User session analysis

In the period from 01.11.2020 to 31.01.2021

Wroclaw, 12/04/2024

User session definition

- User session represents a continuous period of user activity on a website.
- User session consists of a sequence of events by the same user with relatively short gaps between them.
- If the time difference between two events is less than a certain threshold, we consider them as part of the same session.
- If the time difference exceeds the threshold, we start a new session.
- As a benchmark, Google Analytics defaults to 30 minutes as a threshold for session gap.
- A single user can come to a website on multiple days, additionally using multiple devices.
- User’s activity on different devices should be considered as separate sessions.

User session model for the analysis

- For this analysis user session has been defined as a **sequence of events per user per category (desktop, mobile, tablet)**.

- Since one user can come to a website using different devices, events on different devices are considered as parts of separate sessions.

- **Gap in session** aggregating events to separate sessions = **30 minutes**.

  For sequence of events per user per category:
  - if the difference between events is less than or equals 30 minutes, we consider them as part of the same session,
  - if the difference between events is longer than 30 minutes, this will be considered as a gap in session, starting a new session.

- Defined user session model implies, that **one user can have multiple sessions on multiple devices**.

Overall performance

Time period of the analysis:	**3 months from 01.11.2020 to 31.01.2021**
Total number of sessions:	**355 597**
Total number of conversions:	**4 843**
Total conversion rate:	**1,36%**
Total purchase revenue:	**362 165 USD**
Average order value:	**74,78 USD**
Average order per session:	**1,02 USD**

total number of purchases/total number of sessions

total revenue/total number of purchases

total revenue/total number of sessions

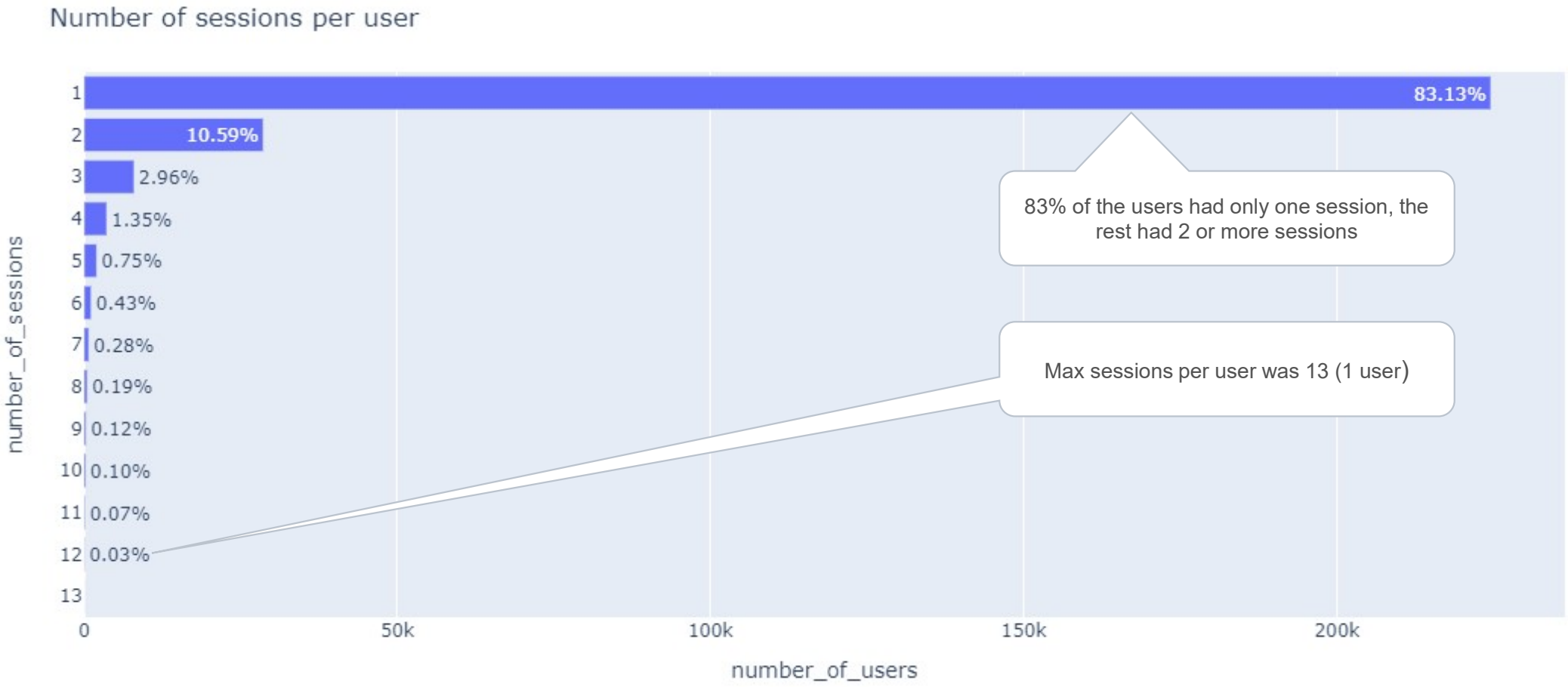
Overall performance

Total number of unique users:	**270 154**
Max number of sessions per user:	**13**
Avg. number of sessions per user:	**1,32**
Max number of conversions per user:	**6**
Total bounce rate:	**36,57%**

total number of bounces/total number of sessions

Bounce = session up to 5 seconds

Overall performance



Overall session duration

Mean: **00:03:32** (212 seconds)

