



ENHANCING BUSINESS STRATEGY WITH SALES DATA VISUALIZATION

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ABSTRACT

This paper explores the importance of business intelligence with a focus on leveraging sales data visualization to gather strategic insights. Beginning with an examination of the importance of data analysis and visualization of sales data, the study emphasizes its crucial role in identifying trends, optimizing performance, and making strategic decisions. Furthermore, the paper offers valuable insights into effective visualizations using the US regional sales dataset which encompasses of sales, transactions and customer data which serves as a rich resource for analyzing sales patterns, product popularity, and channel performance. Practical ideas for visualizing this dataset are presented through this study, catering to a broad audience seeking actionable intelligence from their sales data. Therefore, this paper synthesizes key findings, addresses limitations, and emphasizes the complex nature of sales data and how visualization can empower businesses to harness the full potential of their sales data, fostering data-driven decision-making in an ever-evolving marketplace.

Keywords: Sales Data Visualization, Data Analysis, Business Intelligence, Data-driven Decision-making, Sales Trends, Visual Analytics.

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1. INTRODUCTION

Visualizing sales and transaction data can help to unlock useful insights that go beyond what raw data tables or numerical reports can provide. Some of the advantages of visualizing sales data are as follows – First and foremost visualizing sales data can help improve the understanding of complex and large datasets. Creating interactive visualizations helps the users to explore the data dynamically and enables them to drill down into specific details, filter information, and gain deeper insights into different aspects of sales and transactions. Visualizations can help in identifying trends and patterns within the sales and transactions raw data offering insights into seasons, repetitive cycles in sales, preferences etc. This clear and concise way of presenting information can be helpful to make quick and informed decisions

while understanding the implications. Additionally, such insightful visualizations are often more effective in conveying information to diverse audiences, including non-technical stakeholders which facilitates communication and collaboration across teams within an organization. Another advantage of creating visualizations using sales data is that they can help detect any anomalies in the data such as fraudulent transactions or unexpected fluctuations in sales. Additionally, by visualizing sales data, businesses can optimize their resources allocation by understanding which products or services are performing well, which sales channels are most effective, and if any operational improvements can be made. Visualizing historic sales data can be helpful in forecasting future trends in sales by contributing to better predictions and planning for inventory, staffing, and other resources.

Visualizing data allows the stakeholders to explore the data proactively and allows them to ask specific data-driven questions, test various hypotheses, and helps monitor and uncover insights in real time. Due to the availability of interactive data visualizations that are easy to interpret, the stakeholders are likely to incorporate data-driven insights into their decision-making processes. This aids in fostering a data-driven culture within the organization. Therefore, visualizing sales and transactional data is critical for gaining actionable insights, supporting data-driven decision-making, and communicating complex information effectively within an organization. It plays a crucial role in turning raw data into meaningful and actionable knowledge.

2. RELATED WORK

With the research and development of tools and technologies for visualization, authors have proposed various methods for visualization. This section elaborates on the various techniques used in data visualization.

In the paper [1], the authors have developed business intelligence dashboards for visualizing the sales summary for Indomobil using the Power BI to be used as a reference in the business decision making process. The paper [2] emphasizes the meaningful impact of Business Intelligence (BI) on the IT industry, by highlighting its role in helping organizations to generate insights about data, strategies, profits, and performances. The paper focuses on collecting the data, storing, processing, and visualizing the data using Power BI. The authors have also discussed the importance of data-driven culture in making the right business decisions. The proposed model is built on Power BI as a working framework derived from ordinary sales data to enhance the understanding of sales outcomes by offering a practical approach that incorporates internal and external data sources for real-time analysis of overall sales KPIs, geolocated sales highlights, and forecasts for sales trends over time.

In the paper [3], the fundamentals of data processing, modeling algorithms and machine learning techniques are explored, with a focus on predicting sales for various Big Mart shopping outlets. The implementation involves designing a model using techniques such as linear regression, random forest, and xgboost on the Big Mart 2013 dataset for predicting sales of a specific outlet's product. The results indicate that the proposed technique produces better predictions compared to other available methods like decision trees and ridge regression. Finally, the project utilizes Power BI for data visualization to gain insights into the data and the prediction results.

