Data Visualisation Project Report

Airbnb Listings in Bristol City (UK, 2024)

BEM3064: Analytics and Visualisation for Managers and Consultants

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Table of Contents

Introduction

Company Introduction

Airbnb is a leading firm in the highly competitive short-term rental and travel accommodation industries (Shabrina & Morphet, 2022). Their primary function is a service that links consumers to rental hosts, differentiating itself from traditional hotel bookings. They operate in 220 countries, possessing a strong technological infrastructure and brand loyalty (Airbnb, 2024).

Report Overview

This report examines 2 dashboards, based on Airbnb's Bristol (UK) listings in 2024. The first, Python Plotly dashboard focuses on listing price and quality. The second, Tableau dashboard assesses host quality and reliability. Both contain six visualisations, aimed to answer and achieve general and specific questions and objectives, and target the same audience. Each visualisation will be described and critically evaluated based on its functionality, design elements and contribution to overall report objectives.

Opportunities and Problems

Airbnb are pushing to increase their profitability in the coming years (Airbnb, 2024) by constantly updating their ideas, systems and products to suit changing consumer preferences (Newstex, 2025). The data considered here suggests seasonal trends, which is an opportunity for the company to adopt a dynamic pricing model by following changing demand. Their new ‘Co-host Network’ facilitates seamless hosting and communication (Newstex, 2025). Despite their emphasis on maximising quality, this report highlights many damaging problems and will suggest strategies to mitigate them and exploit many opportunities as well, to align with their profitability goals.

Questions, Objectives and Audiences

Questions

General questions that both dashboards aim to answer regarding Bristol’s 2024 listings include the following.

- What is the general price and quality of listings like?
- How do consumer preferences change?
- Are hosts of quality and reliable?

Specific questions that the visualisations aim to answer consist of the following

- How do prices vary?
- What property types are of quality?
- What is the general availability like?
- Is there a booking season?
- What are the most common amenities?

- Do hosts put effort into writing biographies?
- How experienced are hosts?
- Are most hosts verified?
- Is there a correlation between host response times and rates, having a ‘Superhost’ status and customer reviews?

Audiences

Both dashboards cater to the same audience, which is the public looking to make bookings or assessing Airbnb’s general efficiency and success in Bristol, property hosts and managers, and Airbnb’s operations, marketing and analytics teams with the goal of obtaining useful information for decisions and future strategies.

Objectives

Both dashboards show analytical and strategic elements, which are the identification of patterns in data and tracking of KPIs. Both aim to assist in user decision-making to strategise and achieve specific objectives, which are the following.

- Booking decisions can be made by potential guests as the dashboards provide information on how demand and prices change, rental sizes and the amount they can accommodate, property quality, general host experience and reliability, the potential of booking in advance, and the availability of key amenities.

- Airbnb can identify listing and host improvement strategies to align with the company’s profitability goals by highlighting details such as lacking property categories, reduced words in host biographies, the availability of superhosts, the presence of host profile pictures and verification, provision of key amenities, the over saturation of certain property types, host effort in responding to guests, lack of upcoming availability and the feasibility, through

communication, of implementing a dynamic pricing model to maximise profitability.

The information and measurements provided by these dashboards can further assist potential customers and Airbnb's strategic team, as they can be compared to industry benchmarks to reinforce decisions.

Dashboard Visualisation Analysis

Python Plotly Dashboard

Airbnb.ipynb

Found below is an analysis of each visualisation.

Prices by Neighbourhood

Here the columns 'price' as an average, 'neighbourhood', 'neighbourhood_cleansed', 'longitude' and 'latitude' have been used.

Using a scatter map here facilitates understanding of geographical trends and is the centerpiece for the dashboard as it effectively draws attention.

The points marking each neighbourhood change in size and colour. The colours contrast, aiding user differentiation. Furthermore, yellow, which indicates more expensive rentals, is effective as it is eye-catching.

Price signals are extensively used in businesses for distinguishing quality (Filieri et al., 2023). Therefore, this visualisation helps facilitate user decision-making. A drawback here, however, is that it is difficult, without closer examination, to rank the neighbourhoods on prices. Finally, neighbourhood labels are non-data ink as each dot can be interacted with to reveal relevant information. Removing the labels could give the visualisation a cleaner look.

