

# GLOBOX REPORT - MASTERY PROJECT

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## 1. Executive Summary:

According to an extensive analysis incorporating hypothesis testing and data visualization techniques, the effectiveness of implementing the "Food and Drink Banner" for all users in the long term appears to be insufficient. Based on the findings, **I strongly recommend against its prolonged implementation and suggest reallocating the corresponding digital real estate for a more valuable project.**

In detail, The treatment group boasts a higher conversion rate at 4.63% compared to the control group's 3.92%. However, the average amount spent remains steady at around \$3.37 for both groups. The elevated conversion rate is evident across both iPhone and Android users. In a gender-focused analysis, while females exhibit the highest conversion rate at 5.44%, it is noteworthy that males experience the most substantial increase, rising from 2.63% in the control group to 3.79% in the treatment group. When considering geographic segmentation, Canada and the United States emerge as the countries with the highest conversion rates and average spending amounts.

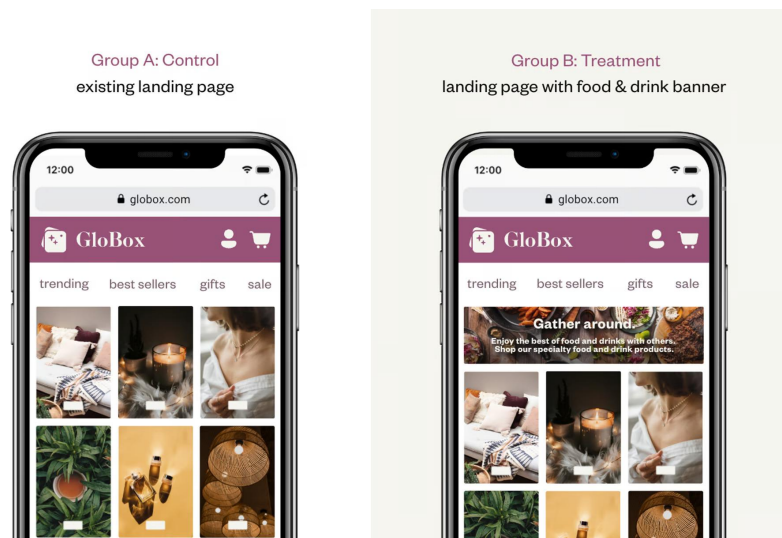
the experiment just run in a short period, and sample size is small may lead to inaccurate result. We will need at least 182,164 users and extend the period of experiment in order to get whether the difference between two groups is significant enough to reject the null hypothesis with a meaningful difference for the business in both conversion rate and average amount spent metrics

## 2. Background and Motivation:

GloBox is primarily known amongst its customer base for boutique fashion items and high-end decor products. However, their food and drink offerings have grown tremendously in the last few months, and the company wants to bring awareness to this product category to increase revenue.

### A/B Test Setup

The Growth team decides to run an A/B test that highlights key products in the food and drink category as a banner at the top of the website. The control group does not see the banner, and the test group sees it as shown below:



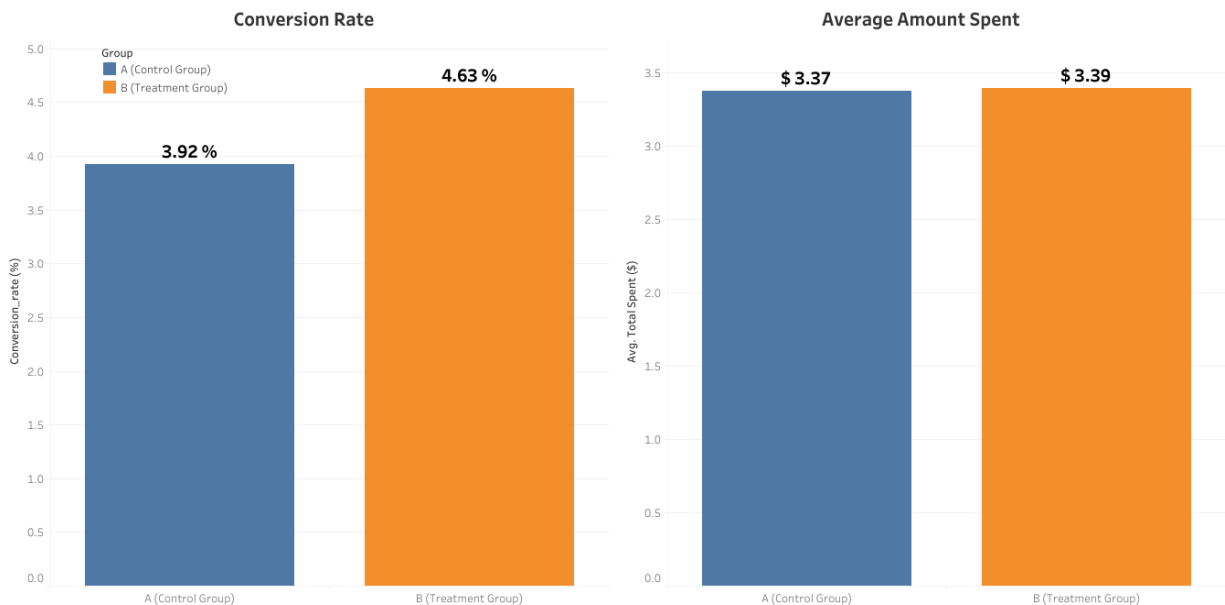
The setup of the A/B test is as follows:

