Facebook Metrics Marketing Analysis:

An analysis of post customizations and their impact on total reach

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Abstract

With over 3 billion users, Facebook presents a significant customizable advertising opportunity (Meta, 2023). This research paper aims to provide actionable recommendations to businesses to optimize their Facebook marketing strategies. They can maximize total reach by leveraging insights related to various post customizations. Recent research recommends that companies should post photos on Fridays at 3pm for optimal reach (Newberry, 2023; Read, 2023). However, this data is based on cross-platform data, and Facebook could be unique. Based on this research, the overall alternate hypothesis is that there is a significant relationship between post customizations and total reach of the post. Our null hypothesis is that there is no significant relationship between the total reach of the post and post customizations. Within the alternate hypothesis, it is predicted that paid photos made on Friday at 3pm will lead to the greatest total reach. To investigate, we are using a dataset that contains Facebook data from a cosmetics brand for all of 2014. Due to confidentiality constraints, 290 rows were removed, leaving 500 rows to analyze. Key performance indicators include the hour and day of post, post type, promotion status, and total reach of the post. Expected insights include recommendations on effectiveness of paid promotions, post format, and optimal posting time and day. These insights align with the project objective by helping businesses maximize the use of Facebook as a marketing platform. They can make decisions that are likely to generate the highest levels of reach on Facebook, and therefore increase brand awareness. However, decision-makers need to recognize that Facebook's advertising algorithms are designed to optimize ad delivery and target specific user groups, in which biases can emerge, leading to unintended consequences.

Keywords: Facebook, Marketing strategies, Post customizations, Total reach

Introduction

Objective

The objective of this research is to determine how to optimize Facebook posts for views based on various customizations, including promotional status, content type, and the time and day of the post. In the rapidly evolving landscape of social media and digital marketing, Facebook stands out as a platform with an extensive user base exceeding 3 billion individuals, enabling businesses to reach and connect with a diverse audience globally (Meta, 2023). Additionally, Facebook provides a range of customizable ad formats, offering companies the flexibility to choose the format that best suits their marketing goals to enhance engagement. Customizing features of a post can increase total reach if done strategically, and we aim to research which specific customization choice leads to the most reach. Moreover, Facebook's analytics tools provide in-depth insights into campaign performance, allowing advertisers to track metrics such as impressions, clicks, and conversions. This data-driven approach is crucial for optimizing marketing campaigns and various existing research supports this. A data-driven marketing approach is a complex challenge that has incredible potential to reach the right user at the right time with the appropriate message in the right place, and it motivates them to an appropriate action (Cioffi, 2019). However, most studies are based on aggregated data across social media platforms and industries. Therefore, we aim to provide recommendations for optimizing Facebook posts for total reach, more specifically for companies in the beauty industry.

Promotion Status

Paid promotion, in contrast with organic promotion, is a marketing strategy that involves the effective allocation of financial expenditures to disseminate promotional messages through

various channels, aim to reach a targeted audience and achieve specific marketing objectives. Oftentimes, when large e-commerce merchants have a targeted promotion in mind, they seek out paid support to make their brand keywords or key features stand out (Yang, et al., 2020). However, for smaller e-commerce merchants, paid promotion can be way more risk-bearing given that it is difficult at times to determine if the paid traffic cannibalizes unpaid traffic when the product array is relatively small (Hao & Yang, 2022). Nevertheless, paid promotion exhibits positive effects on short-term firm performance and long-term firm value (Bayer, et al., 2020). Combined with performance tracking, strategic targeting, and direct placement, paid promotion presents a differential advantage for e-commerce merchants.

Post Type

Data collected from Facebook shows that photos and status get the highest engagement on average compared to links and videos (Newberry, 2023). However, experts also suggest that you customize your content to your product to best present what you are advertising, so this finding could vary across industries. Additionally, the Facebook algorithm has revealed that it ranks whatever you engage with most at the top of your feed. If you engage with photos mainly, it will show you photos first (Newberry, 2023). There may be certain types of content that the majority of people engage with most, so it would be beneficial to find out which content type is most engaged with in order to invest your efforts in making that specific content of the highest quality.

