

Eurobnb Insights.

Exploring travel options with data — the dynamics of short-term rentals across ten European cities.



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Data enrichment · Insights ·
Deployment



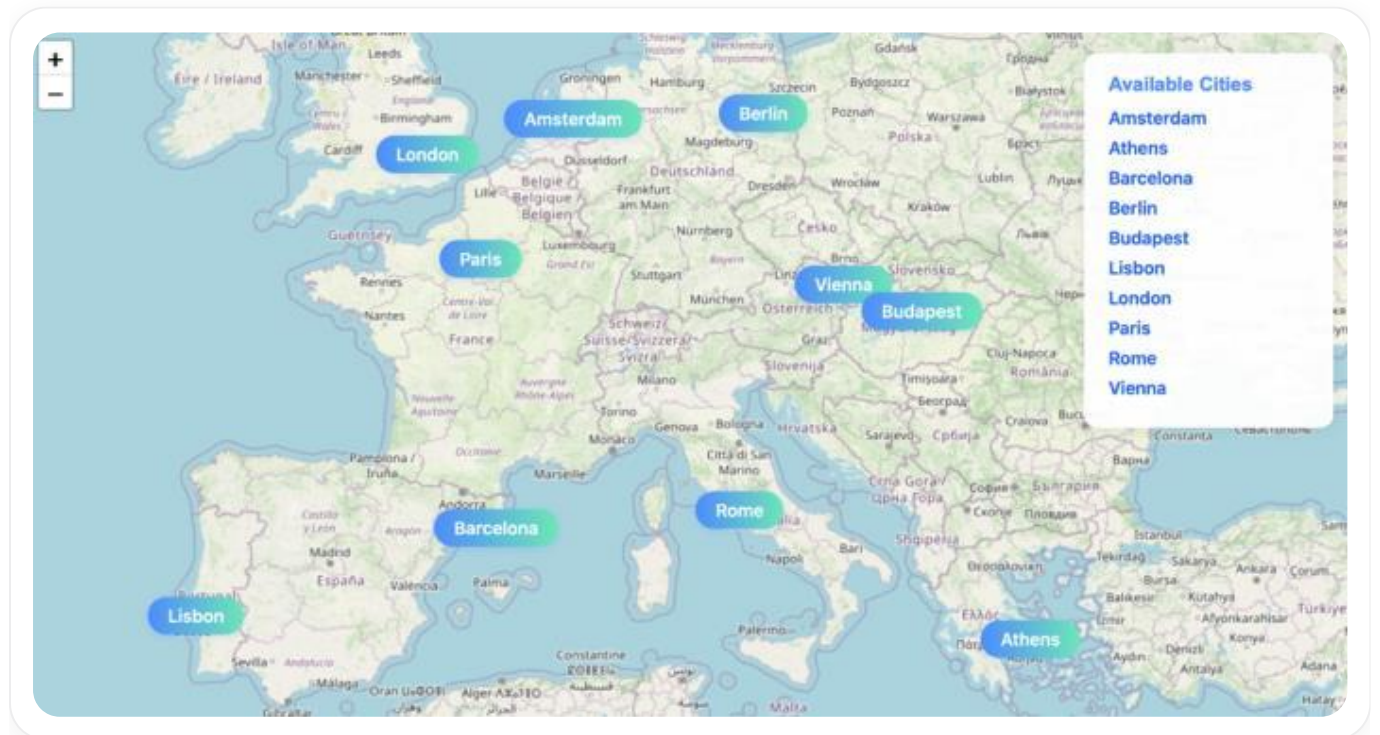
Daniela Gjorgjieva

Preprocessing · Charts ·
Screencast



Imane Jennane

Preprocessing · Maps · Radar
charts



One platform, ten cities, one continental picture

Europe's great cities each tell their own story, but in the last decade a single narrative thread has begun to weave them together: the meteoric rise of short-term rentals. Airbnb, now a staple of the urban travel experience, has reshaped neighborhood economies, housing markets and the way visitors navigate unfamiliar streets. However, despite the ubiquity of the platform, most visual and analytical work still treats each city in isolation or focuses on only one facet of the marketplace: price, location, or guest sentiment. Our project, EuroBnB Insights, steps back to survey the full continental picture and poses a deceptively simple question with complex implications:

How do the dynamics of short-term rentals differ and converge across Europe's most visited urban centers?