1. The experiment is only being run on the mobile website.
2. A user visits the GloBox main page and is randomly assigned to either the control or test group. This is the join date for the user.
3. The page loads the banner if the user is assigned to the test group, and does not load the banner if the user is assigned to the control group.
4. The user subsequently may or may not purchase products from the website. It could be on the same day they join the experiment, or days later. If they do make one or more purchases, this is considered a “conversion”.

#### About the data:

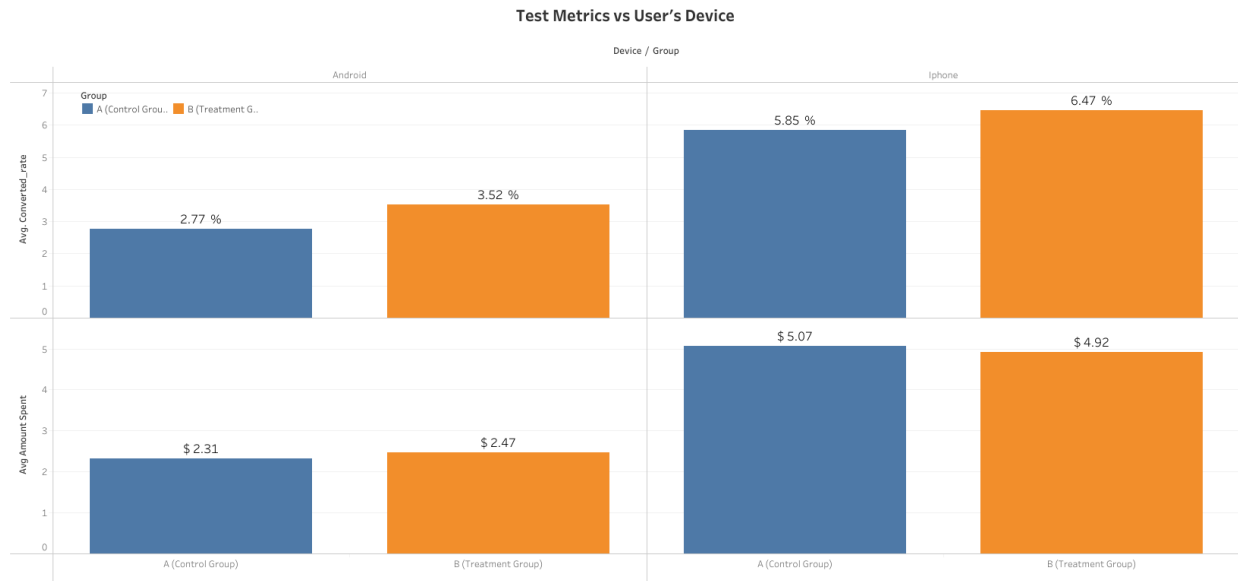
- Total Number of users: 48943
- Number of users purchased during experiment: 2233
- Start date of experiment: 2023 - 01 - 25
- End date of experiment: 2023 - 02 - 06
- User devices: Iphone and Android
- Test metrics: Conversion rate and Average Amount Spent

