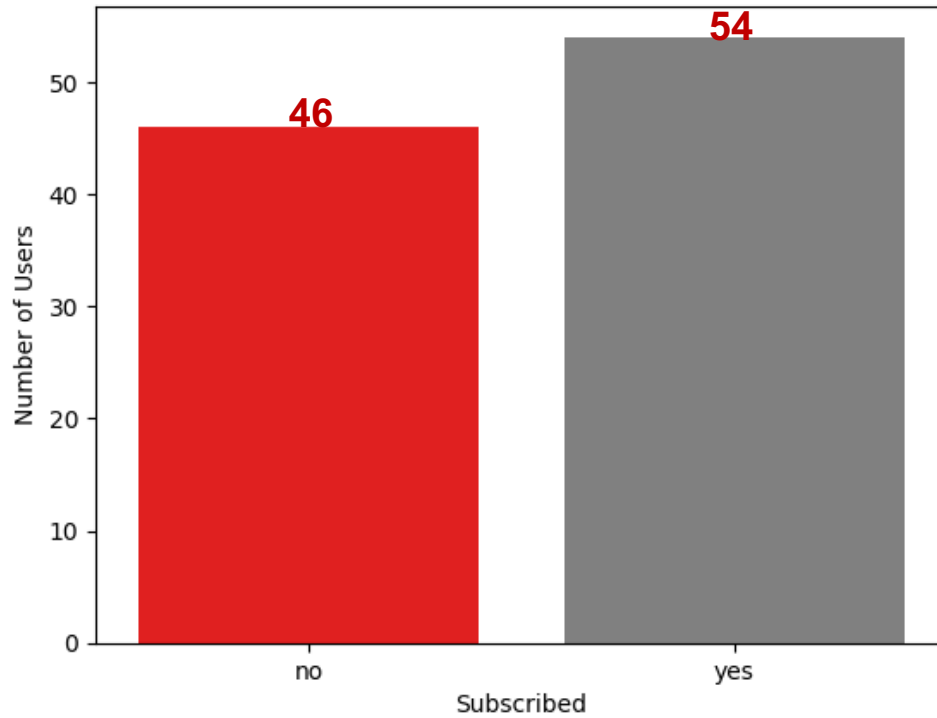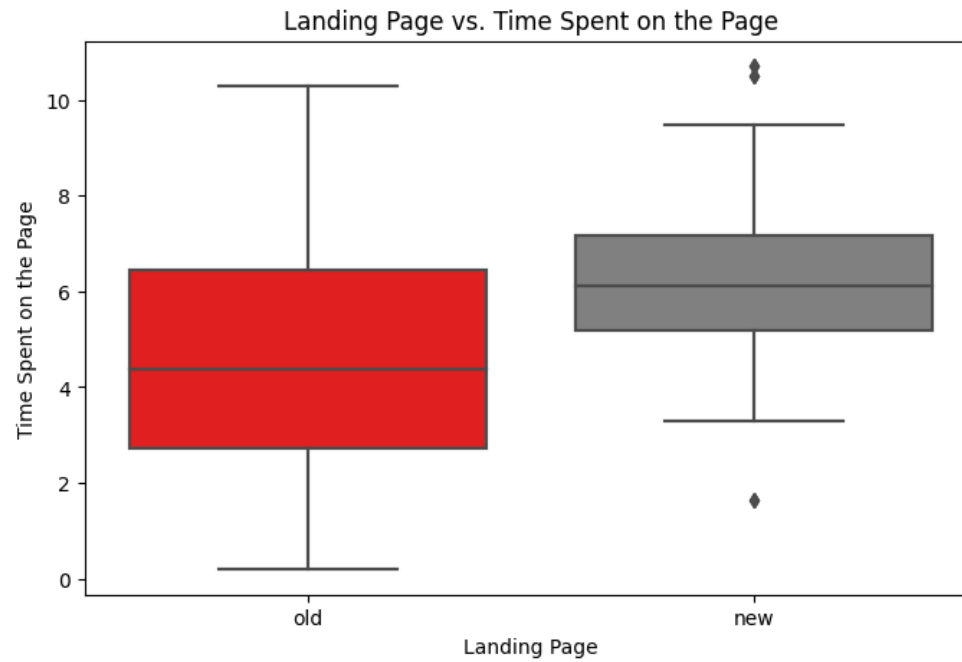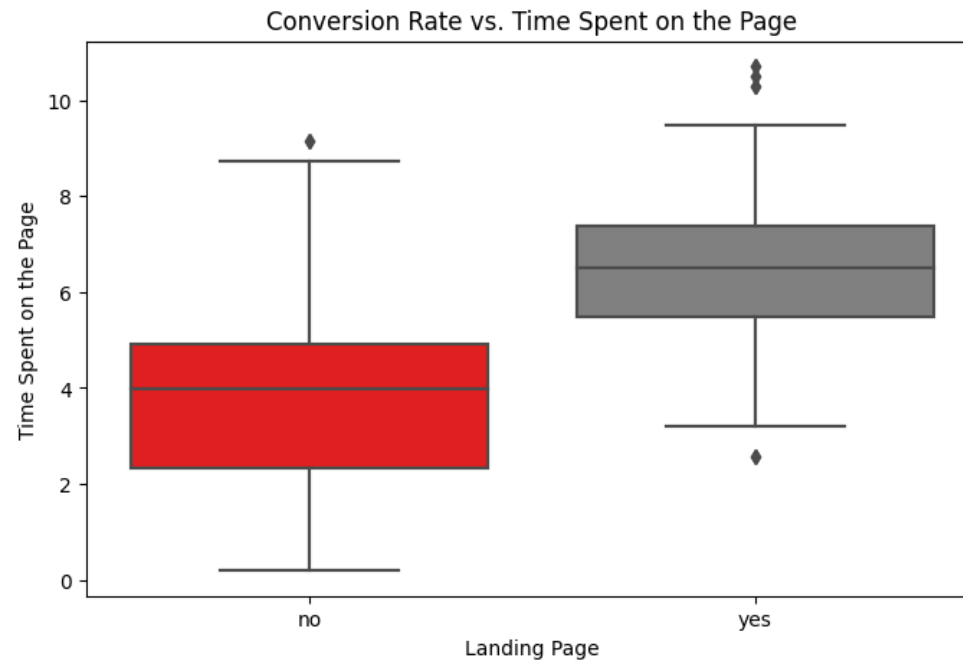