To answer that question we begin with a rich, ready-made foundation: a curated Airbnb dataset spanning ten flagship cities — Amsterdam, Athens, Barcelona, Berlin, Budapest, Lisbon, London, Paris, Rome and Vienna — recording everything from nightly price and room type to host "Superhost" status, cleanliness ratings and precise geo-coordinates. Crucially, the data are split into weekday and weekend snapshots, allowing us to trace how demand and pricing flex with the weekly pulse of tourism and business travel. We have further enhanced the raw tables with an additional "District" field so that every listing can be anchored to its local administrative context and analyzed at the hyper-local scale that matters both to guests and to city planners.

Data on its own doesn't tell a story, so our process turns raw numbers into pictures that people can explore. First, online dashboards let anyone compare the ten cities side by side, showing how average prices, room types and guest ratings differ between, for instance, budget-friendly Budapest and high-end Paris. Next, color-shaded district maps and marker clusters — drawn with Leaflet on top of Mapbox tiles — reveal where listings gather and where gaps remain. Linked scatter plots made in D3.js then help users test ideas such as whether homes near the metro charge more, or whether Superhosts really earn a premium. A working prototype already brings these pieces together and points the way to the full public site outlined in Milestone 2.

Our approach goes further than earlier studies that looked at just one city at a time. By placing ten destinations side by side, we can check whether insights from London also apply to very different markets like Athens or Vienna. Because the data separate weekdays from weekends, we can see how a neighborhood flips from business-traveler zone to holiday hotspot in only two days. This mix of cross-city and day-by-day views fills the gap between narrow local case studies and broad economic reports, giving a fresh, data-driven look at Airbnb across Europe.

Who the project speaks to

Travelers

A map-based guide to pick districts that match their style and budget.

Hosts & small businesses

See how their prices stack up against nearby competition.

City officials

Spot where rentals crowd around nightlife streets, transit lines or sensitive housing areas, helping them craft fair rules.

Data-storytelling enthusiasts

Clear, interactive graphics that work on both phones and desktops.

From raw snapshots to analysis-ready tables

The project is based on two tables for each of the ten cities under study: a raw snapshot scraped directly from Airbnb, and a processed version that has been cleaned and enriched. This dual structure offers the best of both worlds — data fidelity from the raw dump and analysis-readiness from the processed version. To illustrate the pipeline, the subsections below walk through the Vienna weekend slice, though the same workflow, structure, and columns apply across all cities. Only the number of listings and ranges of prices, ratings, and distances vary. Standardizing the schema early ensures clean visualizations, seamless joins, and uniform formatting across cities.

Vienna weekend raw snapshot

The Vienna snapshot includes nearly 2,000 listings available for at least one night over the weekend. Each row captures core details from Airbnb at the time of scraping — nightly price, room type, Superhost status, guest rating, capacity, and more — alongside a few geographic enrichments, such as the straight-line distance to Stephansplatz, Vienna's historic center. This raw table remains largely untouched, providing a faithful and reproducible starting point.

From raw to processed

Cleaning occurs in three steps, applied uniformly across all cities:

1

Unusable rows are dropped:

duplicates, missing coordinates, and extreme price outliers.

2

Listings are matched to official district polygons, adding a district column for spatial grouping.

3

The two amenity scores — restaurant and attraction density — are rescaled to a 0–10 range for consistent visual comparison.

The processed tables feed directly into our maps, dashboards, and statistical summaries. All other snapshots (weekday and other cities) undergo the exact same transformation.

Variable glossary

Table 1 lists the principal columns that appear in every processed file. The names are shared across all cities, ensuring that joins and visual components work without additional code. Together, these variables give a balanced view of price, supply type, guest demand, host quality and fine-grained geography — so subsequent cross-sectional analyses rest on comparable foundations.