### 3. Visualization with Tableau:

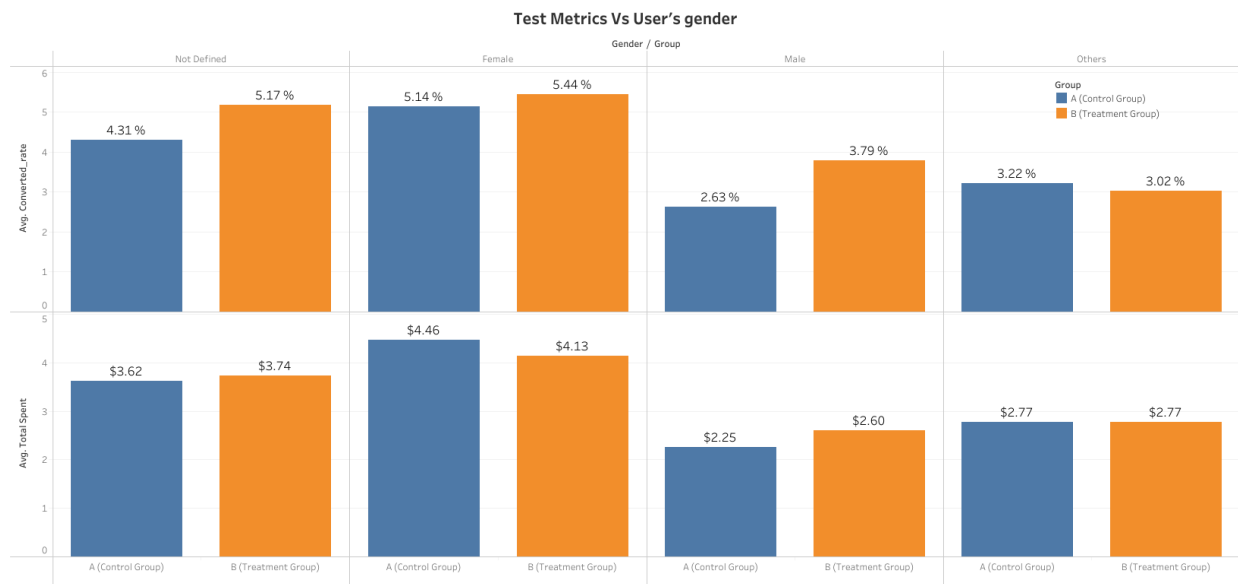


**CONVERSION RATE AND AVERAGE AMOUNT SPENT BETWEEN THE TEST GROUPS**

Conversion rate: There is a higher conversion rate in Group B - Treatment (from 3.92% for Control Group and 4.63% for Treatment group) means there is more customer have made purchased in group B. However, the average spends between 2 groups are most likely the same at ~ \$3.37



Treatment group sees higher conversion rates for Android and iPhone users (3.52% and 6.47%, respectively), yet average spending aligns with the control group, suggesting consistent spending patterns.



Conversion rates are all most higher at all genders, especially male gender has 2.63% for Control Group and 3.79% for Treatment group.

