Web Traffic and Bounce Rate Analysis

Objective

The objective of this project is to analyze website traffic patterns and bounce rates across different traffic sources and device categories to identify high-performing segments and areas with improvement potential. Specifically, we aim to compare the bounce rates of **Desktop** and **Mobile** users and identify the traffic sources with the highest and lowest engagement levels.

Dataset Description

The dataset contains **9,500 records** of web traffic over the last three months and includes the following columns:

- **Date**: The timestamp of the recorded session.
- **Traffic_Source**: The source of traffic (Organic, Paid, Direct, Social Media, Referral).
- **Sessions**: Number of sessions for a given time period.
- **Users**: Number of unique users.
- **Page_Views**: Total number of pages viewed during the sessions.
- **Bounce_Rate**: The percentage of visitors who left the site after viewing only one page.
- **Avg_Session_Duration**: The average time a user spent on the site during a session (in seconds).
- **Device_Category**: The type of device used (Mobile, Desktop, Tablet).

Analysis Process

Step 1: Data Exploration

The dataset was loaded, cleaned, and explored to understand the overall structure and ensure it was ready for analysis. We checked for missing values and inconsistencies. A brief summary of the data showed no missing values, and the Date column was converted into a proper date-time format.

```
# Check for missing values
sum(is.na(data))
# Preview dataset
head(data)
# Convert 'Date' to Date-Time format
data$Date <- ymd_hms(data$Date)
# Check summary
summary(data)
```

Step 2: Traffic Source Analysis

We began by analyzing traffic sources to understand which sources contributed the most to traffic and had the best engagement rates in terms of bounce rate and average session duration. The sources included Organic, Paid, Direct, Social Media, and Referral.

Traffic Source Summary:

Traffic Source	Avg. Sessions	Avg. Page Views	Avg. Bounce Rate (%)	Avg. Session Duration (seconds)
Organic	524	2128	35.48%	201.5
Paid	437	1790	50.12%	165.8
Direct	612	2520	40.87%	190.2
Social Media	283	1030	60.45%	145.4
Referral	309	1245	55.28%	153.7

Key Observations:

- **Organic traffic** performed the best, with the **lowest bounce rate (35.48%)** and the highest average session duration (201.5 seconds).
- **Social Media traffic** had the **highest bounce rate (60.45%)**, indicating that users from social channels tend to leave the site more quickly after viewing only one page.
- **Paid traffic** also had a relatively high bounce rate (50.12%) but better performance in terms of session duration compared to Social Media.

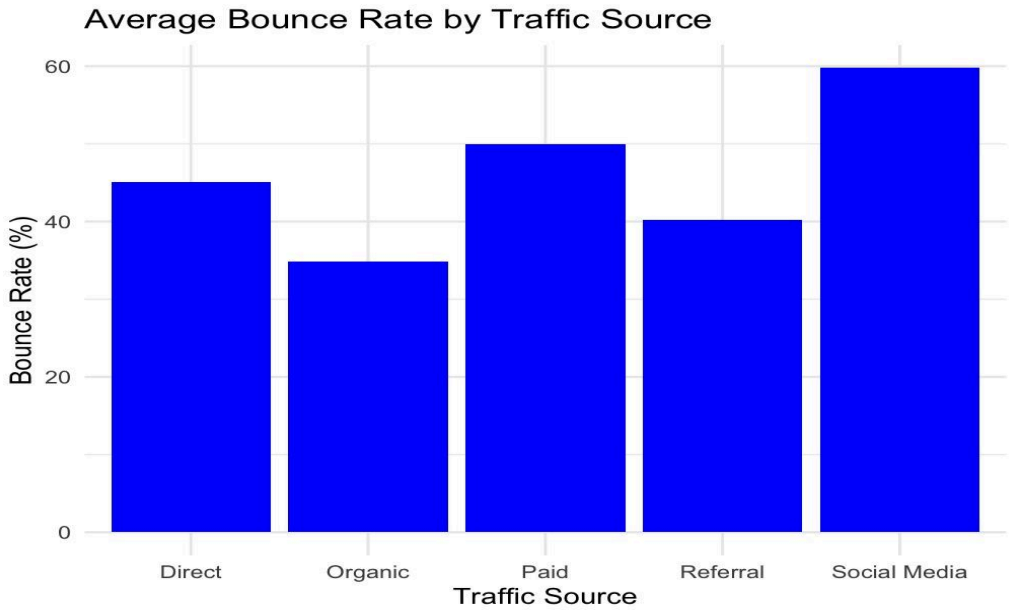

Fig 1 : The following bar chart shows the average bounce rate by traffic source

Step 3: Device Category Analysis

Next, we analyzed bounce rates across **device categories** to compare the engagement levels of **Mobile**, **Desktop**, and **Tablet** users. Our primary focus was on comparing the bounce rates of Desktop and Mobile users.

