PRODUCT BANNER DESIGN A/B TEST REPORT, OLANIYI OLUSEYI ABRAHAM, 5TH AUGUST 2023

Summary

This test was conducted to investigate the influence of a web page banner that highlights key food and drink products on the conversion rate and the average amount spent by users (customers). A total of 48943 users participated in this test. The control group has 24343 while the treatment group contains 24600. The control group consists of the users who visited the existing web page that has no food and drink banner while the treatment page was made of users who visited the new web page that contains the food and drink banner. The test was conducted for 13 days starting from 25th January to 6th February 2023. The outcome of the test reveals that a significant difference exists in the conversion rate but no significant difference exists between the average amounts spent by the two groups. However, due to the existence of novelty effect and inadequate sample size, it was recommended that the test should be repeated for more days to capture appropriate sample size.

Context

This test was conducted to investigate the effect of a key food and drink web page banner on the conversion rate and average amount spent by visitors to the web page. The population is made up of the all the customers of the GloBox. A sample of 48943 was extracted from the database of the company using SQL queries (see Appendix 1). The database of the company is made up of three tables namely: groups, activity and users. The test has two different web pages: the existing web page and the new web page that contains the new food and drink banner. Users are randomly assigned to this web page and their critical data such as date joined, amount spent, device used, gender and country were collected. A conversion is deemed to have occurred whenever a user spent any amount within the two groups. These data were extracted using SQL queries and analysed using spreadsheet and then visualized using tableau. The outcome of the analysis are recorded below

Results

Hypothesis Testing

Hypothesis One

H_0: There is no statistically significant difference between the conversion rate of group A and B

H_{01}: There exists a statistically significant difference between the conversion rate of group A and B

Z-Test	
pa	0.039
pb	0.046
diff	-0.007
P	0.043
1-P	0.957
SE	0.002
z	-3.864
pval	0.0001
α	0.05
Conlusion	There is a significant difference
Decision	The null hypothensis was rejected

The outcome of the test shows that there exists a significant difference between the conversion rate of the two groups with the pvalue of (0.0001) which is greater than 0.05 level of significance. We, therefore, reject the null hypothesis.

95% Confidence Interval

95% Confidence Interval	
Critical Value	1.96
1-pa	0.961
1-pb	0.954
pa(1-pa)	0.03769192
pb(1-pb)	0.044157048
pa(1-pa)/na	1.54837E-06
pb(1-pb)/nb	1.795E-06
SEA	0.001828488
LHS 95% CI	0.0035
RHS 95% CI	0.0107
Conclusion	The difference in conversion rate lies between 0.0035 and 0.0107

The 95% confidence interval using normal distribution for the conversion rate lies between 0.0035 and 0.0107. This is represented visually in the figure below:

95% Confidence Interval for Difference in Conversion Rate between A & B

| | 0.000 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.007 | 0.008 | 0.009 | 0.010 | 0.011 |

Hypothesis two

H_0: There is no statistically significant difference between the average amount spent by group A and B

H_{01}: There exists a statistically significant difference between the average amount spent by group A and B

| T-Test	
Count of A	955
Count of B	1139
Mean of A	3.37
Mean of B	3.39
SD of A	25.94
SD of B	25.41
na	24343
nb	24600
(SD of A)^2	672.70
(SD of B)^2	645.88
((SD of A)^2)/na	0.028
((SD of B)^2)/nb	0.026
t	0.070
pval	0.944
α	0.05
Conclusion	We fail to reject the null hypothesis

According to the table above, the pvalue (0.944) is greater than the 0.05 level of significance. Therefore, we fail to reject the null hypothesis.

95% Confidence Interval

95% Confidence Interval	
t	1.960061445
LHS of 95% CI	-0.439
RHS of 95% CI	0.471
Conclusion	The difference in the average amount spent per user lies between -0.439 and 0.471

The 95% confidence interval using normal distribution for the average amount spent lies between -0.439 and 0.471. This is represented visually in the chart below.