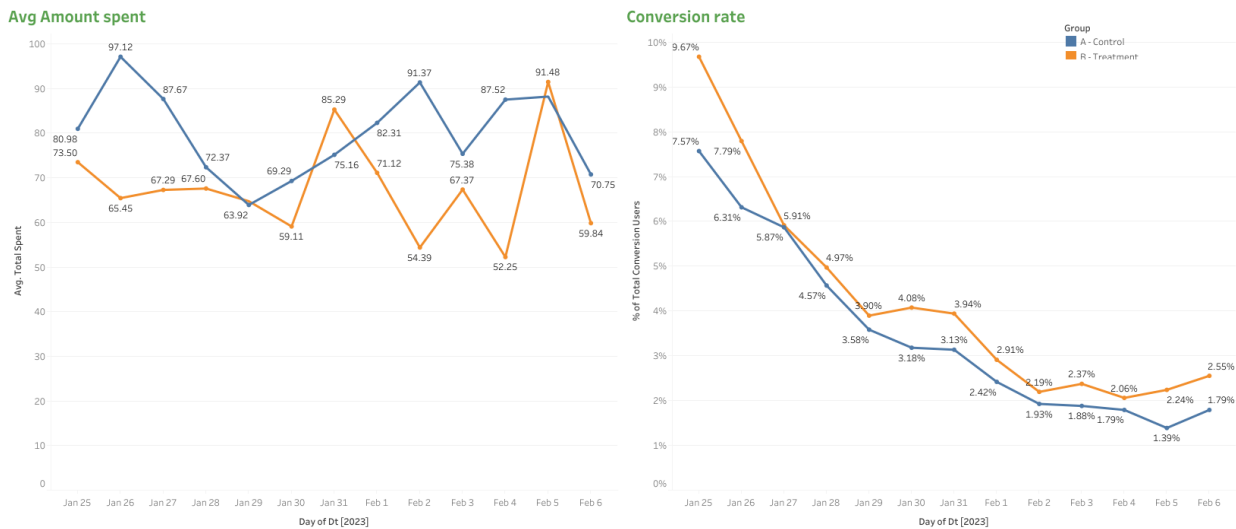
Conversion Rate

Country	Group	
	A (Control Group)	B (Treatment Group)
CAN	4.694	6.476
USA	5.117	5.748
BRA	3.725	4.061
DEU	3.200	4.415
TUR	4.002	3.558
MEX	2.948	4.447
FRA	3.125	4.183
GBR	2.887	3.681
ESP	2.909	3.614
AUS	2.138	3.036

Avg Amount Spent

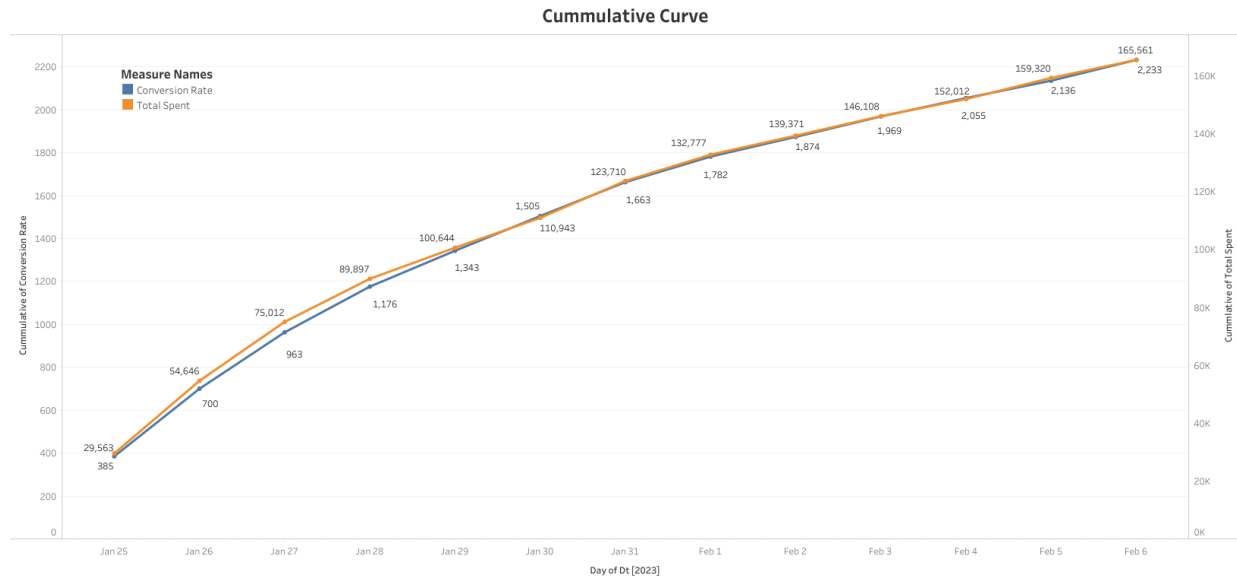
Country	Group	
	A (Control Group)	B (Treatment Group)
USA	4.295	4.053
CAN	3.602	4.199
GBR	2.109	4.498
BRA	3.214	3.066
MEX	2.812	3.346
TUR	3.685	2.489
DEU	3.401	2.708
ESP	2.178	3.234
FRA	2.678	2.268
AUS	1.668	2.081

In global analysis, Canada and the US boast the highest conversion rates and spending averages. These countries warrant intensified focus due to their unparalleled market potential.