Time of Day

The time of day in Facebook posting refers to the specific times when users tend to post content on the platform. Identifying which point of day gets the most engagement can help maximize the level of engagement and reach for posts by targeting the audience when they’re

most likely to be online and interacting with the content. According to the American Marketing Association, the best time to post on Facebook are Tuesday, Wednesday and Friday between 9 a.m. and 1 p.m. (Powers, 2023) Based on this finding, it can be assumed that Facebook users tend to engage the most on weekdays, especially in the morning. At the same time, Saturdays tend to have the least engagement, so it is advised to avoid posting on that day (Powers, 2023). Facebook maintains its dominant position as the leading global social media platform, offering continuous engagement throughout the day. Nevertheless, it can be said that weekdays, especially during early mornings and evenings present the most reliable and consistent engagement levels, providing brands with ample chances to capture attention for their content.

Hypotheses

Our null hypothesis is that there is no significant relationship between the total reach of the post and post customizations. Within the alternate hypothesis, it is predicted that paid photos made on Friday at 3pm will lead to the greatest total reach.

Methods

The Data

The data used in this research was obtained from UC Irvine machine learning repository. To investigate, we are using a dataset that contains Facebook data from a cosmetics brand for all of 2014. Due to confidentiality constraints, 290 rows were removed, leaving 500 rows to analyze. Key performance indicators include the hour and day of post, post type, promotion status, and total reach of the post.

Statistical Analysis

The ultimate goal of our statistical analysis is to test whether there is any relationship between our chosen customizations and total reach. If there is no relationship, that would suggest

that businesses do not need to worry about which customization they choose. If there is a relationship, that would suggest there is an ideal combination of customizations to maximize post total reach. To test the relationship between lifetime post total reach and promotion status (paid and unpaid promotion), a T-test will be conducted. To investigate the relationship between content type (photo, status, link, video) and lifetime post total reach, we will run an ANOVA. To further investigate the results of this ANOVA, Tukey's HSD Test and a Bonferroni Correction will be conducted. Next, To look at the relationship between days of the week and lifetime post total reach, another ANOVA will be conducted. To test the relationship between time of day and lifetime post total reach, an ANOVA will be conducted. Finally, to look at the relationship between time of day, day of the week, and lifetime post total reach, we will run an ANCOVA.

Results

Promotion Status: T-test

Boxplot (Figure 1), Violin Plot (Figure 2), and Density Curve (Figure 3) serve to visualize the relationship between the dependent variable, lifetime post total reach, and the independent variable, promotion status, which can be divided into paid promotion or unpaid promotion. While two different types of promotion both exhibited right-skewed (positive) distribution and similar central tendency, paid promotion has a wider spread, indicating greater variability in data. However, unpaid promotion seems to have a higher overall density for lifetime post total reach under 25,000. These initial findings exhibit a positive effect on short-term firm performance, which is consistent with the academic research on paid promotion's ability to provide differential advantage for e-commerce businesses. Despite the wider span in data for paid promotions, it is still unclear whether paid promotions are cannibalizing unpaid promotions, since both seem to provide positive value to the online business.