TABLE 1 — PRINCIPAL VARIABLES IN THE CITY_WEEKENDS_PROCESSED.CSV FILE

VARIABLE	DESCRIPTION
<code>realSum</code>	Listing price in euro for a typical two-night weekend stay (platform fees excluded).
<code>room_type</code>	Category: entire home/apt, private room, shared room.
<code>room_shared, room_private</code>	Binary flags indicating shared or private room listing.
<code>person_capacity</code>	Maximum guest capacity declared by host.
<code>host_is_superhost</code>	1 = host holds Airbnb “Superhost” badge.
<code>multi</code>	1 = host manages multiple properties in the dataset.
<code>biz</code>	1 = Airbnb tags the listing “business-ready”.
<code>cleanliness_rating</code>	Average cleanliness score on a 0–10 scale.
<code>guest_satisfaction_overall</code>	Overall review score on a 0–100 scale.
<code>bedrooms</code>	Number of separate bedrooms.
<code>dist</code>	Straight-line distance (km) to Stephansplatz.
<code>metro_dist</code>	Distance (km) to the nearest U-Bahn station entrance.
<code>attr_index_norm</code>	Normalized density (0–10) of cultural attractions within 1 km.
<code>rest_index_norm</code>	Normalized density (0–10) of restaurants within 500 m.
<code>lng, lat</code>	WGS-84 longitude and latitude.
<code>district</code>	Vienna municipal district derived from spatial join.

Six views into the European Airbnb market

This section presents the visual components of our interactive dashboard, which supports users in exploring and comparing Airbnb listings across ten major European cities. Each visualization is designed to provide insight into different aspects of the data, such as pricing trends, satisfaction ratings, and spatial distribution. By enabling both city-level and district-level comparisons, the dashboard supports data-driven decision-making for travelers and hosts alike.

Interactive map

The interactive map is the main entry point of our dashboard. Built using Mapbox GL JS and Leaflet with React, it shows the spatial distribution of Airbnb listings across the ten selected cities. Users can select a city by clicking either on its label on the map or via the sidebar. District boundaries and clustering are used to manage visual density. Users can filter the displayed listings based on room type, price range, or satisfaction ratings. Clicking a listing reveals detailed metadata, enabling both high-level exploration and detailed inspection.

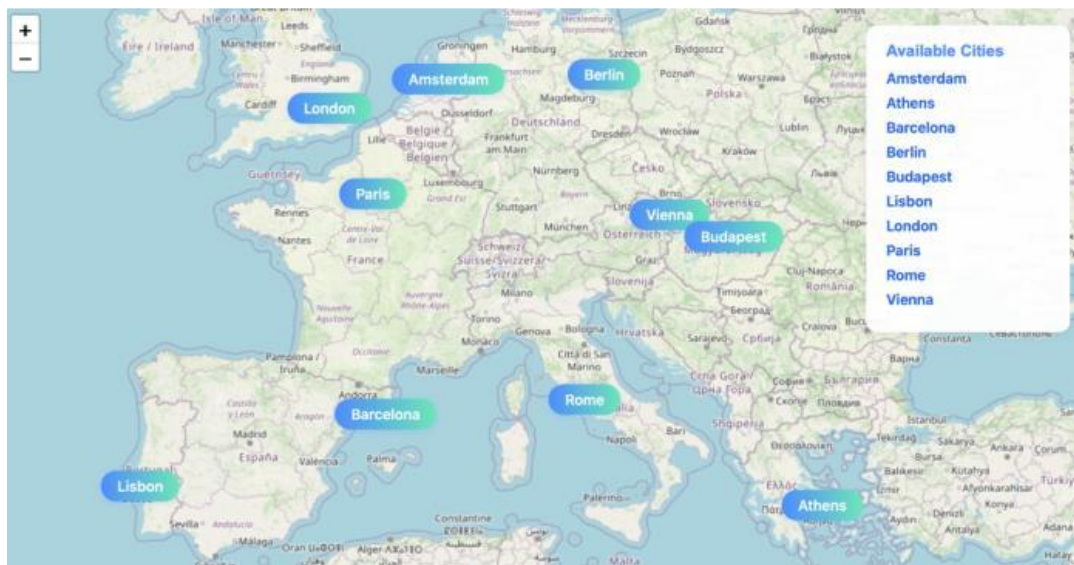


Figure 1 — Interactive map: the main entry point of the dashboard.

Colorful district map

We created an interactive map using Leaflet and a GeoJSON file to show district boundaries in distinct colors. Airbnb listings appear as blue markers, and clicking them reveals tooltips with key details like price, room type, cleanliness, and guest satisfaction. This map helps users explore how listings are distributed across neighborhoods and compare local rental characteristics at a glance.