In the digital age, decision-makers have access to massive and diverse datasets, often referred to as big data, which pose challenges for traditional tools and procedures. The study in the paper [4], explores the process for extracting insights from big data in a company and conducts large-scale data analysis through a thorough analysis cycle. The study also emphasizes the need to explore various methods for extracting knowledge from large, dynamic datasets as their volume continues to grow. The paper highlights the wide range of topics such as social networks, spanning everyday transactions to consumer interactions. Data analytics, particularly the application of advanced analytics approaches to large datasets, is highlighted as a means to extract substantial sales and profit information. The article aims to explore various big data analytics approaches and technologies, including Google Data Studio and Big Data tools, to provide a comprehensive understanding of the field.

The paper [5] focuses on demonstrating how Google Data Studio helps in enhancing the analysis and visualization of data. It addresses the common scenario where experts work with data from existing databases and need to understand them before analysis and visualization. Additionally, it examines the specific findings, such as employee, product, and vendor performance, for a more detailed review and further insights.

Sales and business executives often need to examine the sales information thoroughly to understand their company's performance. To address this issue the paper [6] presents, sales data visualization necessary for understanding the sales for which Google Data Studio emerges as a valuable tool —a user-friendly application designed to present complex datasets in an interactive and comprehensible manner. The Google cloud-based service is accessible from anywhere and enables users to share reports seamlessly. It provides an alternative for businesses to visualize and present data, supporting various data sources and facilitating the combination of reports from different data sources. Most importantly, Google Data Studio ensures data confidentiality when sharing reports with users, making it a versatile tool for visualizing, and communicating sales data.

3. BACKGROUND

3.1. Data Source

In the process of data visualization, the choice of data source plays an important role in the success of the visualization. Creating impactful visualizations requires not only the right tools but also the right data source since the quality and relevance of the data directly impact the effectiveness of the visualizations. The data can be gathered from various sources such as:

- Internal Databases: Internal databases, such as customer relationship management (CRM) systems, sales and transactional databases, and other company-specific repositories can be used as a source of data for visualization. The advantage of internal databases is having direct access for creating accurate and tailored visualizations.
- External APIs: In addition to internal data, external Application Programming Interfaces (APIs) can be used to fetch real-time data from external platforms. This could include social media APIs, financial market APIs, or industry-specific data sources.
- Public Datasets: Availability of public datasets can also be used to enhance the internal data. This could include government databases, industry reports, or datasets from research institutions.

- Surveys and Feedback: Survey data or feedback from customers and employees can be used as a data source for understanding the feedback from customers or employees. This qualitative data can be transformed into quantitative insights and visualized to represent sentiments, preferences, or opinions.

Multiple data sources can also be integrated together depending on the requirements of the visualization. Some of the important points to consider while selecting a data source are – whether the data is relevant to the business objectives, the quality and consistency of data, the frequency at which the data source is updated and the security and compliance of data.

3.2. Data Visualization

Once the data source is selected, the visualization tools play an important role in transforming raw data into meaningful insights and picking the right tools can significantly impact the clarity and effectiveness of visualizations. Let's discuss some of the popularly used visualization tools:

- Tableau: Tableau is a widely used tool for creating interactive and dynamic visualizations. The advantages of tableau are its user-friendly interface, diverse visualization options, and compatibility with various data sources [7].
- Google Data Studio: Google Data Studio, currently renamed as Looker Studio, facilitates the creation of engaging reports and dashboards. The advantage of this tool is its cloud-based nature, accessibility, and seamless integration with other Google services [8].
- Power BI: Power BI is a robust Microsoft tool popularly used for business analytics. Power BI has capabilities in transforming data into insightful visualizations, real-time reporting, and its ease of integration with Microsoft products makes it advantageous when it comes to data visualization [9].
- Open-Source Options: Other open-source visualization language specific tools such as Matplotlib [10], Plotly [11], seaborn [12], etc. can be used to create static, animated, and interactive visualizations while working in python.

When selecting the right tool for visualization the following factors must be considered - importance of tool usability, preference of users within the organization, integration with different data sources, scalability and other features such as collaboration and sharing.

4. METHODOLOGY

In this section we discuss in detail the steps used for processing the data and creating meaningful visualizations.

4.1. Data collection

In this step we collect the CSV files containing the relevant data for the analysis and ensure that the data is well-organized and follows a consistent structure.