Figure 1

Box Plot of Post Total Reach by Promotion Status

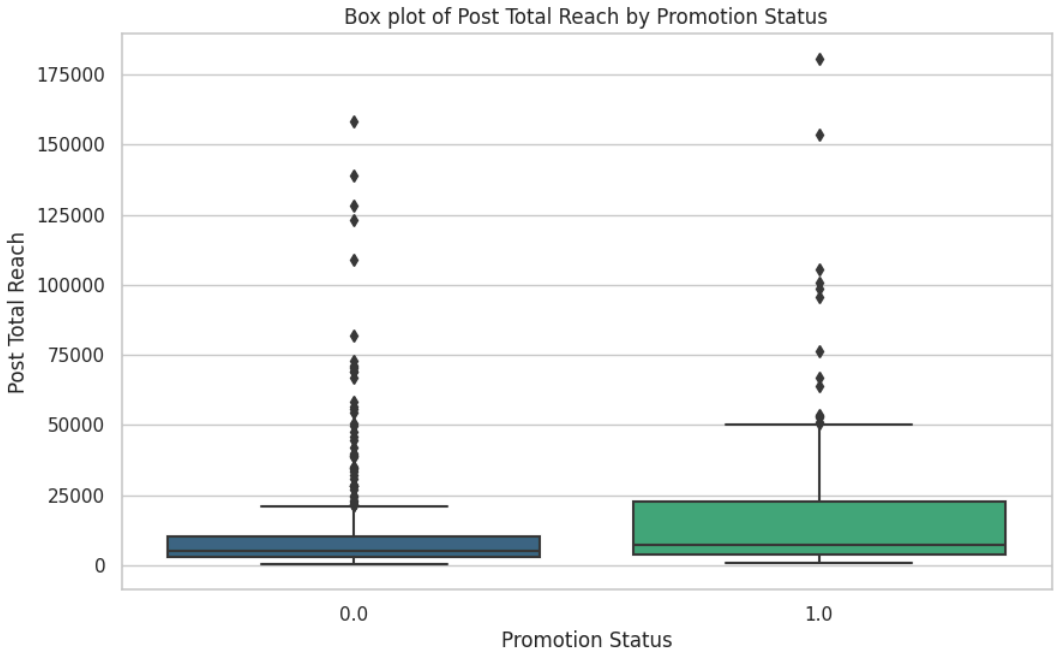


Figure 2

Violin Plot of Post Total Reach by Promotion Status

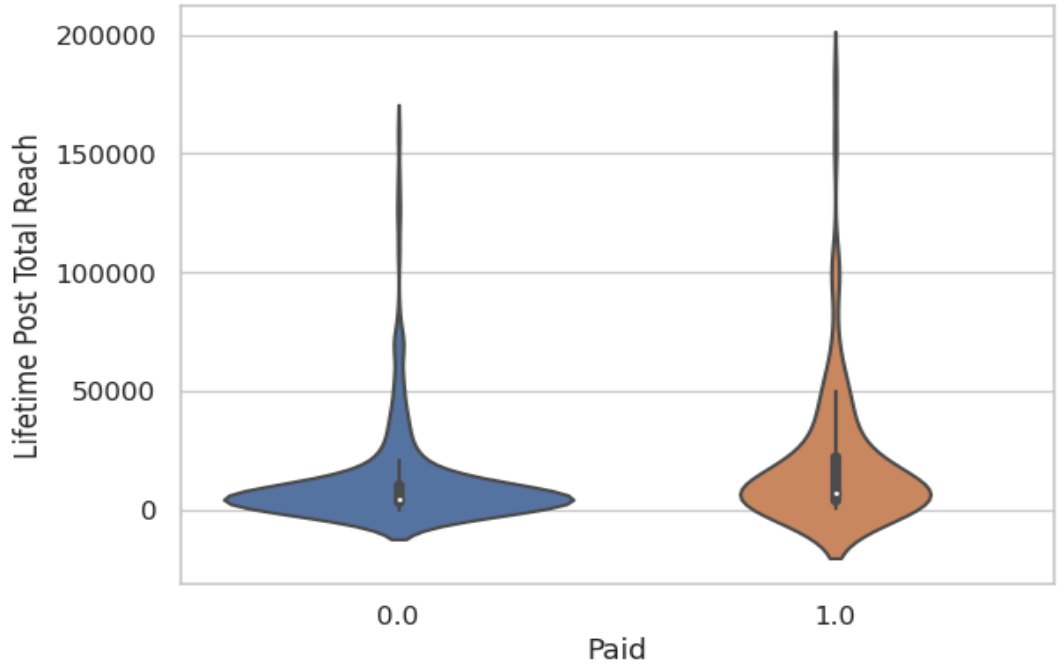
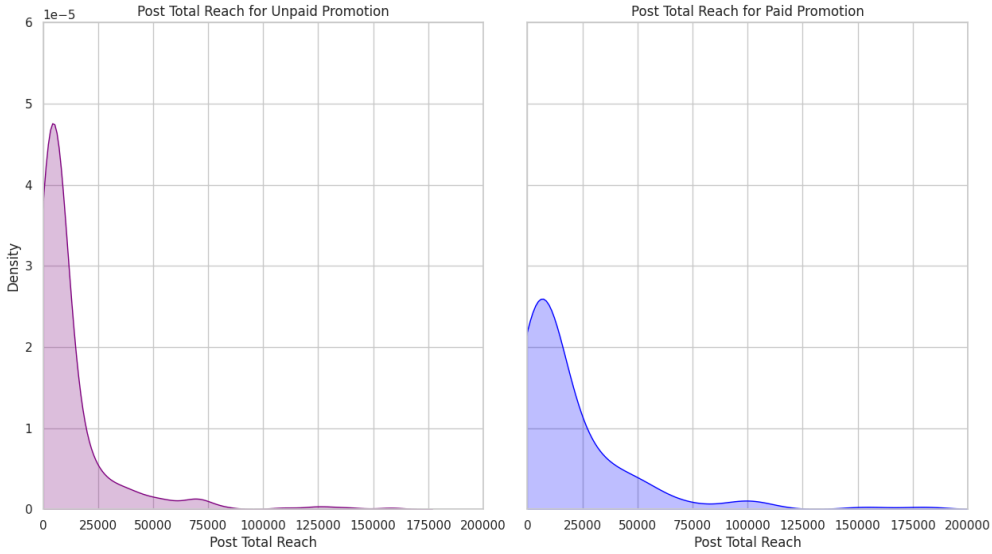