Median: **00:00:14** (14 seconds)

Min: **00:00:00**

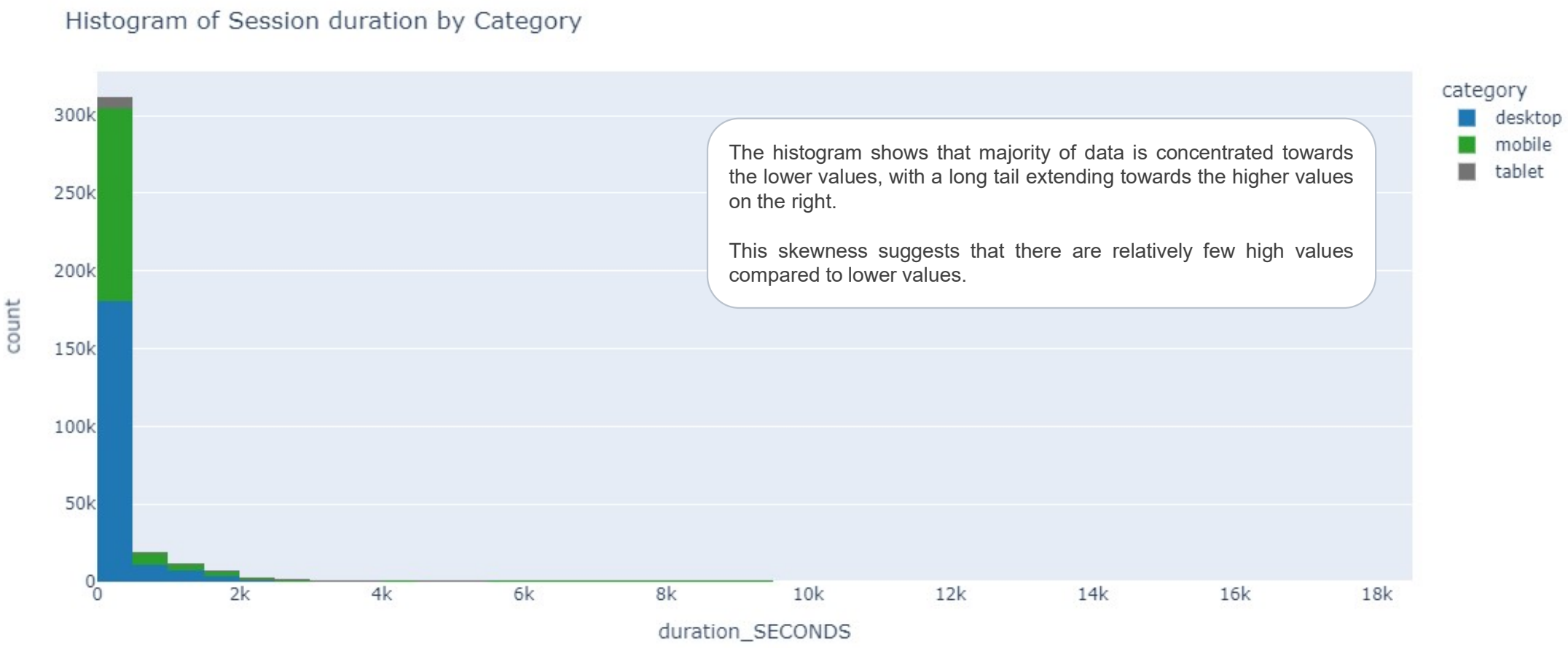
Max: **05:01:04**

Median session duration is significantly lower than the mean due to the following observations:

- there are relatively few high values compared to lower values (right-skewed distribution),
- presence of extreme upper bound outliers, that heavily influence the mean, pulling it upwards and causing it to be significantly higher than the median.