Property Types Pie Chart

Here the column ‘property_type’ was divided into sections which includes an additional threshold section of 2.5% and under, referred to as ‘Other’.

The use of a pie chart here is computationally kind as proportion sizes can be easily interpreted. It is circular, making it stand out in a rectangular dashboard and complements visualisations in the dashboard with sharper edges well.

The pinks and white align well with Airbnb’s colour palette, with the added benefit of minimising eye strain. It effectively explains the general accommodation sizes found in Bristol and the abundance of properties that offer privacy.

A major flaw in the visualisation is that threshold for the ‘Other’ category is too low as the volume of much smaller sized sections clutters the chart, reducing readability. Additionally, the largest section, ‘Entire rental unit’, lacks specificity, which damages the message of the visualisation, limiting the contribution it makes in achieving user objectives.

Review Score Heat Map

The average review scores of the columns ‘rating,cleanliness, location, value, accuracy, communication and check-in' were considered here and grouped by ‘property_type’.

A heat map presentation of the 8 data variables here is optimal as, through using colour, trends can be easily identified. Most components of the dashboard follow Airbnb’s colour pallet. Therefore, this visualisation perfectly complements the price map graphic as they include yellow and orange. The colours used are easily interpretable and cater to colour blind users.

The large amount of data presented here, and identifiability of trends is very informative for user decision-making. However, not every property type has been labelled, which reduces chart clutter but is more damaging as users looking for specific categories are forced to carefully interact with the visualisation. Additional interaction is needed to make comparisons to rank the property types. These drawbacks increase time spent and computations needed, which reduces user-friendliness.

Review Trend Line

The visualisation represents the ‘last_review’ column with a value count for each month.

A Line chart is the ideal visualisation type to deploy when a discrete time variable, in this case ‘last_review’, can be tracked over time, allowing for an easy identification of performance trends as seen here with a clear increase in the number of reviews made by guests as the year progresses. This gives the users a quick and useful insight. It can be argued, however, that due to chart’s simplicity, adding another line such as ‘Review Scores Over Time’ could enhance the message of the visualisation.

The ascending bar chart in the top left of the dashboard complements the rising nature of this graph, which is visually appealing. Finally, the grid lines of the chart are

well aligned with the x and y axis labels making it easy for the user to follow the trend.

Booking Availability Bar Chart

Here a percentage is generated from the average of each of the columns; availability, for at least one night, in 30-, 60-, 90- and 365-days. The four groups of data divided here can be easily compared with the use of a bar chart.

Due to the similarity of each bar size, the use of a colour sequence to represent proportions and percentage annotations enhances the readability and interpretability of the visualisation and effectively translate to the users that it is easier to find a booking in the next year than in the next month. Using actual figures over percentages to indicate the total number of availabilities would provide more context for the users, particularly for analysts. Additionally, there is no information on rental availability either instantly or within a week. Therefore, Airbnb's competitors who do provide this detail will receive the bulk of last-minute bookings.