Figure 3

Density Curves of Post Total Reach by Promotion Status



To better understand the difference between the average lifetime post total reach for paid promotion and the average lifetime post total reach for unpaid promotion, a two-sample independent t-test is performed with the null hypothesis that $H0$: $\mu 1 = \mu 2$ and the alternative hypothesis that Ha: $\mu 1 \neq \mu 2$. Selecting the alpha at 0.05, the test yields a t-test statistic of 3.30 and a p-value of approximately 0. Thus, there is enough evidence to reject the null hypothesis and conclude that there is a difference between the average lifetime post total reach for paid promotion and the average lifetime post total reach for unpaid promotion.

Post Type: ANOVA, Tukey's HSD Test, Bonferroni Correction

Figure 4

Boxplot of Lifetime Post Total Reach by Post Type

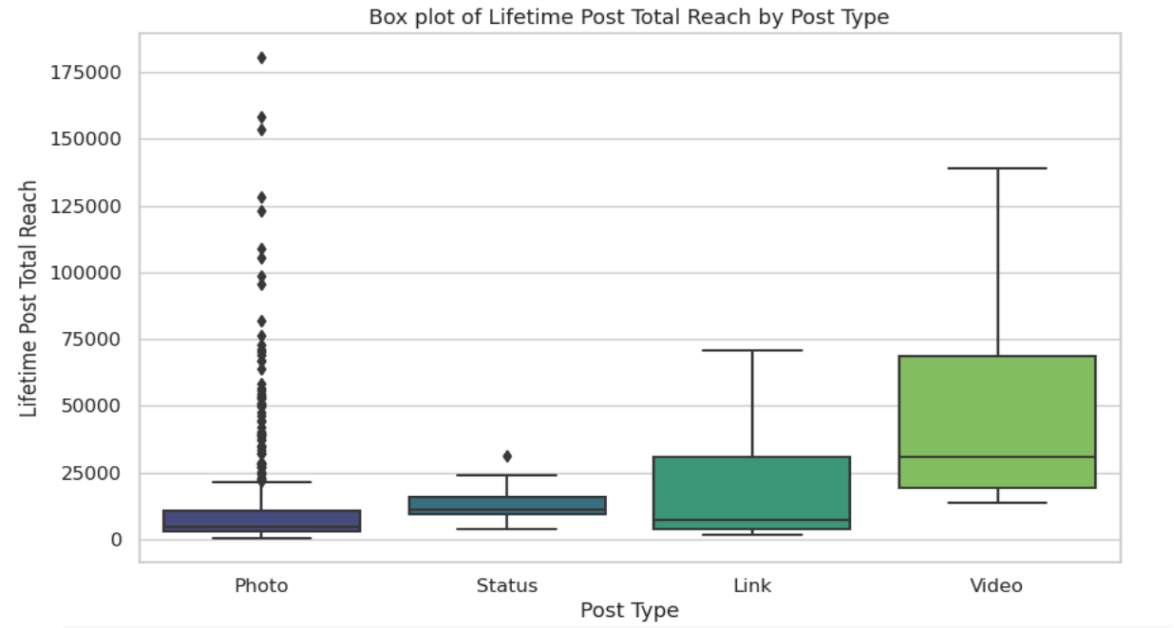


Figure 5

Density Curve of Lifetime Post Total Reach by Post Type

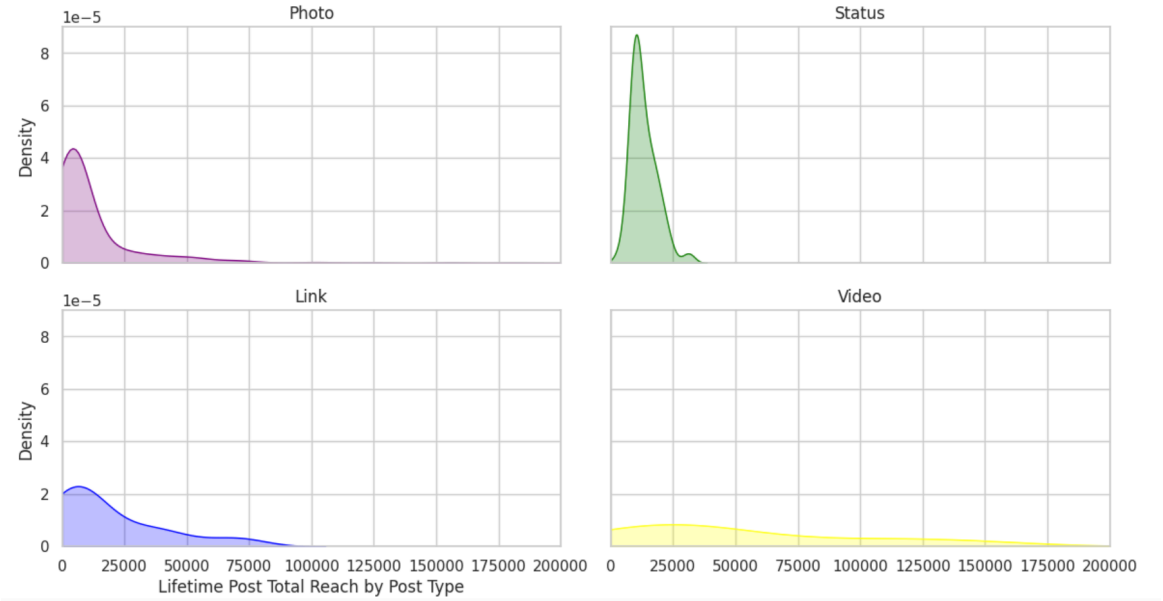


Figure 4 and Figure 5 serve to visualize the relationship between the independent variable, post type, which is divided into four categories: photo, status, link, video, and the dependent variable, lifetime post total reach. There appears to be little variation between the means of photo, status, and link, but large variability in their distributions. There seems to be a large variation between video and the other categories in their means and distributions. Photo and Status also appear to be affected by extreme outliers pulling the mean higher. These initial findings seem to be inconsistent with our research that states photo and status would have more engagement than links and videos on average (Newberry, 2023).

Our ANOVA resulted in F-stat = 7.01, p-value = 0.00, which indicates that there is a statistically significant difference between certain post type categories at the 0.05 alpha level.

Table 1