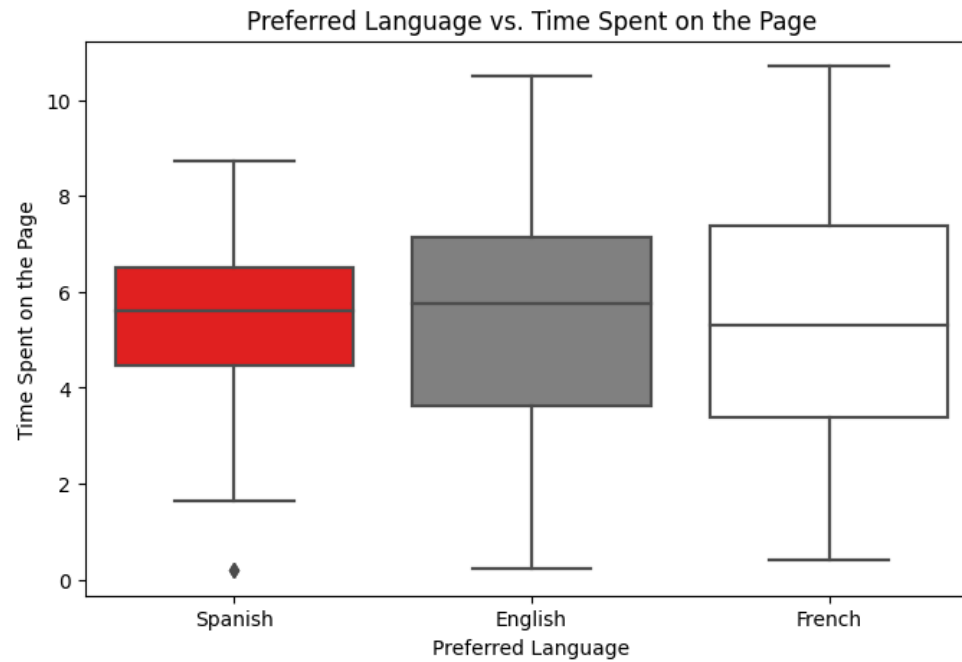
Conversion Rate / Preferred Language
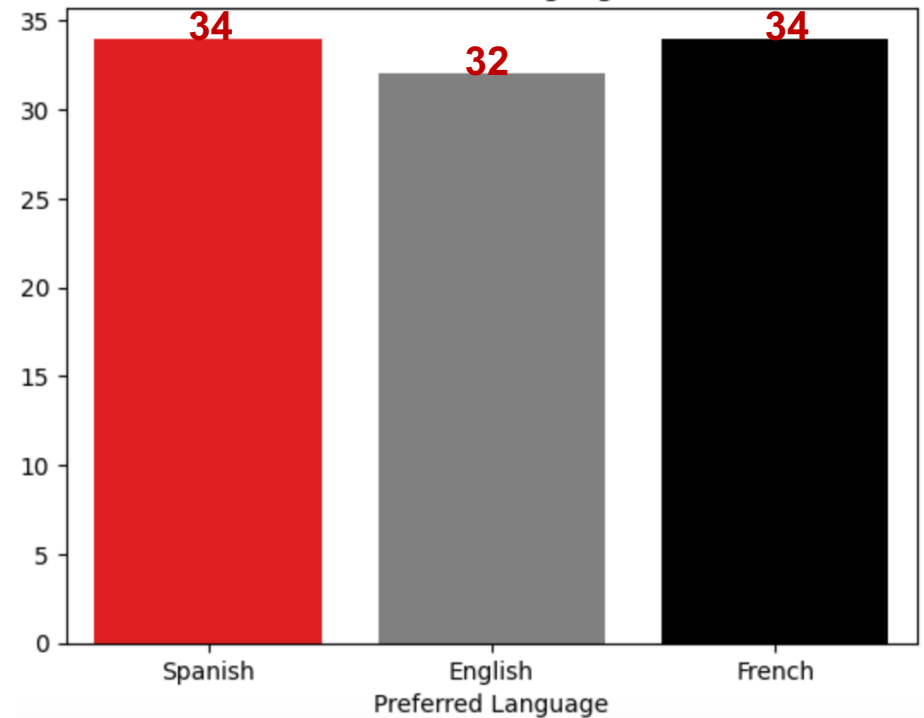
Bivariate Analysis Supporting Graphs