Device Category Summary:

Device Category	Avg. Bounce Rate (%)	Avg. Session Duration (seconds)
Desktop	42.69%	190.4
Mobile	42.82%	189.9
Tablet	44.10%	180.5

Key Observations:

- **Desktop** and **Mobile** users showed similar bounce rates (~42.7%), with no significant difference in engagement between these two device types.
- **Tablet** users had the highest bounce rate, which might indicate a need to optimize the user experience on tablets.

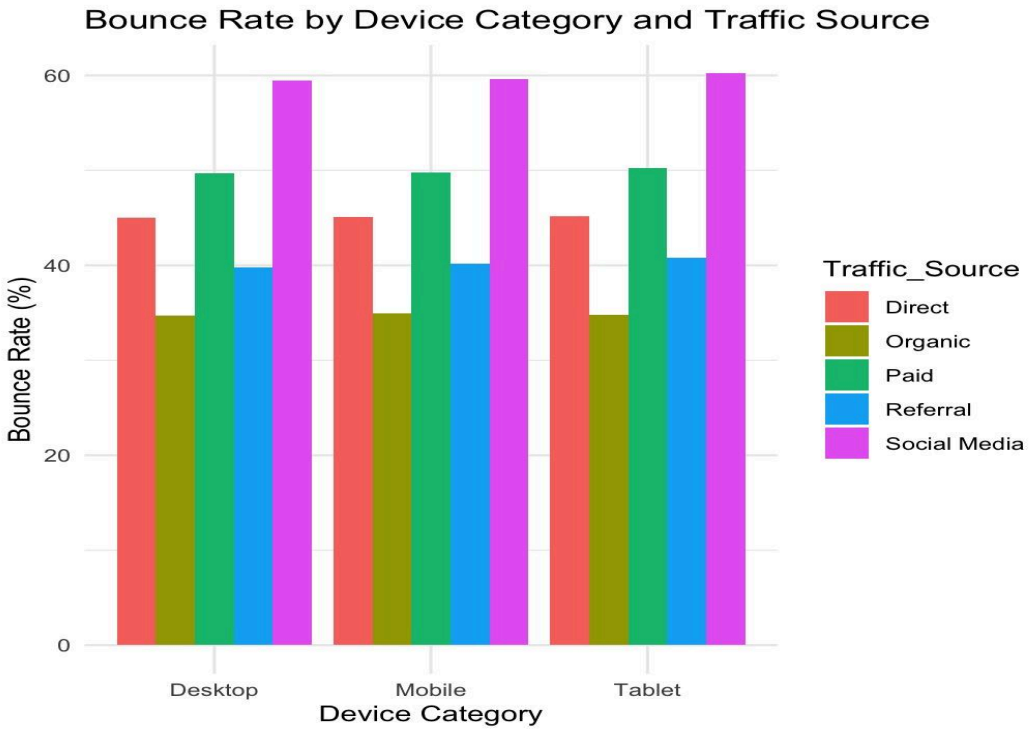

Fig2. A comparison of bounce rates between device categories.

Step 4: T-Test Analysis (Mobile vs Desktop Bounce Rates)

We performed a **t-test** to determine if there was a statistically significant difference between the bounce rates of **Desktop** and **Mobile** users.

```
# Perform t-test between Desktop and Mobile
t_test_result <- t.test(Bounce_Rate ~ Device_Category, data =
filter(data, Device_Category %in% c('Mobile', 'Desktop')))
print(t_test_result)
```

T-test Results

t-value	-0.57558
Degrees of freedom (df)	6362.9
p-value	0.5649 (greater than 0.05)
95% Confidence Interval	[-0.5987, 0.3269]
Mean Bounce Rate (Desktop)	42.69%
Mean Bounce Rate (Mobile)	42.82%

Conclusion: The **p-value (0.5649)** indicates that there is **no statistically significant difference** in the bounce rates between Desktop and Mobile users. The difference in bounce rates is likely due to random variation rather than an actual difference in user behavior across devices.

Step 5: Recommendations

Based on the analysis, we provide the following recommendations:

1. **Focus on Organic Traffic**: Organic traffic performed the best in terms of bounce rate and session duration. Invest more in **SEO strategies** and content marketing to further capitalize on this source.
2. **Optimize for Social Media Traffic**: Social Media traffic had the highest bounce rate. Consider improving **landing page relevance**, **call-to-action (CTA)** positioning, and **content** for users coming from social media channels to lower the bounce rate.
3. **No Immediate Need for Device-Specific Optimization**: The analysis showed no significant difference in bounce rates between Desktop and Mobile users. Therefore, device-specific optimization for these platforms may not be a priority at this time. However, the **Tablet user experience** could be improved to lower bounce rates.

4. **Consider A/B Testing for Paid Traffic**: Since paid traffic had a moderately high bounce rate (50.12%), you might want to **A/B test landing pages** to see if changes (e.g., faster loading times, better content alignment) could reduce bounce rates.

Next Steps

- Implement **A/B tests** to optimize landing pages for '**high bounce rate traffic sources'** like Social Media and Paid channels.
- Conduct additional segmentation analysis, such as analyzing bounce rates by geographic regions or referral websites, to uncover more specific optimization opportunities.