Tukey's HSD Test

```
Tukey's HSD Test:
     Multiple Comparison of Means - Tukey HSD, FWER=0.05
=============================================================
group1 group2  meandiff  p-adj     lower      upper    reject
-------------------------------------------------------------
  Link  Photo -5406.7764 0.6854 -17997.9181  7184.3654  False
  Link Status  -5465.702 0.7831 -20447.4349  9516.0309  False
  Link  Video 32661.1234 0.0045   7670.2817 57651.9651   True
 Photo Status   -58.9257    1.0  -9085.8883  8968.0369  False
 Photo  Video 38067.8997 0.0001   16123.062 60012.7375   True
Status  Video 38126.8254 0.0002  14728.2918  61525.359   True
-------------------------------------------------------------

Pairwise t-tests with Bonferroni Correction:
Video vs Link: t=2.53, p=0.02, p<0.016666666666666666 -> Not Significant
Video vs Photo: t=4.26, p=0.00, p<0.016666666666666666 -> Significant
Video vs Status: t=5.33, p=0.00, p<0.016666666666666666 -> Significant
```

These differences are further described in Table 1, which displays the results of the Tukey post hoc test. Three of the relationships are statistically significant at the 0.05 alpha level: Link-Video (p=0.0045), Photo-Video (p=0.0001), Status-Video (p=0.0002). This indicates that

the means of link, photo, and status do not differ significantly, but they do vary significantly from video.

To further investigate the difference between lifetime post total reach for post type, pairwise t-tests with Bonferroni Correction were performed between Video-Link, Video-Photo, and Video-Status. Two of the relationships are statistically significant at the 0.05 alpha level, which is transformed to alpha = 0.05/3 = 0.017 in the Bonferroni Correction: Photo-Video (p=0.00), Status-Video (p=0.00). This is not surprising as the Bonferroni Correction is more conservative in measuring significance compared to Tukey's test (Perneger, 1998).