95% Confidence Interval for Difference in Average Amount Spent between A & B
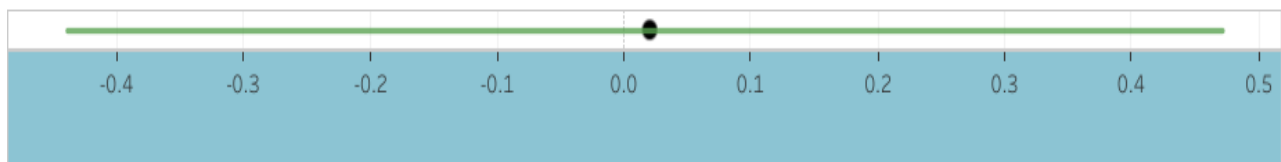
The chart above indicates that if we conducted the experiment in 100 instances, the values for the difference in average amount spent between the two groups will lie between -0.439 and 0.471 in 95 cases of such instances. This implies that, there is a chance of having an instance in which there will be no difference between the average amounts spent by each group. That is, there may be an instance in which the experimental treatment will have no effect on the users. Thus this experiment should be extended for more days to increase the sample size.
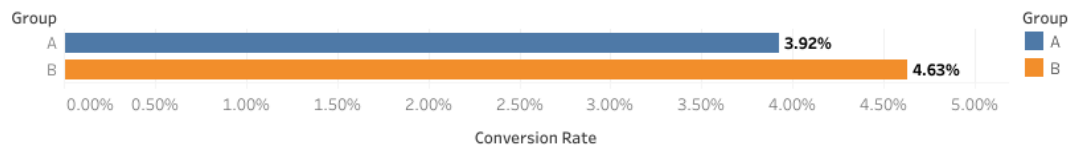
Demographic Analysis

Distribution of Conversion Rate for A & B
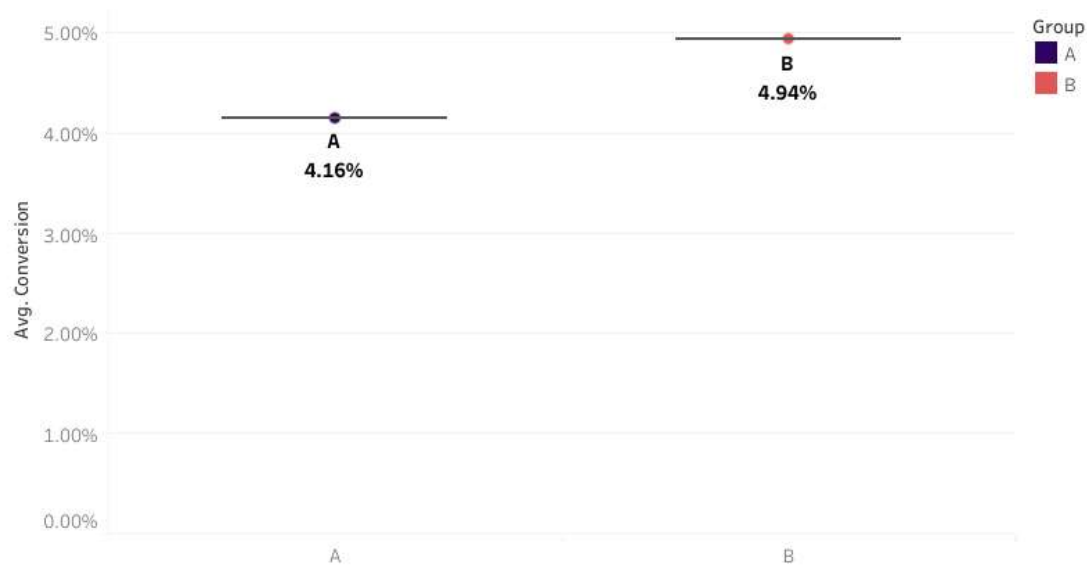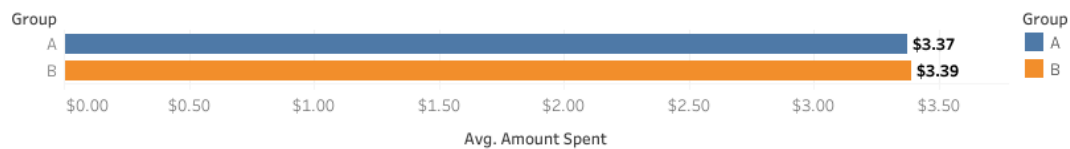