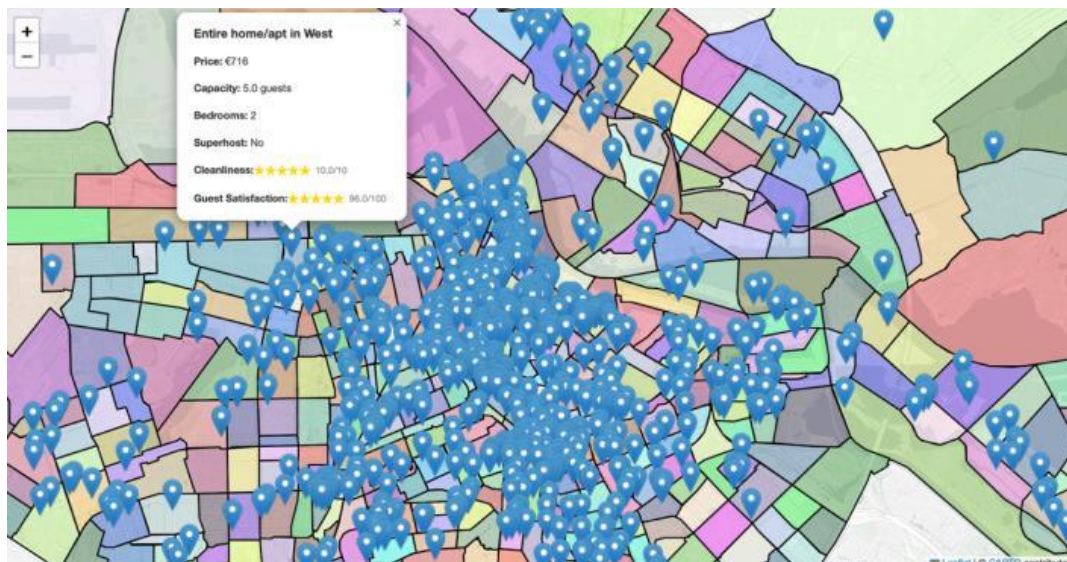


Figure 2 — Amsterdam's color map per district, with listing markers and detail tooltip.

Scatter plot

To visualize the guest satisfaction and cleanliness relationship among two different cities, we decided to use a scatter plot. Each point on the plot represents a single observation, where its position is determined by its cleanliness rating and its corresponding guest satisfaction. This visualization is important because it makes it much easier to understand the correlation between the two important variables: cleanliness and guest satisfaction. It also allows the user to make a data-driven decision through this visualization and draw easy conclusions.



Figure 3 — Scatter plot: guest satisfaction vs cleanliness for two cities.

Radar charts

Radar charts allow comparison of multiple variables at once in a compact and interpretable format. The City Comparison Radar Chart helps users compare two cities based on metrics such as price, guest satisfaction, cleanliness, location, and amenities. The Room Type Comparison Radar Chart focuses on

comparing room types (e.g., private room vs. entire home), filtered by weekday data. Implemented using Chart.js and Victory, these interactive charts provide immediate visual insights into strengths and weaknesses across cities or accommodation types.



Figure 4 — Radar chart: different variables compared within a city.

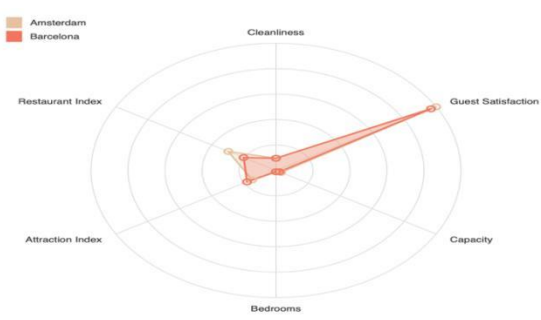


Figure 5 — Radar chart: city comparison (Amsterdam vs Barcelona).

Bar charts — across & within city comparison

These bar charts highlight temporal differences in Airbnb metrics such as average price and satisfaction. By comparing data for weekdays and weekends, users can identify pricing fluctuations and customer experience patterns over time. The charts are interactive, allowing users to filter by city, district, and selected metrics. Built with Recharts and Nivo, they support strategic planning for both budget-conscious travelers and hosts looking to optimize availability or pricing strategies.