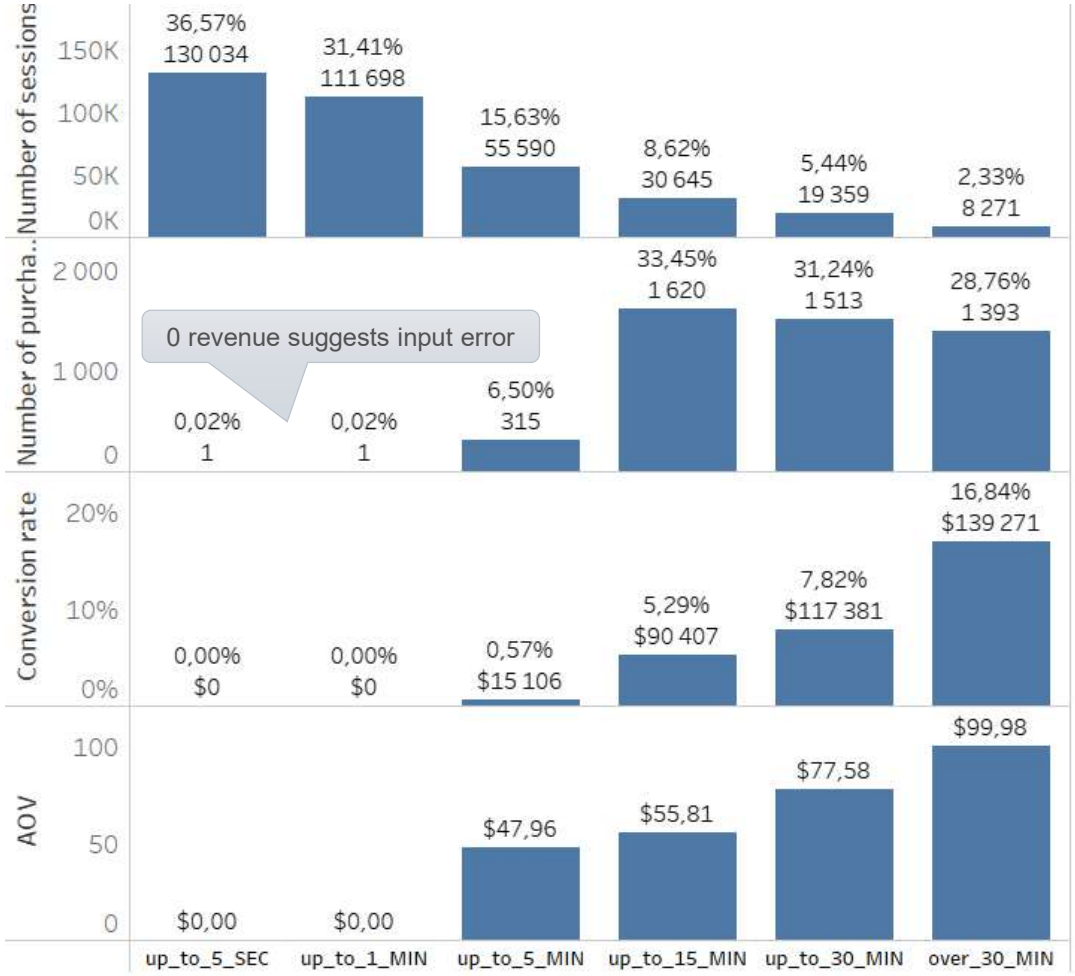
- For such type of dataset median provides a better representation of the central tendency, as it is less sensitive to outliers.
- Therefore for further analysis of session duration across different dimensions, median was used as a measure of central tendency.

Session duration values distribution



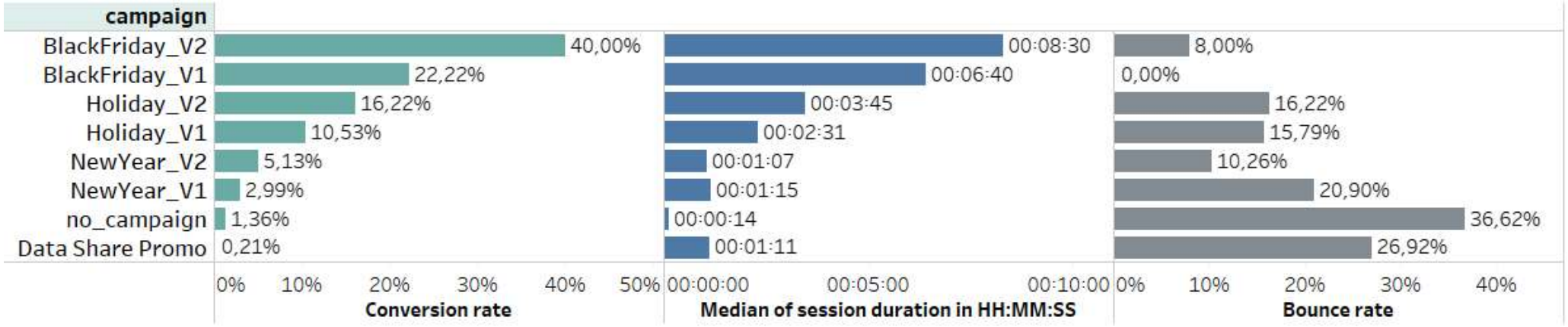
Session duration values distribution

Performence by session duration segment



- To show overall session trends, sessions were assigned to 6 segments, based on duration.
- The largest number are sessions up to 5 seconds (36% of all sessions), followed by sessions up to 60 seconds (31.41%). There are no conversions among these sessions, suggesting that they can be treated as bounces.
- The highest number of conversions is for sessions lasting up to 15 minutes. A common behavior is that users do not make a purchase in the initial session, but in subsequent sessions, which can be shorter.
- The highest revenue comes from sessions over 30 minutes, which are the lowest number of sessions.
- This indicates the highest AOV in this segment, suggesting that users making higher orders are spending more time on the site.