4.2. Data exploration

This step involves utilizing tools like spreadsheet software like Microsoft Excel to explore the CSV files to check for missing values, anomalies, and assess the overall quality of the data.

4.3. Data cleaning

This step involves cleaning and preprocessing the data by handling missing values, errors, and formatting the data appropriately. This step is crucial for ensuring the accuracy and reliability of the visualizations.

4.4. Understanding the requirements

This step is useful to identify the metrics and KPIs that are crucial for the analysis, and it is used to determine the questions we want to answer through the visualizations and dashboards.

4.5. Tableau data connection

In this step the data is loaded by importing the CSV files into Tableau. Tableau provides an intuitive interface for connecting to various data sources, including CSV files.

4.6. Visualization

In this step we use Tableau's drag-and-drop interface to create various visualizations such as bar charts, line charts, etc. based on the defined metrics and KPIs and customize the visualizations to enhance clarity and interpretability.

4.7. Dashboard Creation

In this step we combine the individual visualizations into interactive dashboards to tell a cohesive and insightful data story and implement filters, parameters, and actions for dynamic user interaction.

5. DATASET

For our research we used a sales and transactions dataset from Kaggle containing 17,992 rows and 15 columns. This dataset contains a variety of details, ranging from order and product details to sales performance metrics. The dataset offers a complete overview of sales transactions which helps in enabling in-depth analysis of sales patterns and trends and unlock potential opportunities.

6. RESULTS AND ANALYSIS

In this section we will dive deep into the US Regional Sales Data by examining the visualization and by looking into the insights from each of these visualizations.

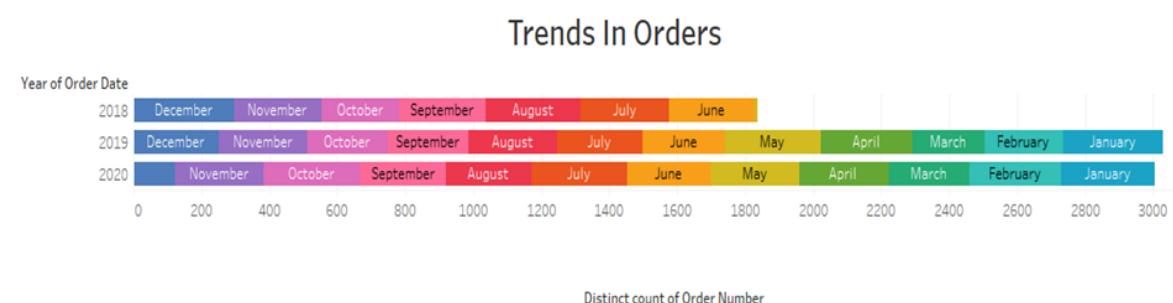


Fig. 1. Trends in orders over the years

In Fig 1., we have created a bar chart depicting trends in orders over the years. On the x-axis we have the count of orders and on the y-axis, we have the years. As per the observation in the trends in the number of orders the sales have increased in 2019 as compared to 2018 by a significant amount and then the number of orders have decreased slightly in 2020 which might

have been due to the pandemic. Additionally, the distribution of number of orders for every month have been highlighted with different colors. This kind of visualization can help the business stakeholders to understand the patterns in sales over the period of months and years.