Common Amenities Bar Chart

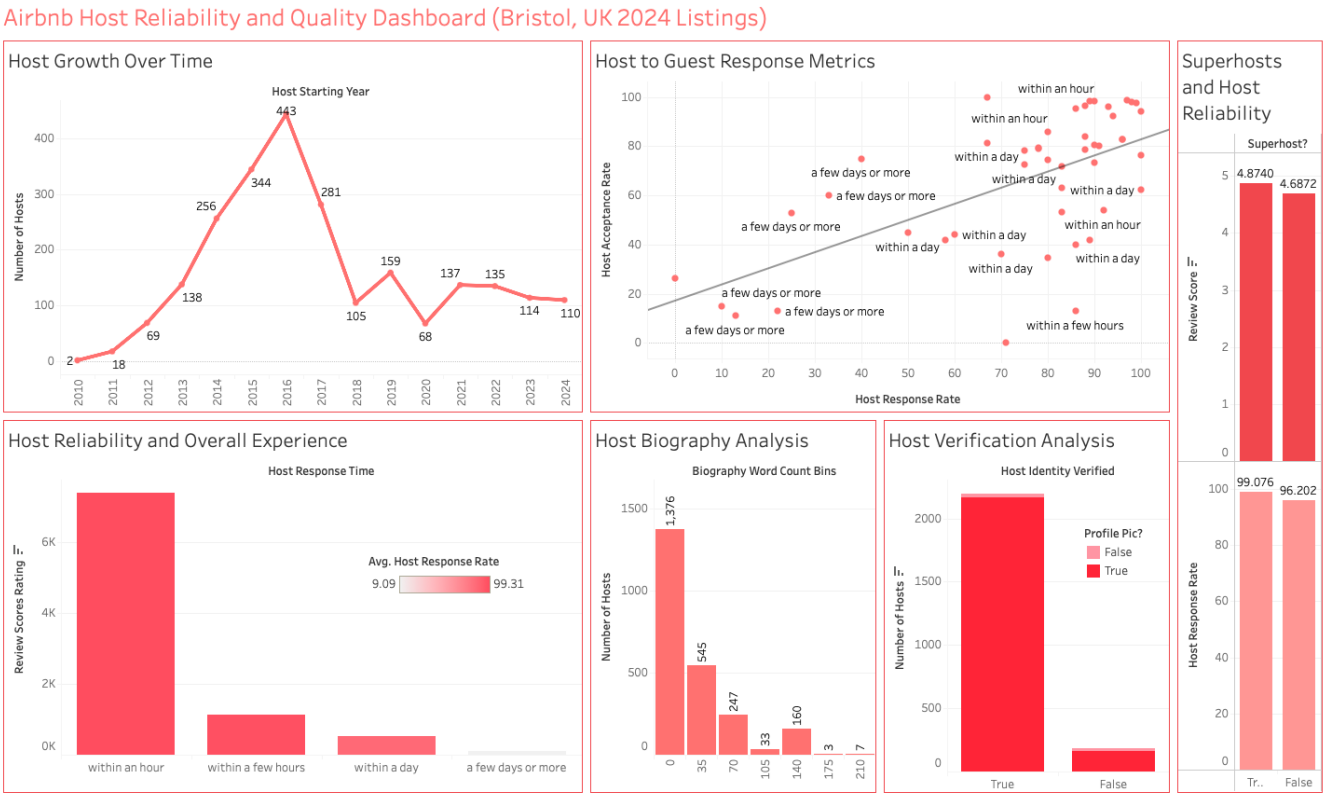
Here, the qualitative data of the 'amenities' column, is counted to generate quantitative data visualised using a descending bar chart, which like the previously discussed visualisation, is useful for the analysis of grouped categorical data. The 2 mentioned bar charts are placed on either end of the dashboard which adds a sense of symmetry and further emphasises the central visualisations.

The inclusion of a note that explains what amenities are in the context of short-term rentals assists user interpretation and does not clutter the chart. The colour variation further improves the users' ability to differentiate between each bar as they are similar in size.

Here, the conversion of value counts into percentages, simplifies the visualisation as the actual sum of each amenity isn't useful information to decision makers. A

comparison of the availability of more important such as free parking, washers and heating, which is particularly critical as bookings increase in colder seasons, would be more informative.

Tableau Dashboard



https://public.tableau.com/views/BNB_17443725866560/Dashboard?:language=en-GB&:sid=&:redirect=auth&:display_count=n&:origin=viz_share_link

The column ‘host_id’ has been used extensively here and only serves as a count for the rows in the dataset. Additionally, the dataset used in the previous dashboard was filtered and new columns were created for convenience (See Appendix). Found below is an analysis of each visualisation.

Host Biography Analysis

Here, qualitative data is made quantitative in the column ‘host_about_word_count’. The data was grouped into bins to simplify the visualisation. Therefore, a histogram is optimal for displaying this frequency distribution and effective in analytical dashboards as a large range of data is clearly presented. The bottom row of the dashboard contains 3 bar charts that complement each other as they appear to descend which creates intrigue and draws the attention of users. The bar annotations are clear and the numerical and spatial differences in the axes are consistent which is computationally kind.