Performance by campaign vs. non-campaign



- There were 7 campaigns in the analyzed period.
- Conversion rates of 6 campaigns (Black Friday, Holiday, NewYear) suggest that they were an imporovement to non-campaign sessions.
- Data Share Promo campaign did not result in higher conversions.
- Each campaign resulted in longer sessions, although this is not necessarily associated with a linear increase in conversion rates.
- Data Share Promo sessions are five times longer than non-campaign sessions, but do not result in higher conversions.
- Bounce rate is highest for non-campaigns sessions, further suggesting that campaigns in general are improvement.

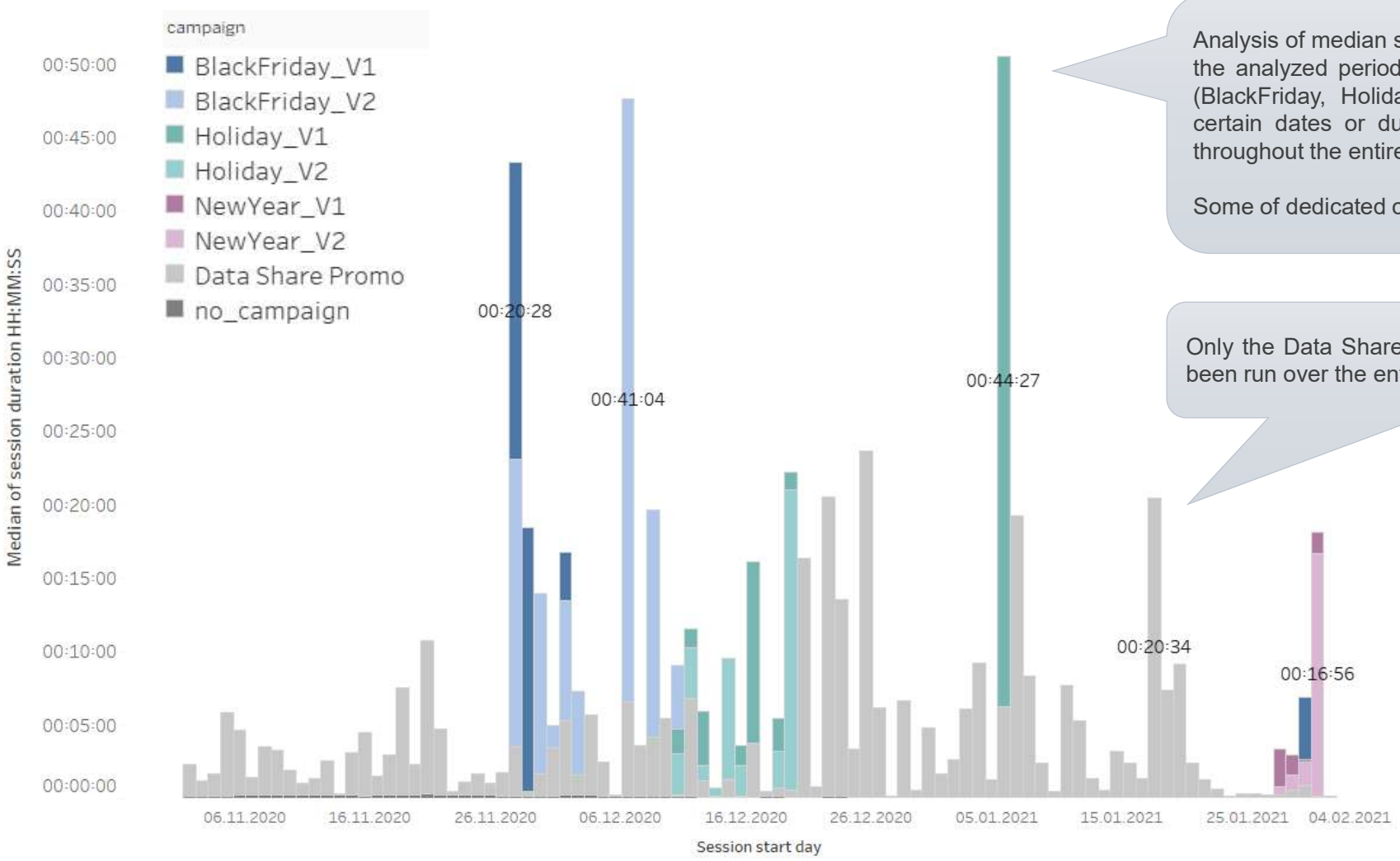
AB testing campaign vs. non-campaign significance