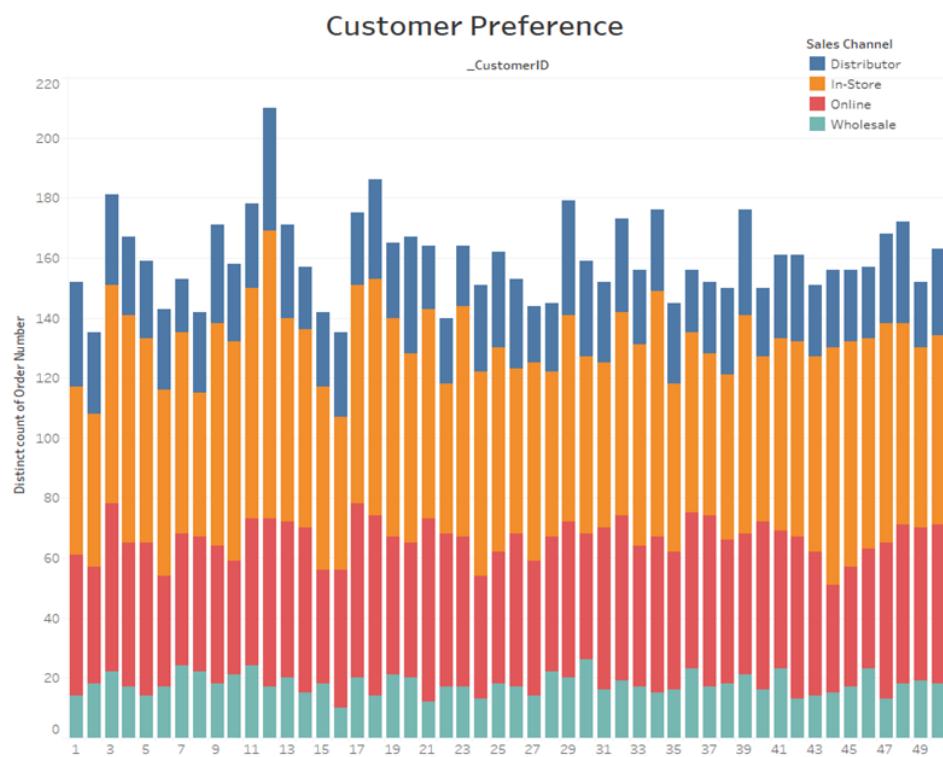


Fig. 2. Customer Preferences with Sales Channel distribution

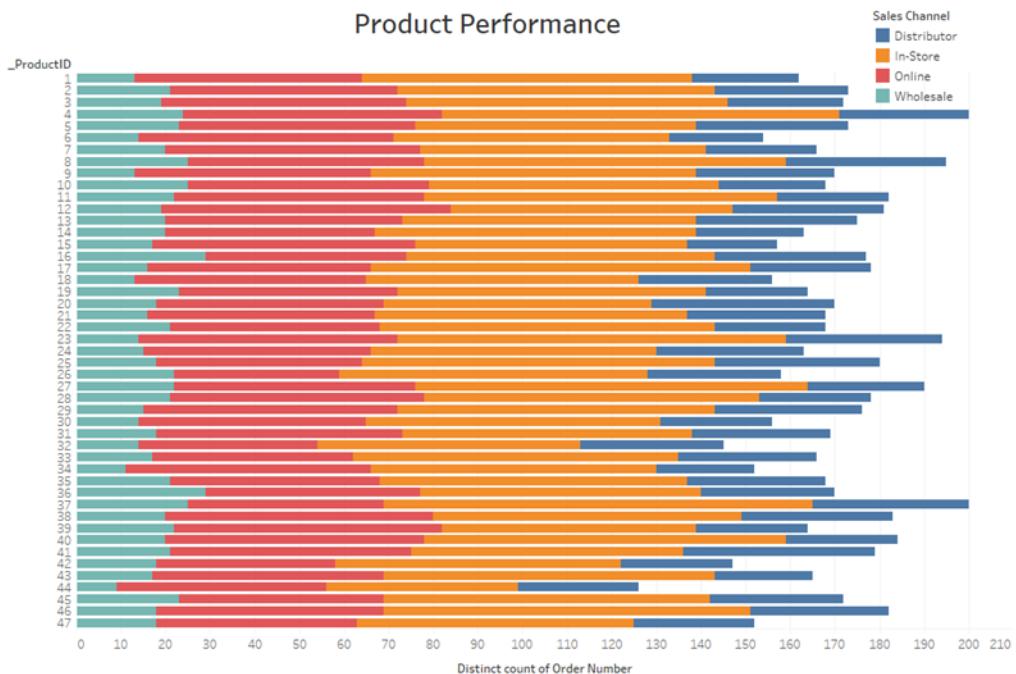


Fig. 3. Product performance with Sales Channel distribution

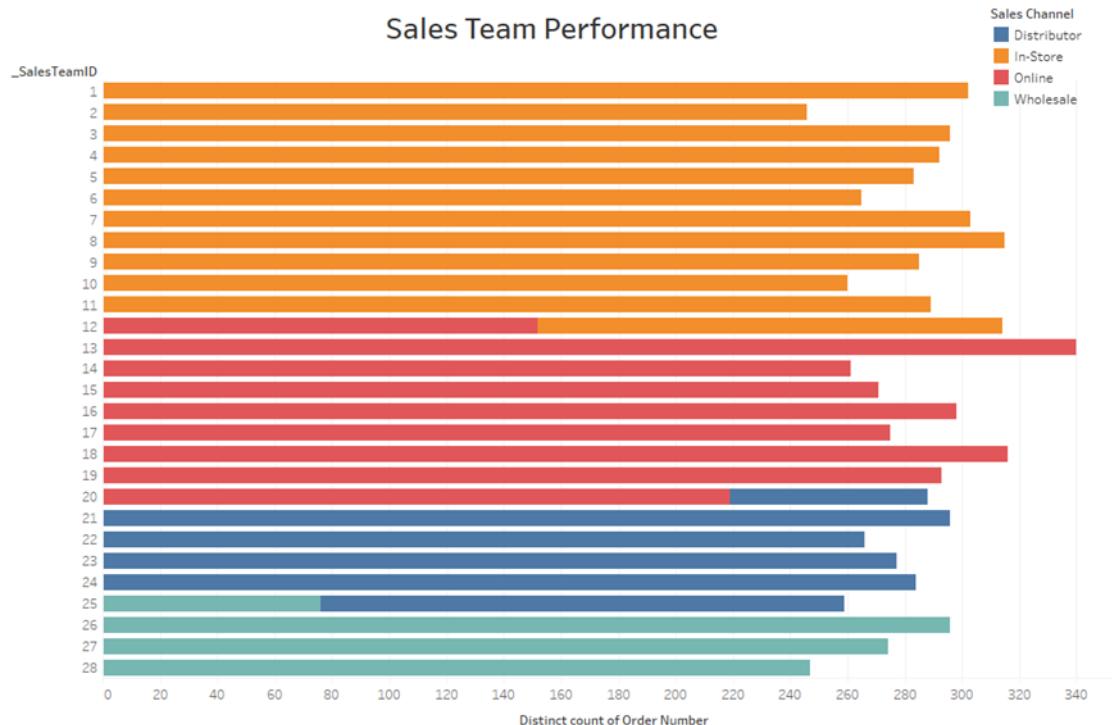


Fig. 4. Sales Team Performance

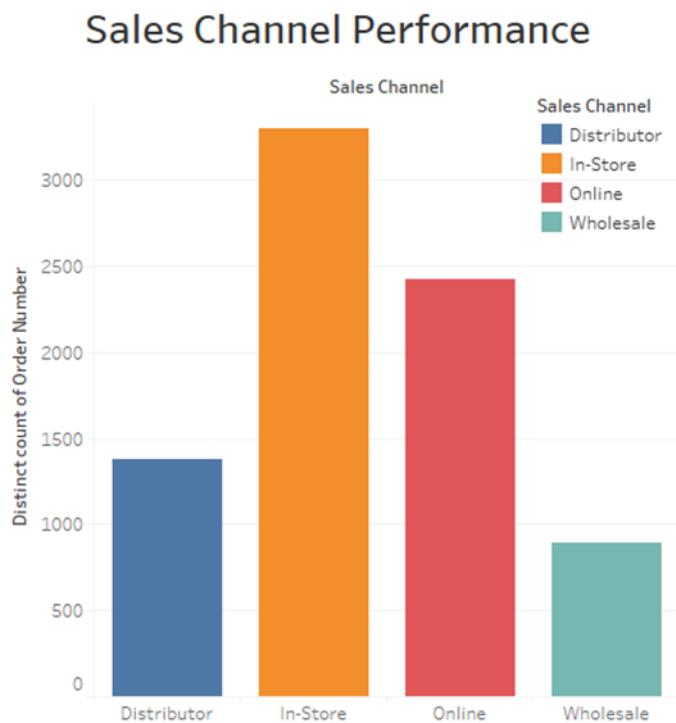


Fig. 5. Sales Channel Performance

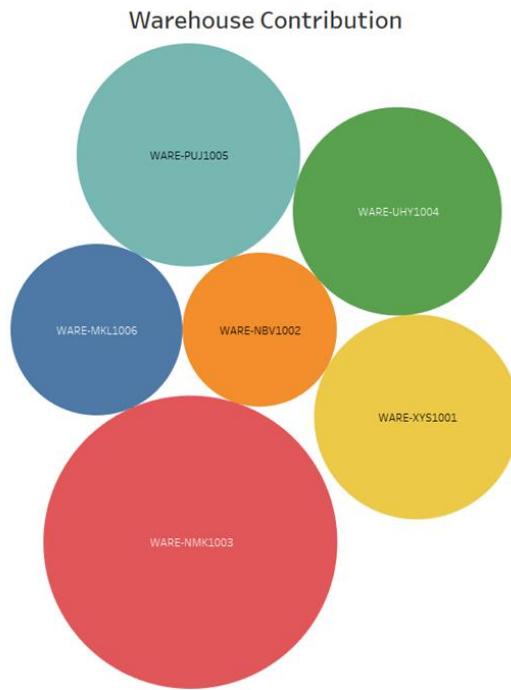


Fig. 6. Warehouse Performance

Similarly in Fig 2., we have created a bar chart to highlight the trends in orders for customers. We have added an additional dimension, which is the sales channel. By observing the x-axis (no. of orders) and y-axis (customer ID's) in the visualization we can see that the customer with ID 12 has the highest number of orders. And we can also observe that customers have more orders via in-store shopping on average. These insights can be used by businesses to optimize sales by making strategic decisions. For example, the customer with ID 12 could be given promotional offers to maintain customer loyalty since they have the highest number of orders.

In Fig 3., we have created a bar chart to measure product performance based on the sales data. By looking at the bar chart, x-axis (no. of orders) and y-axis (Product ID's), it can be seen that products with ID's 4 and 37 have been ordered the greatest number of times and more products were purchased instore as compared to other channels. Therefore, the business stakeholders can take specific action by stocking the warehouses and stores with a higher quantity of popular products such as products with ID's 4 and 37.