Distribution of Average Amount Spent
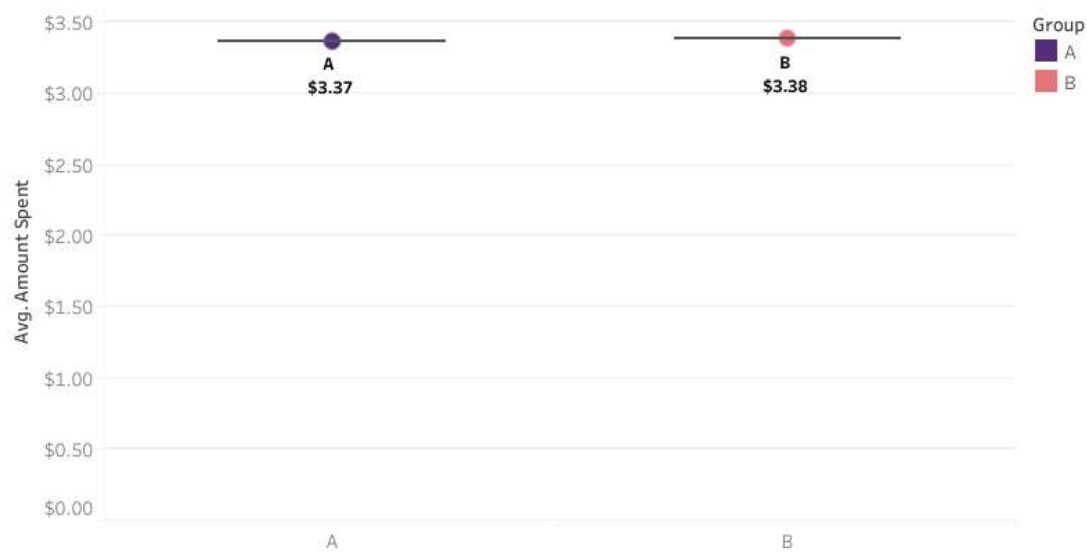
Conversion Rate by Group

As indicated in the chart above, the conversion rate of group B was higher than that of group A. This implies that the banner might have influence the choice of the users assigned to group B to certain extent.

Average Amount Spent by Group

The influence of the banner on the choice of the users is further highlighted in the chart above. The average amount spent by users in group B was slightly higher than that of Group A.

Conversion Rate by Device

According to the figure above, iOS has the highest conversion rates in both groups. This implies that the banner appealed mostly to iOS users. Thus a marketing campaign can be targeted at this group. In group B, users of other devices have the second conversion rate. However, the small number of their population suggests that this rating may be superficial.
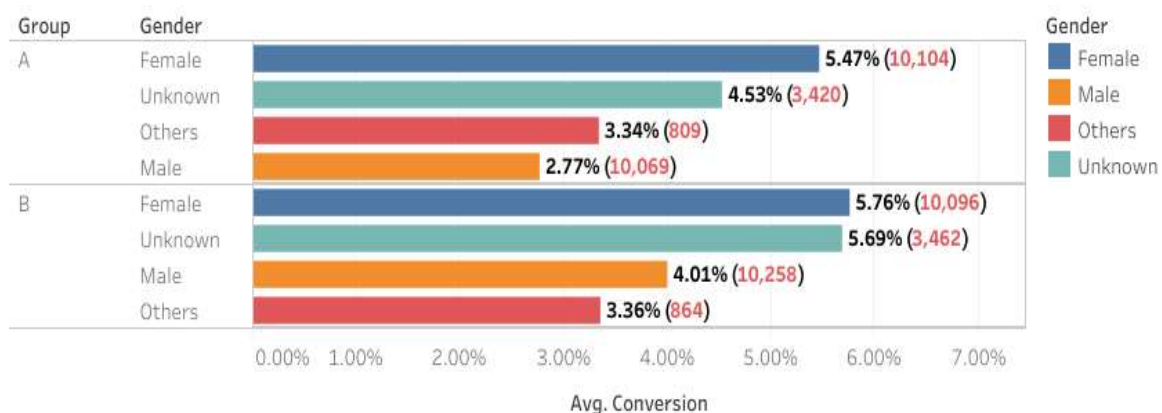
Thus, it will be logical to deduce that Android users are the next to the iOS users in both groups