The clarity of the labels reduces chart clutter; however, users are forced to compute bin sizes that go from 0 to 34, 35 to 69 and so on, which isn’t indicated. The story of the visualisation, that most hosts prefer not to write long biographies, is told effectively as there is a clear descend. It can be argued, however, that clarity and directness of words used might be more appealing than quantity.

Host to Guest Response Analysis

The columns ‘host_response_rate, host_acceptance_rate’ and ‘host_response_time’ are used here.

The use of a scatter plot visualisation is ideal here to effectively display a clear positive correlation between the 3 variables as there is a clear response variation from left to right of chart. The visualisation stands out in the dashboard as it consists of mostly bar charts.

It is found that the average individual can only process 4 to 5 chunks of information at once (Kahneman, 2011) and this is something that dashboard creators must bear in mind. Here, the title and the axis labels are concise. Therefore, the users can focus their attention on dissecting this complex visualisation. The addition of a third

variable ‘host_response_time’ makes the visualisation more informative, however, it can be argued that this addition not only clutters the graph but adds another information layer for users to consider. Finally, the x-axis starts at –5. Although this ensures the first data point isn’t missed, it is misleading, as a percentage cannot be negative.

Host Growth Over Time

The column ‘host_since_year_month’ is a discrete time variable. Therefore, a line chart here is effective in highlighting the story of the visualisation, which is that most hosts are experienced. This interpretation is made easier using Airbnb’s signature pink for the trend line, which contrasts well with the white background, and clear spike is seen in the middle of the chart. This simple message complements the dashboard well as its layout is already information heavy.

A drawback here is that, although the line annotation helps quantify results, a quick reference to the y-axis and interaction with visualisation is adequate. Therefore, this is an unnecessary addition, and its removal would make the display cleaner. Finally, the title is misleading as, although, there has been a growth since 2010, there has been a steeper decline from 2016. A more general title such as ‘New Host Registrations Every Year’ would have better suited the visualisation.

Host Responses and Listing Quality

A summation of ‘review_score_rating’ is taken here as it considers the number of bookings made, suggesting demand. The decline in review scores as the ‘host_response_rate’ and ‘host_response_time’ increases is clearly visible, allowing for an easy user interpretation that there is a customer preference for quicker host responses. It can be argued, however, that an average score rather than a summation would show stronger correlation between host responses and quality of experience, which would suggest that there are many signs of poor hosts.

The position of the visualisation on the bottom left of the dashboard highlights its importance as the drastic change of bar colours here would draw user attention.

In terms of the key design elements here, firstly, the height of the tallest bar isn't exaggerated as the y-axis has consistent numerical and spatial differences. The x-axis labels, however, lack septicity, which is damaging as analysts and property managers are unable to quantify results for respective research.

Host Verification Analysis

The columns 'host_has_profile_pic' and 'host_verifications' provides an interesting insight into host reliability in terms of verification. When guests can see a profile picture it forms an initial connection to the host, reducing anonymity.

A stacked bar chart is useful here as 3 variables are considered, and comparisons can be made not only using bar sizes but the individual components as well. This chart fills out the bottom row of the dashboard well as the bar charts are similar in their descending nature.

The visualisation has no unnecessary embellishments and non-data ink is minimised, which is complements an already information heavy dashboard well. Because of the drastic difference between the sizes of the bars, it can be said that the visualisation effectively translates to the user that most hosts are verified and have a profile picture. However, it is difficult to distinguish between the components of each bar, reducing interpretability and fit for visually impaired users.

Superhosts and Host Reliability

The columns 'host_is_superhost', 'review_score_rating' and 'host_response_rate' are considered here. A grouped bar chart is best to visualise this data as it complements the division of 3 the variables into subcategories that are placed in proximity allowing for an easy identification of trends, which is that booking with Superhosts tends to lead to the best customer experience. This is the final addition

to the dashboard. It fills the rectangular full screen layout of the dashboard well without losing its message. The annotation above each bar is a vital addition as every bar is of similar size. However, the use of 3 or more decimal places adds unnecessary clutter to the chart. Finally, the numerical scales of both y-axes are different, which makes it difficult to interpret the true affect the Superhost status has on both metrics. If the percentage differences between ‘True’ and ‘False’ were used, the relative differences could be understood better.