The following one-sided A/B tests were conducted to test statistical significance of observed difference in conversion rates of specific campaigns' sessions to non-campaign related sessions *(p-value 0.05, significance level 95%).*

Control	Variant	Number of purchases	Numbers of sessions	Conversion rate	AB testing result	p-value
no-capaign	BlackFriday_V1	2	9	22,22%	Result not significant	0,0661
no-capaign	BlackFriday_V2	10	25	40,00%	Significant result	0,0000
no-capaign	Holiday_V1	2	19	10,53%	Result not significant	0,0965
no-capaign	Holiday_V2	6	37	16,22%	Significant result	0,0071
no-capaign	NewYear_V1	2	67	2,99%	Result not significant	0,2173
no-capaign	NewYear_V2	2	39	5,13%	Result not significant	0,1431
no-capaign	Data Share Promo	3	1 460	0,21%	Significant result	1,0000
Control	no_campaign	4 816	353 941	1,36%		

- The AB test results for BlackFriday_V2 and Holiday_V2 campaigns demonstrate statistically significant increases in conversion rates, suggesting that these campaigns effectively lead to higher conversions compared to sessions without campaigns.
- The AB tests conducted for BlackFriday_V1, Holiday_V1, NewYear_V1 and NewYear_V2 reveal no statistically significant difference in conversion rates. The observed results are very likely due to random chance alone. Therefore, there is not enough evidence to conclude that these campaigns will lead to higher conversions.
- The conversion rate of sessions associated with Data Share Promo campaigh was 84.9% lower than the conversion rate of non-campaign sessions. The AB test result indicates that this campaign will perform worse than no campaign, with the difference not attributed to random chance.