Average Amount Spent by Device

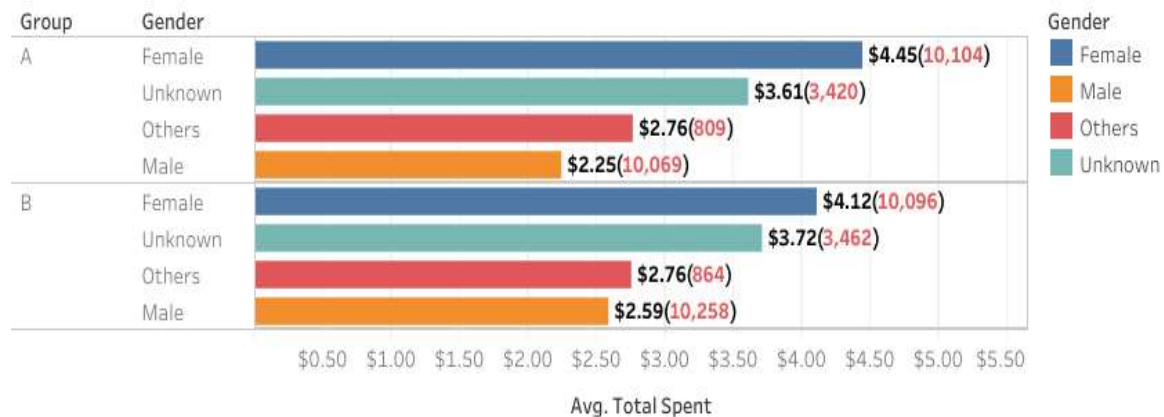In the chart above, iOS has the highest average amount spent in both groups. This supports the ideal of a marketing campaign targeted at this group. In group B, users of other devices has the second average amount spent, however, the small number of their population suggests that this may be superficial. Thus, it will be logical to deduce that Android users are likely to spend more.
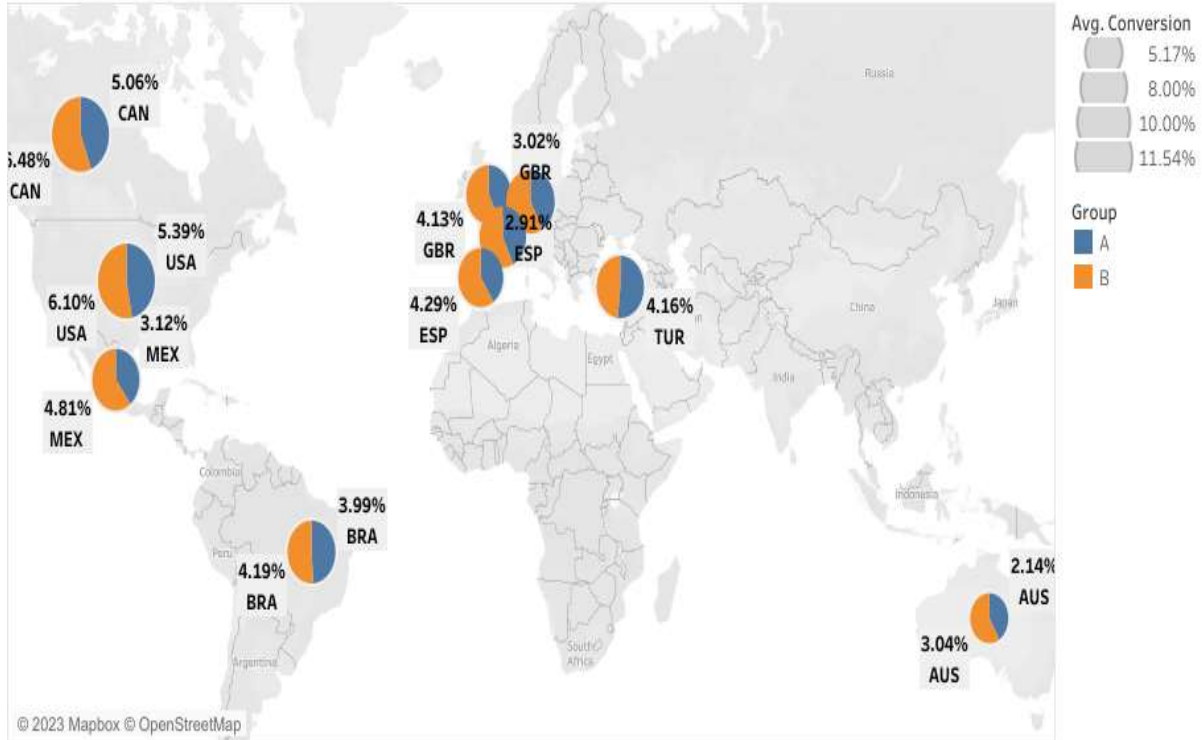
Conversion Rate by Gender