Day of the Week: ANOVA, Tukey's HSD Test

Figure 6

Boxplot of Lifetime Post Total Reach by Day of the Week

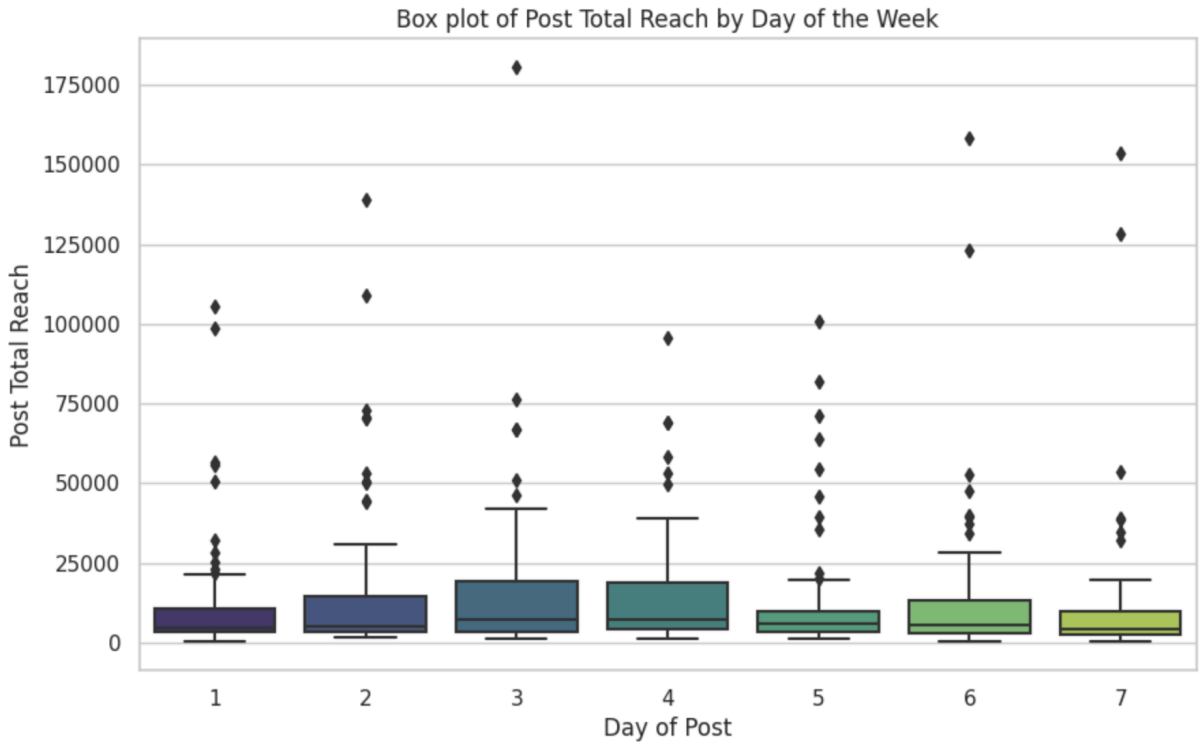


Figure 6 serves as a visual representation of the interplay between the independent variable, *the day of the week*, and the dependent variable, *lifetime post total reach*. In this

representation, Monday is designated as the first day of the week and is accordingly denoted as '1'. A noticeable symmetry is apparent across the distributions, as evidenced in their descriptive statistics. Notably, each day of the week exhibits related minimums, medians, first quartile values, and third quartile values, with an exception observed in the case of Wednesday and Thursday. Furthermore, a significant right skewness is present in each distribution. The most prominent difference within this boxplot pertains to the maximum values associated with individual days, exclusive of outliers. Wednesday and Thursday, denoted as 3 and 4 respectively, exhibit maximum values approximately double that of Monday, Friday, and Sunday.

The one-way ANOVA applied to the different days of the week yielded a high p-value of 0.58 which indicates that there is not a statistically significant difference between the lifetime post total reach and the day of the week the post was made at a 0.05 alpha, and thus we would fail to reject the null hypothesis. Given the non-significant findings from the ANOVA, a Tukey Post Hoc Analysis is deemed unnecessary. Nonetheless, in Table 2, one has been conducted to analyze the nuanced relationships between specific days. The most noteworthy association emerges between Sunday and Wednesday, with an adjusted p-value of 0.6248.