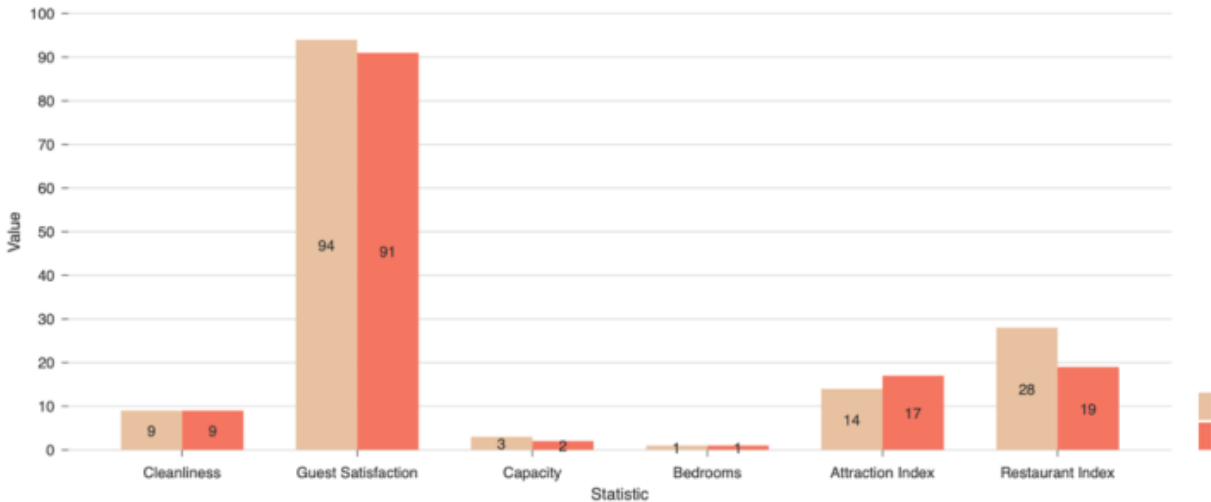


Figure 6 — Bar chart: Amsterdam vs Barcelona, weekday vs weekend.

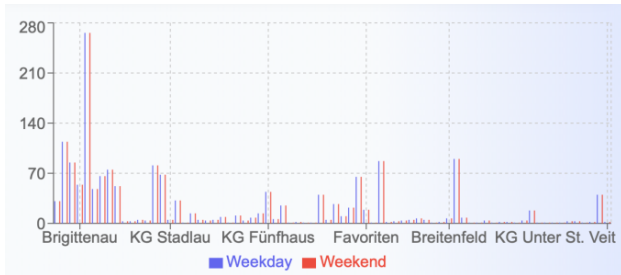


Figure 7 — Bar chart: Vienna, weekday vs weekend by district.

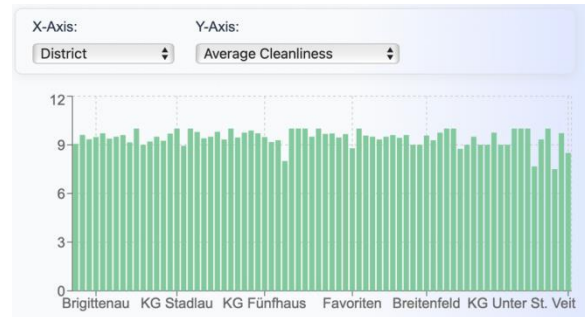


Figure 8 — Bar chart: Vienna, district vs average cleanliness.

Treemap

The treemap visualizes the number of listings per district in a selected city, using area to represent count and color to represent another variable (e.g., average price, cleanliness, or rating). Larger blocks indicate districts with more listings, while color helps highlight quality or affordability. This visualization, implemented with D3.js and Nivo, enables users to rapidly assess spatial density and evaluate trade-offs across districts. For example, a user can easily identify which neighborhoods offer both a large number of listings and high satisfaction scores.