Deliverables, Implications and Recommendations

Summary of Key Deliverables

- Geographic Price Variation: Northeast Bristol is more affordable than the southwest. Rentals near parks, particularly in the Knowle and Brislington East, are more expensive.

- Consumer Preference for Larger and More Traditional Rentals: An increased amount and score of reviews for cabins, cottages and homes, either as a whole or only private rooms, over apartment or hotel rooms.

- Seasonal Trend: The number of reviews, which translates to the number of bookings, accelerates rapidly in the holiday season, with a significant drop in January, suggesting that Bristol’s rentals are a hotspot for people wanting a relaxed and family-orientated end to the year.

- Host Reliability: Majority of hosts are experienced, verified and reliable. However, reliability metrics positively correlates with overall listing reviews, indicating a performance gap between top-tier and poorer performing listings.

- Consumer Preference for More Responsive Hosts: This indicates that these listings are more competitive.

These insights can be transformed into actionable insights to facilitate user decision-making and strategy optimisation.

Strategic Implications of Findings for Airbnb

Operations

A lean approach can be taken by focusing time and resources in nullifying specific rental performance issues. Airbnb constantly inspect listing quality (Property Inspect, 2022). They could inquire about the availability of heating, washers and free parking, as most properties seem to lack these vital additions. They could urge hosts to increase their verification and reliability by highlighting the increase in reviews as a result. This will increase host efficiency which might incentivise an upgrading of properties, increasing listing competition in the long run.

Considering only a single host reliability measure in an optimisation strategy is adequate, due to the positive correlation between all measures.

Marketing

The price and promotion from the ‘4 Ps’ marketing mix strategy will be adopted here.

As the holiday season approaches, Airbnb could emphasise high performance properties as ‘a cozy way to spend the holidays with your loved ones’, a large price range depending on the level of comfort and scenery desired and the availability of kitchens and Wi-Fi strong enough to stream holiday movies, in marketing campaigns.

The data provided suggests that the listings have fixed prices, Airbnb should increase prices in season, as demand is inelastic, and reduce prices in the offseason to maximise profit.

Airbnb should promote their hosts as experienced and reliable, emphasing their

rigorous property and host inspection methods such as video tours and interview process (Airbnb, 2025), and the abundance of Superhosts who generally provide a quality customer experience.

Recommendations of Future Actions for Airbnb to Consider

Ensuring platform reliability and quality would enhance brand reputation. This can be achieved through the following.

- Removing inactive hosts and listings by investigating missing and incomplete data.

- Urge property managers to increase more immediate availability to align better with the consumer preference for more advanced bookings.

- Increase awareness of competition levels of certain property types through releasing blogs and personally contacting hosts, which will lead to host improvement.

- Airbnb's co-hosting platform is an opportunity for property managers and hosts to collaborate (Newstex, 2025). The company should share the data and insights provided by each of the dashboards and create a multi-purpose platform where future data entries can be made to monitor KPIs over time by both Airbnb and hosts, and communication is facilitated. Each major city in the UK should have its own platform for convenience.

The company can improve the quality and competitiveness of listings, which would increase long-run profitability from Bristol's listings.

- There has been a global shift in consumer demand to more localised products (Deloitte, n.d.) which is a key strategic element of Airbnb's vision (Airbnb, 2024). Many of their high performance of their rentals in Bristol have a local touch such as their cottages, boathouses and cabins. The company should

advertise them more and guide these property managers to improve the authenticity of these offerings.

- Airbnb's projected growth in the next few years (Airbnb, 2024) will lead to an increase in the number of new host and property managers in Bristol. The analysis conducted in this report found that even the slightest deviation in host performance such as a slowness in response can lead to a worsening in other reliability measures and overall listing and customer experiences over time. It is therefore imperative that Airbnb closely monitor details through live dashboards and deploy constant feedback mechanisms, and host and property checkups.

Appendix

Link to filtered data used in Tableau: data_cleaned_2.csv

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