Difference in Avg Amount Spent and Conversion Rate over time

Based on the chart data, the conversion rate consistently favors the treatment group over the control group. However, the average amount spent does not uniformly follow this pattern. Specifically, there are only two days during the experiment when the average amount spent is higher for the treatment group.



### **Conclusion:**

Insufficient evidence exists to draw conclusions regarding differences in conversion rates and average spending between the two groups. Consequently, A/B testing is imperative to conduct a rigorous analysis and determine any potential disparities accurately.

## **4. Calculate A/B Testing with Spreadsheets:**

- a. Conduct hypothesis testing to see whether there is a difference in the conversion rate between the test groups

- Determine null and alternative hypothesis

Null hypothesis: There is no difference in the conversion rate between the two groups

$$H_0: \bar{x}_A = \bar{x}_B$$

Alternative hypothesis H1: a difference exist in the conversion rate between the two groups

$$H_0: \bar{x}_1 \neq \bar{x}_2$$

- Determine what kind of test I am using:

Since we are working with proportions which is the conversion rate, and determine whether there is a difference in conversion rate between 2 groups, I am going to use **“Two sample z int/test for difference in proportions”**

- Calculate test statistic and draw conclusion:

$$T\text{-test} = 0.00011$$

**Conclusion:** p-value =  $0.00011 \leq 0.05$ , statistically significant, we reject the null hypothesis that there is no difference in the conversion rate between the two groups

Or we can say: The conversion rate between two groups are different

⇒ At 95% confidence interval, the difference in the conversion rate between two groups is 0.0035 at the lower bound 0.01 at upper bound

b. Conduct hypothesis testing to see whether there is a difference in the average amount spent between the test groups

- Determine null and alternative hypothesis

Null hypothesis: there is no difference in the average amount spent per user between two groups

$$H_0: \bar{x}_A = \bar{x}_B$$

Alternative hypothesis: a difference exist in the average amount spent per user between two groups

$$H_0: \bar{x}_1 \neq \bar{x}_2$$

- Determine what kind of test I am using:

Since we are working with means which is the average amount spent, and determine whether there is a difference between 2 groups, I am going to use **“Two sample t int/test for difference in proportions”**

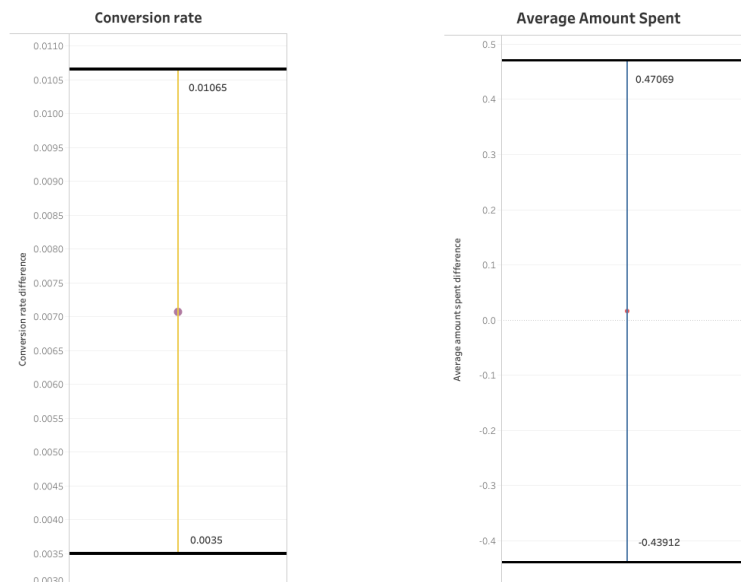
- Calculate test statistic and draw conclusion:

$$T\text{-test} = 0.944$$

**Conclusion:**  $p\text{-value} = 0.944 \geq 0.05$ , we fail to reject the null hypothesis that there is no difference in the average amount spent between the two groups

Or we can say: The average amount spent between two groups are the same

⇒ At 95% confidence interval, the difference in the average amount spent between two groups is -0.439 at the lower bound 0.471 at upper bound