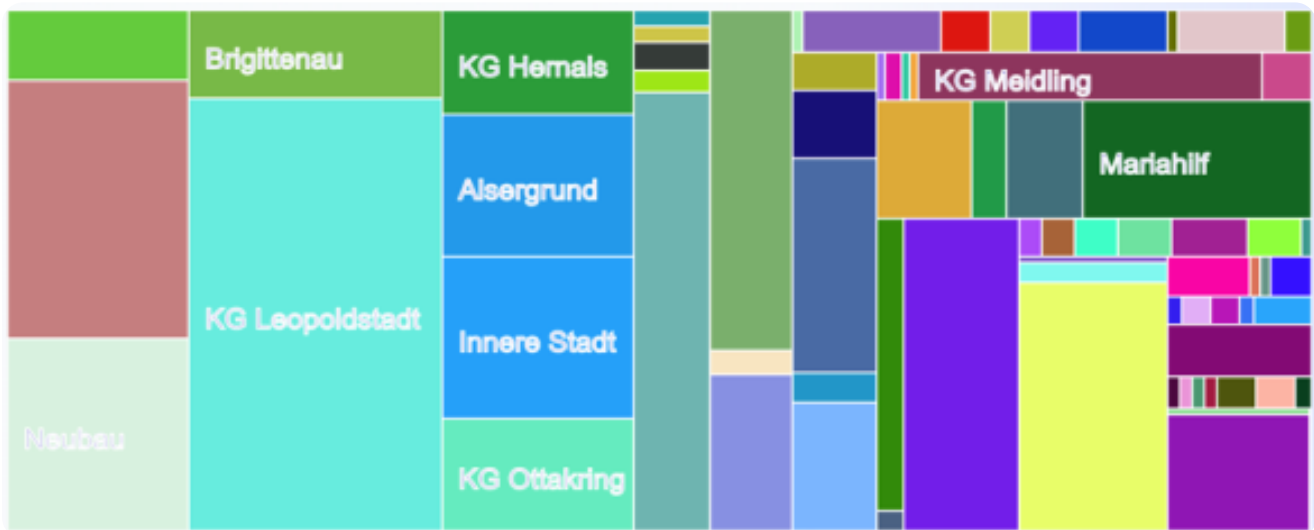


Figure 9 — Treemap: listings by district (Vienna).

What pushed back, and what we learned

During the development of our dashboard, we faced several challenges that influenced our design choices and helped us learn important lessons:

1

Making the tool easy to use

Some of the visualizations we planned, like the parallel coordinates plot, were too complex for most users. While these tools are powerful, they can be confusing without experience. We decided to leave some of them out to keep the dashboard simple and user-friendly.

2

Handling a lot of data

Since our project includes data from ten large cities, there were many listings to display, especially on the map. Showing all of them at once caused the website to slow down. To fix this, we used clustering and filters to show only part of the data at a time and keep the site fast.

3

Comparing data fairly across cities

Each city had slightly different data. For example, not all cities had the same details about amenities or cleanliness. To compare cities fairly, we had to clean and adjust the data so the visualizations made sense.

4

Combining many tools in one website

We used many libraries like Mapbox, Chart.js, and D3.js along with React. It was sometimes tricky to make all of them work well together. We had to spend time making sure the charts and maps looked good and updated correctly when users interacted with them.

Who built what

Collaboration was at the core of our approach. For each major part, we ensured that two team members worked together (often through pair programming) to maintain consistent implementation standards.

● Harkeerat Singh Sawhney ● Daniela Gjorgjieva ● Imane Jennane

Data collection

We all conducted individual research to collect candidate datasets. After collaborative discussion of each dataset’s pros and cons, we selected the Europe Airbnb Datasets.

Data preprocessing

Initial data processing — standardization and consistency: value normalization, type standardization, removal of listings with missing fields.	● ●
Dataset extension — district fields added for each listing, facilitating easier visualization.	●

Visualization implementation

Map navigation	● ●
Key insights for city comparison & analysis	●
Bar graphs — city vs city comparison	●
Bar graphs — city analysis	●
Radar charts	●
Scatter plot — guest satisfaction vs cleanliness	●
Map visualization — listing mapping	●
Map visualization — detail popups	●
Treemap visualization	● ●

Backend logic

Harkeerat Singh Sawhney and Imane Jennane connected the frontend with the backend:

- Implemented city-specific dataset retrieval
- Designed frontend computation for key insights
- Structured visualization data pipelines
- Configured navigation links (Harkeerat Singh Sawhney)

Deployment

Harkeerat Singh Sawhney deployed the website on GitHub Pages (including datasets) using the gh-pages npm package.

Process book

Collaborative effort documenting implementation details and visualization explanations.

Screencast

Daniela Gjorgjieva created the demonstration showcasing website functionality for exploring European Airbnb vacation spots.

06 — CONCLUSION

Simple, clean visuals for a continental question

Our project helps people understand Airbnb trends in Europe with simple, clean visuals. It's useful for both travelers and people curious about housing trends. The final app is easy to use and lets you explore pricing, satisfaction, and locations interactively.

GITHUB

github.com/com-480-data-visualization/eurobnb-insights

WEBSITE

com-480-data-visualization.github.io/eurobnb-insights