Average Amount Spent by Gender

Group	Gender	Avg. Total Spent
A	Female	$4.45(10,104)
	Unknown	$3.61(3,420)
	Others	$2.76(809)
	Male	$2.25(10,069)
B	Female	$4.12(10,096)
	Unknown	$3.72(3,462)
	Others	$2.76(864)
	Male	$2.59(10,258)

Gender: Female, Male, Others, Unknown

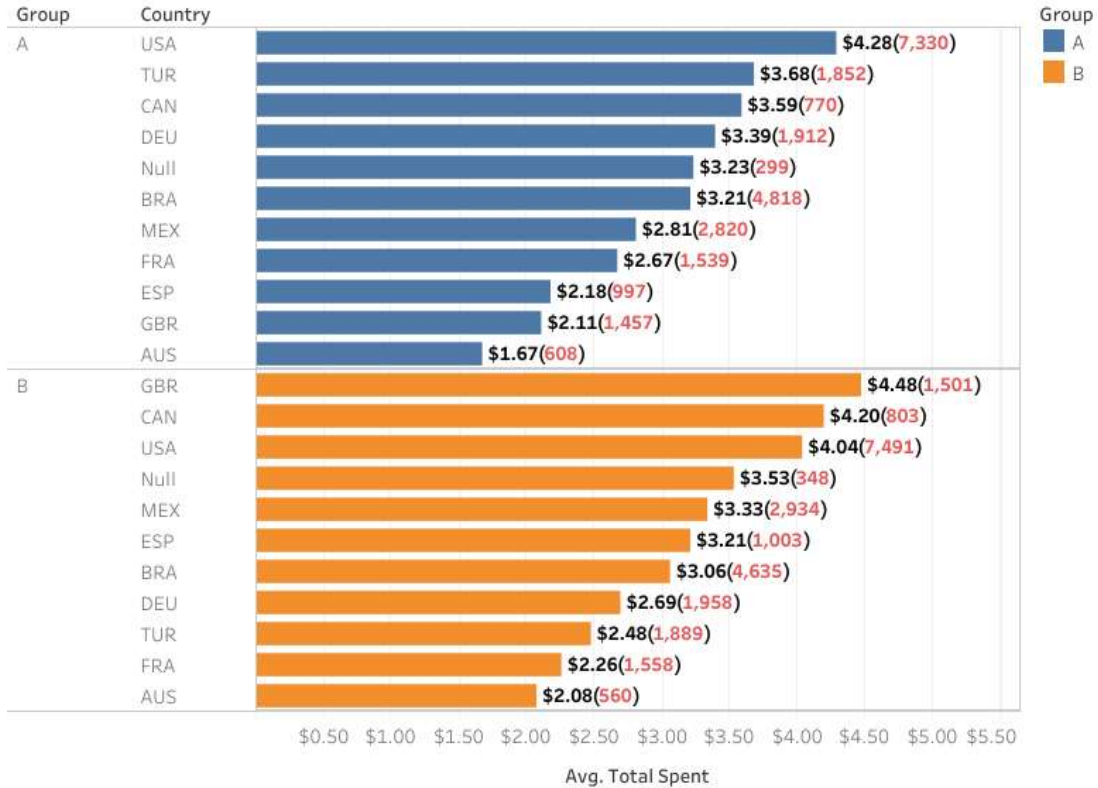Female enjoyed the highest conversion rate in both groups. They also recorded the highest average amount spent in both group. This suggests that different marketing campaigns may be considered for both genders. The small population sizes of the "others" category both terms of conversion rate and average amount spent and across both group may be an indication that that category is made up of erroneous data.