CONFIDENCE INTERVAL

## 5. Power analysis:

### SAMPLE SIZE FOR CONVERSION RATE:

- Baseline conversion rate (%): preexisting conversion rate of the control group - group A (3.92%)
- Determine the minimum detectable effect: with the difference in statistical Significance and Meaningful Significance (Practical Significance), not all the statistically significant test results are meaningful for the business. We expect to increase the revenue at a certain level to be able to cover the engineering cost for new features, and the business cost of not using that high-value page space for something else. However, the MDE should be lower than the practical significance level so that if we observed the difference that we are interested in, we will be able to detect it as statistically significant. In this project, I use 10% relative change for both conversion rate and average amount spent

⇒ each group size should be 38,500 observations so the total sample size is 77,000 observations for CONVERSION RATE

### SAMPLE SIZE FOR AVERAGE AMOUNT SPENT: Expected Difference Between 2 Groups (10% change)

- Expected Difference Between two means: 0.337
- Expected Standard Deviation: 25.67

⇒ A study would require 91,082 observations for each group (total sample size of 182,164 observations) assuming equal group sizes, to achieve a power of 80%

**Conclusion:** We need at least **182,164** observations in order to see whether the difference between two groups is significant enough to reject the null hypothesis with a meaningful difference for the business in both conversion rate and average amount spent metrics

**Recommendation:** Do not launch the experiment as following factors

- Higher conversion rate but total revenue remains unchanged
- Only effective in early run (first few days the most)
- Need a larger sample size (182,164 users totally) and longer experiment for exact and meaningful result




⇒ The observed lack of improvement in our key success metrics indicates that releasing the banner to all users is not advisable. The outcomes from the A/B test suggest that the perceived cost of launching the feature does not align with the expected benefits, leading to the conclusion that the investment might not be justified at this time. However, we might have a better result with larger sample size and longer experiment

## APPENDIX

SQL queries to get data from the database:

```
1 WITH table_with_group AS (  
2 SELECT DISTINCT u.id, country, gender, device, g.group  
3 FROM users u  
4 INNER JOIN groups g ON u.id = g.uid  
5 ),  
6 table_with_spent AS (  
7 SELECT id, country, gender, tp.device, "group",  
8 SUM(spent) AS total_spent  
9 FROM table_with_group tp  
10 LEFT JOIN activity a ON tp.id = a.uid  
11 GROUP BY id, country, gender, tp.device, "group"  
12 )  
13 SELECT id, country,  
14 COALESCE(gender, 'N/A') AS gender  
15 , device, "group",  
16 COALESCE(total_spent, 0) AS total_spent,  
17 CASE WHEN total_spent > 0 THEN 1  
18 ELSE 0 END AS conversion_users  
19 FROM table_with_spent
```

id	country	gender	device	group	total_spent	conversion_users
1008043	GBR	M	A	A	0	0
1016846	BRA	F	I	B	0	0
1048699	USA	N/A	A	A	0	0
1043758	AUS	M	I	B	24.6	1
1034031	BRA	M	A	B	0	0
1045751	DEU	F	A	B	0	0
1017436	USA	N/A	A	B	0	0
1022345	AUS	M	I	B	0	0
1029958	MEX	N/A	A	A	0	0
1012808	MEX	N/A	I	B	0	0
1020249	BRA	M	I	B	0	0
1003981	CAN	M	A	A	0	0
1016923	BRA	F	A	A	0	0
1000067	BRA	F	I	A	0	0

 48943  0 affected  1.033 s



### Link to Tableau Public:

[https://public.tableau.com/views/Globox\\_16973176703530/Story1?:language=en-US&publish=yes&:display\\_count=n&:origin=viz\\_share\\_link](https://public.tableau.com/views/Globox_16973176703530/Story1?:language=en-US&publish=yes&:display_count=n&:origin=viz_share_link)

### Link to Tableau Public for dataset with Date:

[https://public.tableau.com/views/GloboxwithDate/Datasetwithdate?:language=en-US&publish=yes&:display\\_count=n&:origin=viz\\_share\\_link](https://public.tableau.com/views/GloboxwithDate/Datasetwithdate?:language=en-US&publish=yes&:display_count=n&:origin=viz_share_link)

### Link to spread sheets:

<https://docs.google.com/spreadsheets/d/1ZKqEztLPeLYZg8ddxEMdM-US5j9oSgMrKXMrEHtOdXE/edit?usp=sharing>