Similarly, in Fig 4., we have created the bar chart to highlight the distribution of the number of orders across different sales teams. By observing the chart with x-axis (no. of orders) and y-axis (sales teams) we can see patterns such as the team with ID 13 has the highest number of sales and the team with ID 2 has the lowest number of sales. Therefore, the team with ID 2 and other teams with similar numbers might need more focus and support as compared to other teams.

In Fig 5., we have the bar chart to see trends in the sales channel performance. By looking at the bar chart with x-axis (sales channels) and y-axis (no. of orders), we can see that the in-store sales channel has the highest numbers of orders followed by online, followed by distributor and then the wholesale channel. This might be because consumers prefer shopping in-store and therefore the business can decide to invest more capital in the in-store sales channel

followed by online. Such an insights can also be used for updating the marketing and sales goals.

Finally, we also have a bubble chart showing patterns and trends in the numbers of orders processed at each warehouse in Fig 6. In this chart, the bigger the bubble, bigger is the number of orders processed at each warehouse and vice versa. As we can see from the chart the warehouse with the code WARE-NMK1003 has received the greatest number of orders for processing and shipping and the warehouse with the code WARE-NBV1002 has received the least number of orders. This might be due to factors such as location, product availability, etc. For instance, the warehouse WARE-NMK1003 might be located close to a larger metropolitan area which might be worth exploring further. Therefore, such insights can be used by the business to make decisions for restocking, enhancing the warehouses, etc. to increase productivity in the busy warehouses.

After creating these individual charts, we combine them into a comprehensive dashboard for telling a data story and interactive visualizations for users with useful components such as filters and the dashboard is made available on Tableau Public [13].

7. CONCLUSION

In conclusion, this paper has systematically explored the visualization of sales and transactional data, by discussing crucial insights. We began by discussing the key role played by data visualization to unlock potential insights from data. Throughout the paper, we have dived into the details of data visualization and its methodology and uncovered patterns, trends, and potential implications for US regional sales and transactional data by creating various visualizations. The analysis helped us to demonstrate how visualization can be used to understand data and make data-driven decisions. Although data visualization can be very helpful in extracting information, its effectiveness depends on a various number of factors which we have highlighted in the background section such as data quality and accuracy, tools used for visualization, contextual understanding, user skills, etc. These factors need to be carefully assessed during the implementation. But as per the analysis presented in this paper visualization can be a powerful tool for understanding data and data storytelling.

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