Median session duration by campaign over time

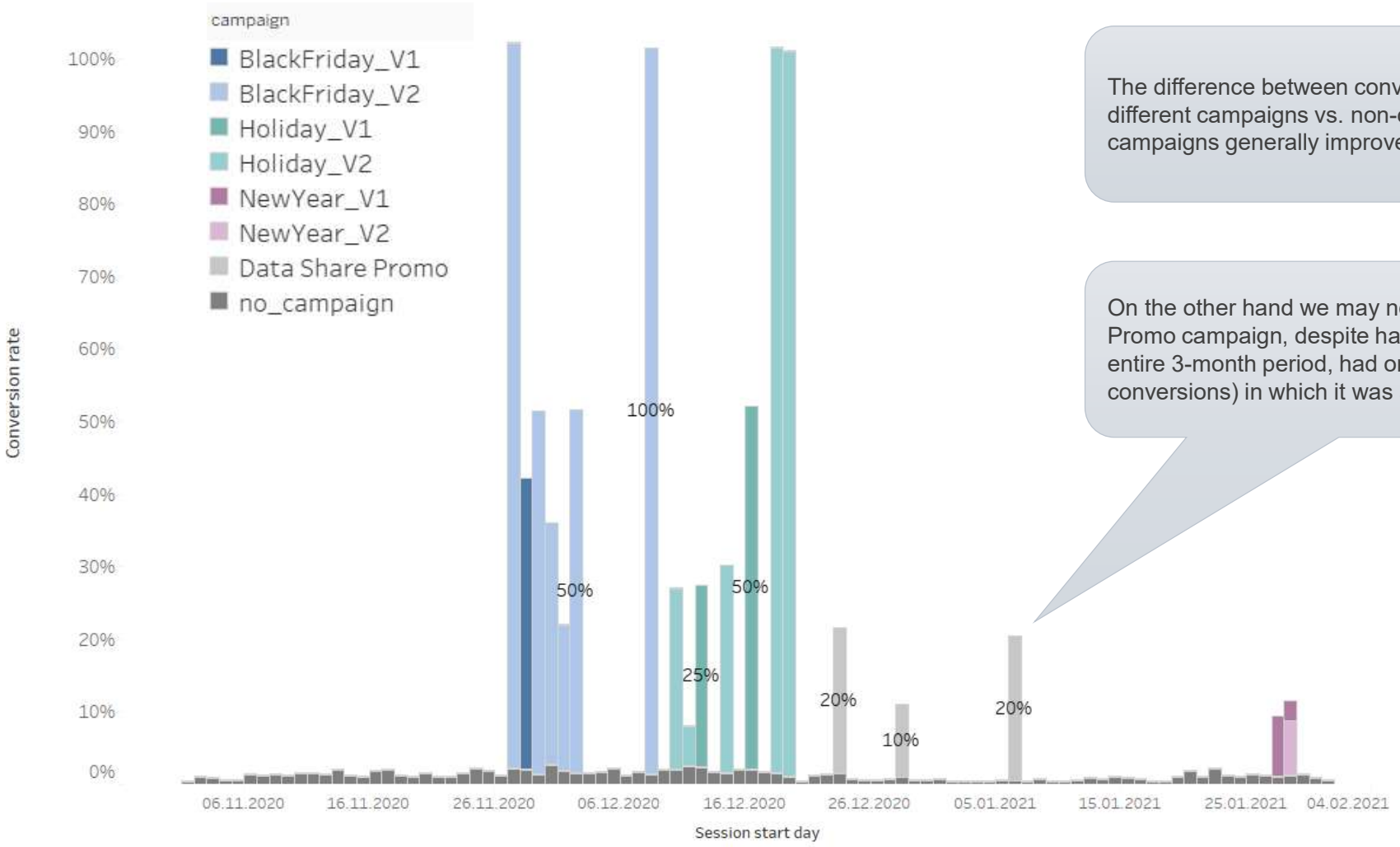


Analysis of median session duration by campaign over the analyzed period suggests, that some campaigns (BlackFriday, Holiday, NewYear) were run only on certain dates or during certain periods, rather than throughout the entire analyzed period.

Some of dedicated campaigns were run simulatively.

Only the Data Share Promo campaign appear to have been run over the entire analyzed period.

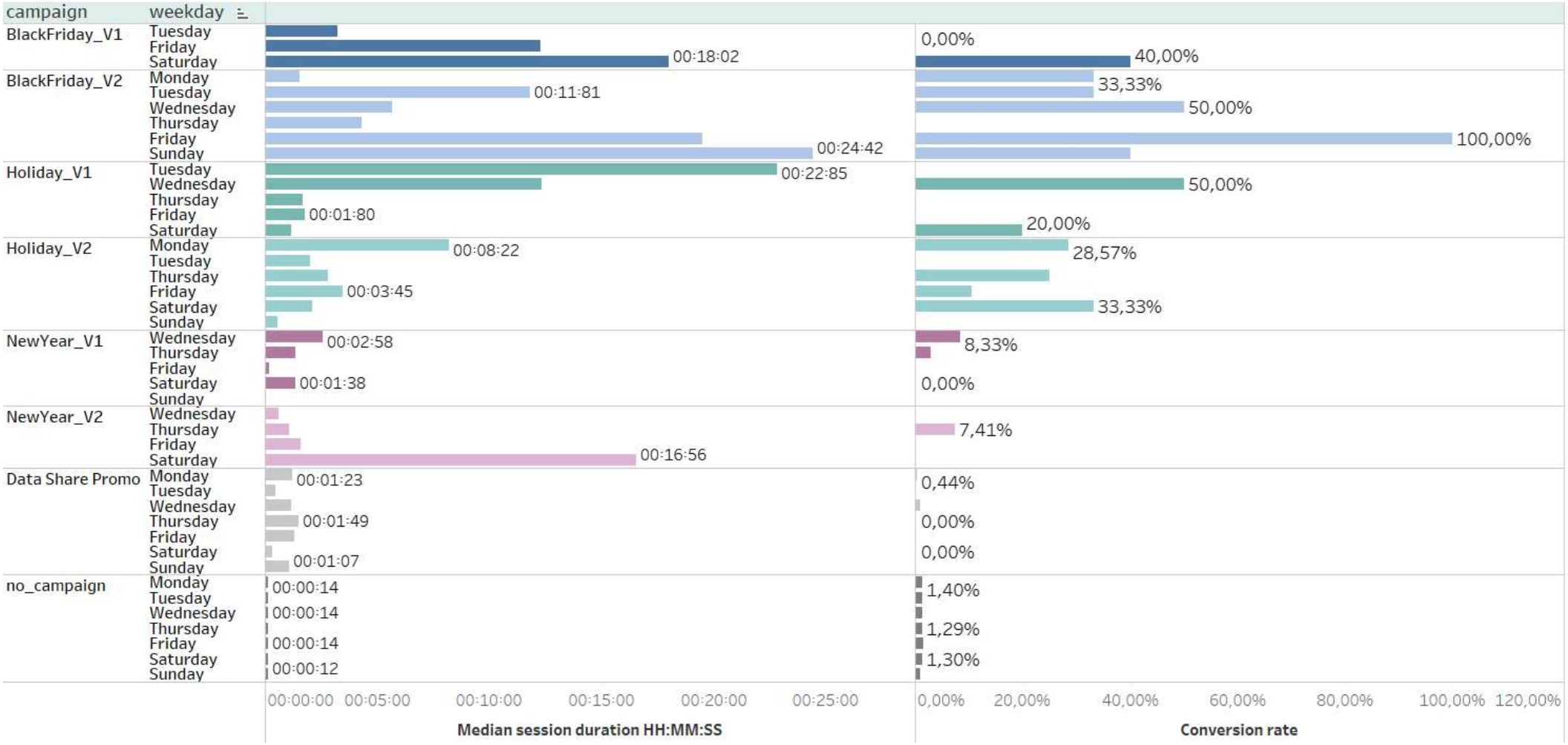
Conversion rate by campaign over time



The difference between conversion rates between different campaigns vs. non-campaign suggest that campaigns generally improve conversion rates.

On the other hand we may notice that Data Share Promo campaign, despite having been running for the entire 3-month period, had only 3 days (specifically, 3 conversions) in which it was successful.