Bivariate Analysis Supporting Graphs

Bivariate Analysis Supporting Graphs

Hypothesis Testing Details

HYPOTHESIS*: Do users spend more time on the new landing page than the existing landing page?

- **Null Hypothesis:** The mean time spent by the users on the new page is equal to the mean time spent by the users on the old page.
- **Alternative Hypothesis:** *The mean time spent by the users on the new page is greater than the mean time spent by the users on the old page.*

- **Hypothesis Test selected:** Two sample independent t-test
- **p-value obtained:** 0.0001392381225166549
- **Level of Significance:** .05
- We *REJECT* the null hypothesis: p-value is much less than the level of significance 5%
- **Population standard deviations can be assumed be unequal**
  - The sample standard deviation of the time spent on the new page is: 1.82
  - The sample standard deviation of the time spent on the old page is: 2.58

Hypothesis Testing Details

HYPOTHESIS*:* Is the conversion rate for the new page greater than the conversion rate for the old page?

- **Null Hypothesis:** The conversion rate of the new page is equal to the conversion rate of the old page.
- **Alternative Hypothesis:** The conversion rate of the new page is greater than the conversion rate of the old page.

- **Hypothesis Test selected:** two-proportion z-test
- **p-value obtained:** 0.008026308204056278
- **Level of Significance:** .05
- We *REJECT* the null hypothesis: p-value is much less than the level of significance 5%
- **Normal Distribution:** The numbers of users served the new and old pages are 50 & 50 respectively

Hypothesis Testing Details

HYPOTHESIS: Is the conversion status and preferred language independent or related?

- **Null Hypothesis:** The converted status is independent of the preferred language.
- **Alternative Hypothesis:** The converted status is dependent of the preferred language.

- **Hypothesis Test selected:** chi-square test for independence
- **p-value obtained:** 0.2129888748754345
- **Level of Significance:** .05
- We *FAIL to REJECT* the null hypothesis: p-value is greater than the level of significance 5%

Hypothesis Testing Details

HYPOTHESIS: Is the time spent on the new page same for the different language users?

- **Null Hypothesis:** The mean time spent on the new lading page is the same across all preferred languages.
- **Alternative Hypothesis:** At least one of the mean times spent on the new landing page is different amongst the preferred languages.

- **Hypothesis Test selected:** One-way ANOVA F-test
- **p-value obtained:** 0.43204138694325955
- **Level of Significance:** .05
- We ***FAIL to REJECT*** the null hypothesis: p-value is greater than the level of significance 5%