Table 2

Tukey's HSD Test - Day of the Week

Tukey's HSD Test:
Multiple Comparison of Means - Tukey HSD, FWER=0.05

group1	group2	meandiff	p-adj	lower	upper	reject
Friday	Monday	-817.0748	1.0	-12420.857	10786.7073	False
Friday	Saturday	199.4413	1.0	-10932.6174	11331.5	False
Friday	Sunday	-2118.8213	0.9977	-13220.1087	8982.4662	False
Friday	Thursday	2456.6188	0.9956	-8986.0754	13899.313	False
Friday	Tuesday	3687.3195	0.967	-8003.3933	15378.0324	False
Friday	Wednesday	4289.7698	0.9344	-7492.6041	16072.1437	False
Monday	Saturday	1016.5162	1.0	-10070.6539	12103.6862	False
Monday	Sunday	-1301.7464	0.9999	-12358.0203	9754.5275	False
Monday	Thursday	3273.6936	0.9794	-8125.3353	14672.7225	False
Monday	Tuesday	4504.3944	0.9138	-7143.5829	16152.3717	False
Monday	Wednesday	5106.8447	0.8574	-6633.1274	16846.8167	False
Saturday	Sunday	-2318.2626	0.995	-12878.3839	8241.8587	False
Saturday	Thursday	2257.1775	0.9964	-8661.2853	13175.6403	False
Saturday	Tuesday	3487.8782	0.9687	-7690.2408	14665.9973	False
Saturday	Wednesday	4090.3285	0.9355	-7183.62	15364.277	False
Sunday	Thursday	4575.44	0.8764	-6311.6478	15462.5279	False
Sunday	Tuesday	5806.1408	0.7192	-5341.3341	16953.6157	False
Sunday	Wednesday	6408.5911	0.6248	-4834.9745	17652.1566	False
Thursday	Tuesday	1230.7008	0.9999	-10256.8083	12718.2098	False
Thursday	Wednesday	1833.151	0.9992	-9747.6276	13413.9297	False
Tuesday	Wednesday	602.4503	1.0	-11223.4513	12428.3519	False

Time of Day: ANOVA

Figure 7

Boxplot of Lifetime Post Total Reach by Post Hour

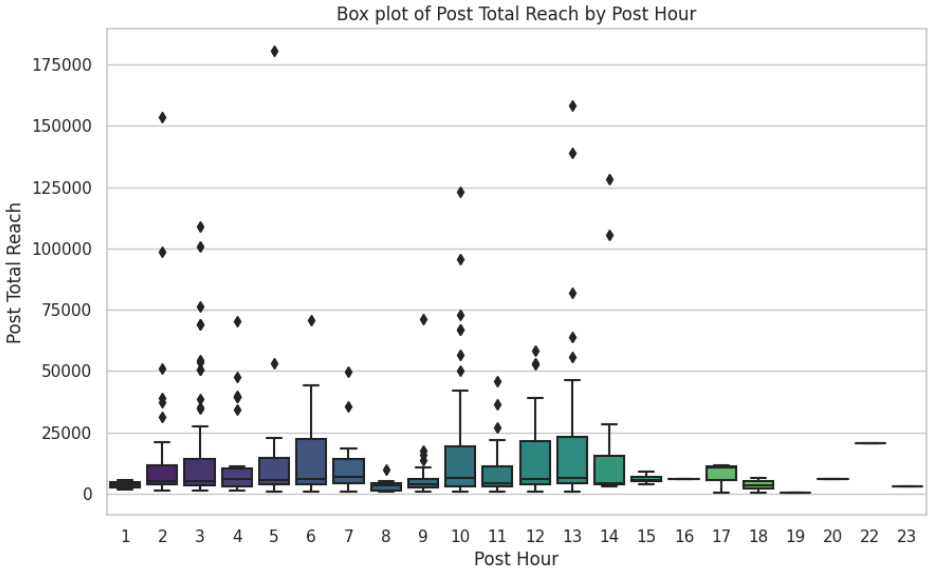
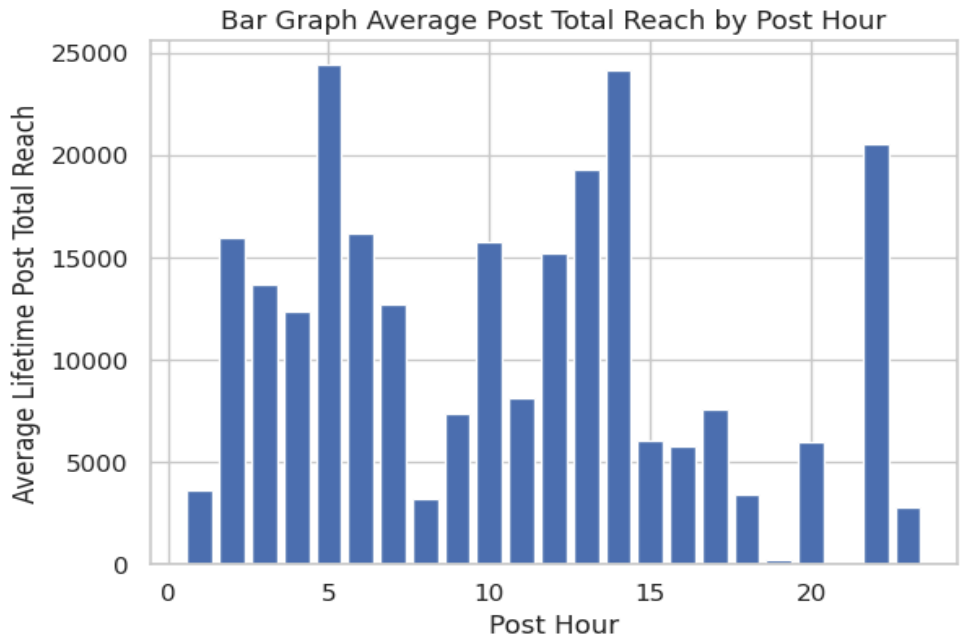