Conversion Rate by Country

Avg. Conversion
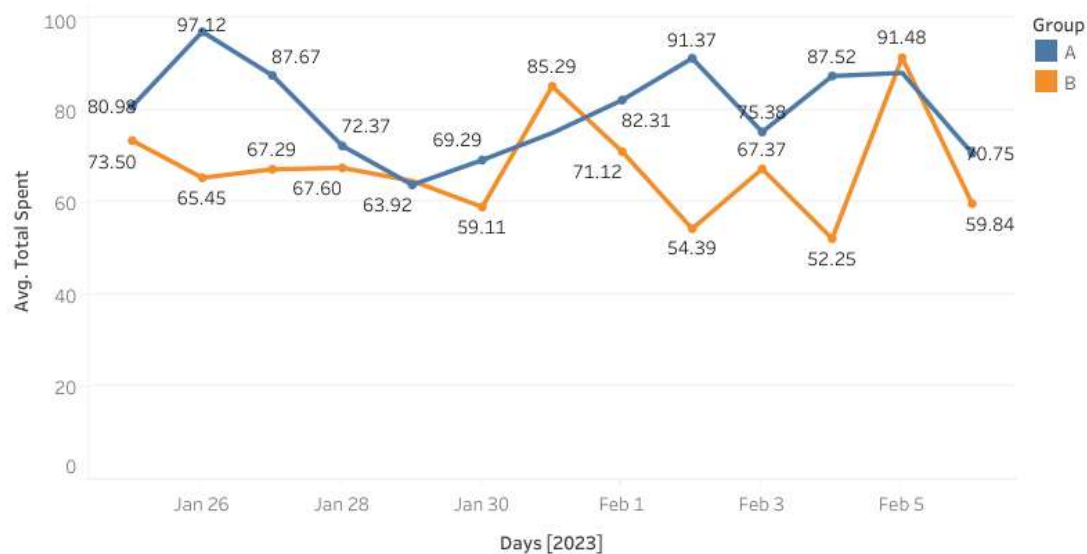- 5.17%
- 8.00%
- 10.00%
- 11.54%

Group
- A
- B

5.06%
CAN

5.48%
CAN

3.02%
GBR

5.39%
USA

4.13%
GBR

2.91%
ESP

6.10%
USA

3.12%
MEX

4.29%
ESP

4.16%
TUR

4.81%
MEX

3.99%
BRA

4.19%
BRA

2.14%
AUS

3.04%
AUS

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Average Amount by Spent Per Country.