Sessions' performance by days of week by campaign



Sessions' performance by days of week by campaign

- As a consequence of different performance on specific dates, campaigns show different performance depending on the day of the week, which applies to both session duration and conversion rates.

- Nevertheless, due to the small number of data points (only specific dates on which campaigns were most likely run), we cannot draw a general conclusion that specific campaigns have better performance on specific days of the week.

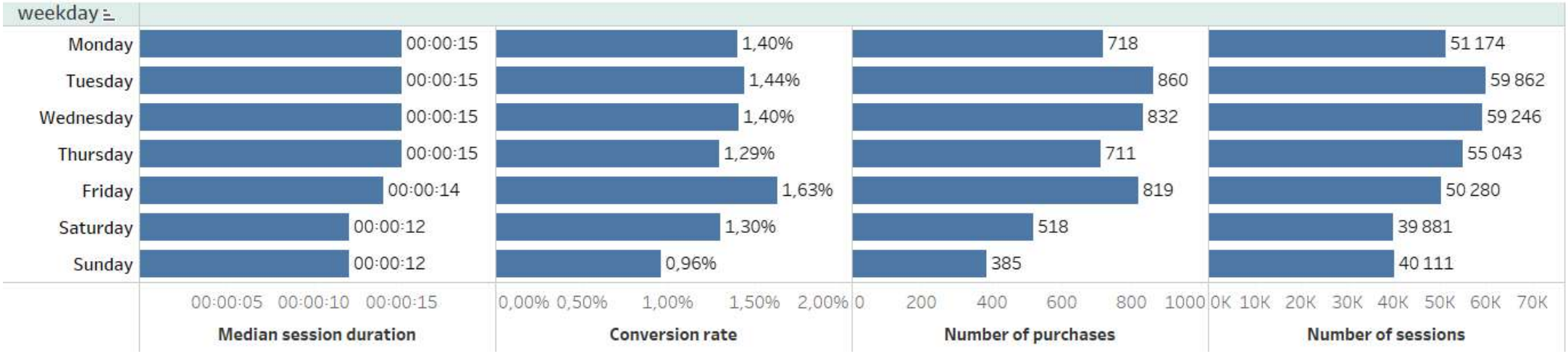
- On the other hand, this does not apply to non-campaign-related sessions. In contrast to campaigns, we can observe a trend in non-campaign results, during the period analyzed:

    - Median session duration is generally higher on weekdays (14 - 15 seconds) and drops to 12 seconds on weekend.

    - The conversion rate is best on Fridays at 1.63% and worst on Sundays at 0.96%.

- The Data Share Promo campaign had only 3 conversions in the entire three-month period, specifically on Monday and Wednesday. Despite the fact that the campaign ran for the entire period, it is more a coincidence than a general rule that it was effective on those specific days of the week.

Days of week overall trend



For the entire dataset, we can observe a trend in weekday performance over the period analyzed:

- Median session duration is generally higher on weekdays (14 - 15 seconds) and drops to 12 seconds on weekends.
- The conversion rate is best on Fridays at 1.63%, and worst on Sundays at 0.96%.
- Number of sessions and purchases reveal that users are more active on weekdays rather than weekends.

AB testing days of week conversion rate significance

The following one-sided A/B tests were conducted to test statistical significance of observed improvement in conversion rate on Fridays comparing to other days of week *(p-value 0.05, significance level 95%).*

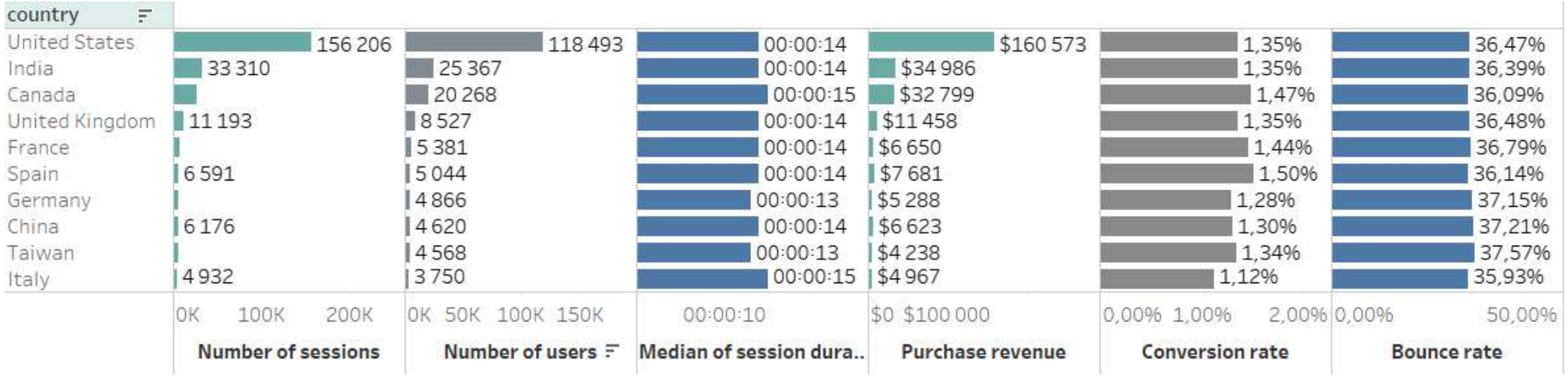
Control	Variant	Session duration	Number of purchases	Numbers of sessions	Conversion rate	AB testing result	p-value
Monday	Friday	00:00:15	718	51 174	1,40%	Significant result	0,0017
Tuesday	Friday	00:00:15	860	59 862	1,44%	Significant result	0,0049
Wednesday	Friday	00:00:15	832	59 246	1,40%	Significant result	0,0013
Thursday	Friday	00:00:15	711	55 043	1,29%	Significant result	0,0000
Saturday	Friday	00:00:12	518	39 881	1,30%	Significant result	0,0000
Sunday	Friday	00:00:12	385	40 111	0,96%	Significant result	0,0000
Variant	Friday	00:00:14	819	50 280	1,63%		