Figure 8

Bar Graph of Average Post Total Reach by Post Hour



In our Facebook metrics analysis using ANOVA, a p-value of 0.941 was obtained, indicating a high probability that any observed differences in posting times are attributable to random chance rather than a significant effect. In statistical hypothesis testing, the p-value serves as a crucial metric for assessing the strength of evidence against a null hypothesis. A p-value exceeding the conventional significance level of 0.05 implies insufficient grounds to reject the null hypothesis, which, in this context, might posit that there is no substantial difference in engagement based on posting time. The elevated p-value suggests that the observed variations in the data are likely to occur randomly, raising questions about the practical significance of our conclusions.

Given a p-value of 0.941, it's imperative to approach the implications of this result judiciously in our decision-making process. The data, at this level of statistical significance, does not strongly support the idea of a meaningful relationship between posting times and

engagement. However, it's essential to consider potential confounding factors or revisit aspects of the experimental design, such as sample size, to ensure a comprehensive understanding of the observed patterns. This result prompts a thoughtful reconsideration of the experimental approach and a cautious interpretation of the findings, recognizing the need for potential refinements in future analyses to better capture the dynamics of Facebook engagement.

Discussion

Two of the most consequential limitations in our study revolve around the quality and validity of our data. Much of our data input into our ANOVAs were not normally distributed. In future analyses, we would want to log-transform the data to take these distributions into account. Additionally, there is an underlying assumption that the brand is posting uniformly across days, times, and post types. In reality, the company may be utilizing the post customizations already deemed for optimal reach, so our study would not have access to data for non-optimized view times. Furthermore, if a posting did not generate enough views, there is a possibility that it was deleted from the account and thus our data to preserve a higher view and reach count.

One interesting finding from running our post type ANOVA was that the only content type that seemed to have a significant difference in mean of lifetime post total reach between other content types was video. The mean was significantly different and higher than the other means. This is inconsistent with research that finds videos do not normally perform as well on average compared to other content types (Newberry, 2023). Additionally, in the Tukey's test, there was a significant difference between video and link for lifetime post total reach, but in the Bonferroni Correction, there was no significant difference. This is consistent with literature stating that Bonferroni Correction is more conservative in measuring significance than Tukey's HSD Test. This minimizes the chance of type 1 error, but it increases the chance of type II errors

(Perneger, 1998). As far as our recommendation based on this finding, we will choose to follow the results of the Tukey test because we would rather take the risk of a false positive than incorrectly failing to reject the null.

With one of the most surprising results of our findings, both Day of the Week and Time of Day and time were the only variables tested that did not produce any statistical significance towards the Lifetime Post Total Reach. This discovery is extremely inconsistent with research that there is clear evidence that Facebook posts created on weekdays, specifically Tuesday, Wednesday and Friday, between 9 a.m. and 1 p.m. generated the greatest engagement (Powers, 2023). This discovery is impactful because it provides valuable insights to companies in shaping future marketing strategies. To optimize audience reach, companies may find it more effective to channel their efforts into manipulating other variables, such as post content and type, rather than fixating on day-specific posting strategies.

From our research, we have come up with the following actionable recommendations for marketing teams looking to optimize their post total reach on Facebook. First, because video stood out as the post type that performed best on average, companies should experiment further with different formats within video content, such as live videos, short clips, and longer-form videos, to understand what resonates best with their audience. Second, to gain a deeper understanding of the audience's behavior, companies should have data analysts in place, regularly analyzing Facebook Insights to track key metrics and identify trends. In the long term, companies can consider establishing a machine learning team and employ sophisticated attribution models and analytics tools to gain a more comprehensive understanding of the customer journey and mitigate algorithmic biases.

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