Group	Country	Avg. Total Spent
A	USA	$4.28(7,330)
	TUR	$3.68(1,852)
	CAN	$3.59(770)
	DEU	$3.39(1,912)
	Null	$3.23(299)
	BRA	$3.21(4,818)
	MEX	$2.81(2,820)
	FRA	$2.67(1,539)
	ESP	$2.18(997)
	GBR	$2.11(1,457)
	AUS	$1.67(608)
B	GBR	$4.48(1,501)
	CAN	$4.20(803)
	USA	$4.04(7,491)
	Null	$3.53(348)
	MEX	$3.33(2,934)
	ESP	$3.21(1,003)
	BRA	$3.06(4,635)
	DEU	$2.69(1,958)
	TUR	$2.48(1,889)
	FRA	$2.26(1,558)
	AUS	$2.08(560)

Group: A, B

Sample B has higher conversion rate and average amount spent in all country. This implies that the users' choices were not influenced by their country of residence.

Novelty Effect

Group A values: 80.98, 97.12, 87.67, 72.37, 69.29, 82.31, 91.37, 75.38, 87.52, 91.48, 70.75

Group B values: 73.50, 65.45, 67.29, 67.60, 63.92, 59.11, 85.29, 71.12, 54.39, 67.37, 52.25, 59.84

Avg. Total Spent vs Days [2023]

The impact of the banner declined gradually with time with few occasional spikes. This implies that the influence of the banner on users' choices may lack lasting effect as it appeared to have waned with time.

Metrics	Expected Minimum Size	Used Size	Expected Minimum Change	Observed Minimum Change	Input
Conversion Rate	60.6k	48.9k	3.9%	0.7%	• **3.9% baseline conversion rate** • **MDE: 10%** • **Two-sided, $\alpha =$ 0.05, power $= 0.8$**
Average Amount Spent	186k	48.9k	33.7%	2%	• **Difference between two means 0.337(10% of control)** • **Expected standard deviation: 25.94** • **Two-sided, $\alpha =$ 0.05, power $= 0.8$**

As shown in the table above, the observed difference in conversion rate (0.7%) and average in amount spent (2%) are far lesser than the expected differences of 3.9% and 33.7% respectively. This can be assigned to the fact that the sample size used for the study is less than the expected sample sizes. Thus, it would be more appropriate to allow for more time to capture the expected sample size

NOTE: After merging 2 tables together, I discovered that changes to my tableau were not being saved.

Recommendation

The following recommendations are suggested:

1. Do not lunch the banner for now. The is an need for iterated attempt to accommodate more users

2. Repeat the experiment for more days to generate more sample size

3. Look out for novelty effects. There is very important to confirm that the observed change is not short lived.

4. Look out for 0 in the 95% CI values.

Appendix One

- **To generate main table for Data Exploration**

  SELECT g.uid, u.country, u.gender, g.device, g.group, SUM(a.spent) AS Amount_Spent, CASE WHEN SUM(a.spent) > 0 THEN 1 ELSE 0 END AS conversion

  FROM groups AS g

  LEFT JOIN activity AS a

  ON g.uid = a.uid

  LEFT JOIN users AS u

  ON a.uid = u.id

  GROUP BY g.uid, u.country, u.gender, g.device, g.group

- **To generate amount spent in USA**

```
with users_spent as (SELECT g.uid, u.country, u.gender, g.device, g.group,
SUM(COALESCE(a.spent, 0)) AS total_spent

FROM groups AS g

LEFT JOIN users AS u

ON g.uid = u.id

LEFT JOIN activity AS a

ON g.uid = a.uid

WHERE country = 'USA'

GROUP BY g.uid, g.group, u.country, u.gender, g.device)


SELECT "group", AVG (total_spent), SUM(total_spent), COUNT(uid)

FROM users_spent

GROUP BY "group"
```

Appendix 2

[https://public.tableau.com/views/ProjectSpreedSheetAnalysis/AverageConversionbyDevice ?:language=en-US&:display_count=n&:origin=viz_share_link](https://public.tableau.com/views/ProjectSpreedSheetAnalysis/AverageConversionbyDevice)

[https://public.tableau.com/views/MasterschoolFinalProject/AverageAmountSpentbyGroup ?:language=en-US&:display_count=n&:origin=viz_share_link](https://public.tableau.com/views/MasterschoolFinalProject/AverageAmountSpentbyGroup)