- Each test showed a statistically significant difference in conversion rate on Friday compared to other days of week. The observed results are not likely to be due to random chance alone.
- This indicates a conclusion, that the conversion rate on Friday will be with 95% confidence better than on other days of week.

Performance by Category

- There are 3 categories of devices on which sessions are conducted: desktop, mobile, tablet.
- Desktop has the highest number of sessions, followed by mobile and tablet.
- The bounce rate and conversion rate are comparable for each category, with a slightly higher conversion rate for mobile devices.
- Median session duration is equal for each category and the same as overall for the entire data set
- Purchase revenue is the highest on desktop.
- Desktop and tablet present comparable AOV and average revenue per session. Both metrics are slightly lower for tablets.

Performance by Top 5 Countries



- Sessions are reported for users in 109 countries.
- The top three countries in terms of number of sessions, number of users and revenue are the United States, India and Canada, 61% of all sessions are attributed to these 3 countries.
- Median session duration, conversion rate, and bounce rate have a normal distribution around the median and mean for the entire data set.

Conclusions

- Longer user sessions generally signal positive engagement, potentially indicating purchase intent. However, for a comprehensive understanding of user behavior and its impact on performance in e-commerce, additional metrics such as conversion rate and bounce rate should be incorporated into the analysis.

- The analysis reveals that longer sessions, particularly those achieved through marketing campaigns, do not always translate to higher conversions. For example, the Data Share Promo campaign, although it resulted in five times longer sessions than non-campaign sessions over a three-month period and collected a significantly higher number of sessions than dedicated campaigns, led to only three conversions. The AB test indicates a statistically significant finding: this campaign performed worse in conversion rates compared to non-campaign sessions.

- Analyzing other campaigns, BlackFriday_V2 and Holiday_V2 can be considered successful, showing statistically significant improvement in conversion rates.

- BlackFriday_V1, Holiday_V1, NewYear_V1 and NewYear_V2 conversion rates are higher than non-campaign sessions, however the AB tests results indicate that the difference is not statistically significant. The observed results are very likely due to random chance alone.

- Although these dedicated campaigns appear to have been carried out on specific dates or within short date ranges based on data distribution, further investigation of the period they were executed in is recommended for a comprehensive understanding of their performance.

- Furthermore, an additional AB test demonstrates a statistically significant difference in conversion rates by weekdays, with Fridays showing the highest conversion rates. This suggests that users are more likely to make purchases on Fridays compared to other days of the week. However, it's important to note that it's common for users not to make purchases in their initial session. This behavior is reflected in the higher median session duration observed from Monday to Friday, as well as the number of sessions on those days.

Recommendations

- ✓ Resign from Data Share Promo Campaign, especially if it is associated with costs. Although this campaign resulted in five times longer sessions than non-campaign sessions, it performed worse in conversion rates compared to non-campaign sessions.

- ✓ Out of dedicated campaigns, BlackFriday_V2 and Holiday_V2 can be considered successful, showing statistically significant improvement in conversion rates. However, to fully understand the contribution of these campaigns to the business, it is recommended to further analyze their revenue against cost (ROI) and make a decision accordingly to continue or not.

- ✓ Dedicated campaigns seem to have a good impact on conversion, although to achieve optimal performance, especially reducing costs, it can be considered to run these campaigns on specific days of the week, specifically Monday to Friday, and especially Friday. Analysis revealed the statistical significance of better conversion rates on Fridays, although we need to remember that the initial sessions might start on earlier days.

Thank you

PATRYCJA DANILCZUK

Data Analyst | Insurance Market Expert | Team Leader

Location: Wroclaw, Poland Nationality: Polish email: patrycja.danilczuk@gmail.com
phone: +48 721 776 030 LinkedIn profile: https://www.linkedin.com/in/patrycja-danilczuk