

GreenAce Project

CS-480 - Data Visualization

EPFL

FED
May 29, 2024

1. OVERVIEW OF THE PROJECT

The primary goal of the GreenAce project is to comprehensively analyze and visualize the environmental impact of player movements throughout an ATP tennis season. Our objective is to offer precise, realistic statistics paired with dynamic visual representations that elucidate the ecological footprint associated with professional tennis tours.

1.1. OUR GOAL

The overarching theme of this project is the intersection of professional tennis and CO_2 emissions. The modern tennis tour is characterized by its global footprint, with tournaments scheduled in diverse cities worldwide on a weekly basis – or over two weeks for major tournaments. This relentless calendar necessitates that the top 100 players frequently travel vast distances to compete, incurring significant carbon emissions in the process. Our objective is to quantify, visualize, and evaluate these emissions to foster greater environmental awareness among players. By providing detailed insights into their carbon footprint, we aim to encourage athletes to consider more sustainable approaches to planning their season, potentially leading to a reduction in overall emissions associated with professional tennis.

This project aims to offer meaningful insights towards fostering a more eco-friendly tennis tour, not only for the players but also for fans, journalists, tournament directors, and anyone else with a keen interest in tennis. This initiative seeks to engage a broad spectrum of the tennis community in a dialogue about sustainability, encouraging all players to consider greener practices and strategies. Ultimately, the project aspires to contribute to the evolution of tennis into a more environmentally conscious and sustainable sport, benefiting everyone involved and the planet at large.

1.2. OUR CONTRIBUTION

The project is developed as a website. It features and highlights various visualizations aimed at presenting, analyzing, and raising awareness of the environmental impact of the extensive travel undertaken by tennis players over the course of a season. The goal is not to assign blame or demonize the sport, but rather to propose alternative transportation solutions that could reduce the carbon footprint associated with these travels.

2. FROM CONCEPT...

2.1. PREMISES OF THE PROJECT

Our project embarked on a journey to enhance environmental sustainability within the professional tennis circuit, specifically focusing on the ATP Tour. Recognizing the significant carbon footprint associated with travel between tournaments, we aimed to develop a tool that identifies and promotes greener travel alternatives.

The initial phase of our project involved selecting the data we wanted to visualize. After extensive brainstorming and evaluating various ideas, we decided to concentrate on the environmental sustainability of the ATP Tour, specifically examining how travel can be made more eco-friendly.

2.2. SELECTING THE CORRECT DATA

When selecting our dataset, we asked ourselves: "What is the story we want to tell?" We reviewed existing works and observed that most focused solely on visualizing the ATP Tour schedule without considering the environmental impact of travel. To offer a fresh perspective, we decided to emphasize the sustainability aspect by showcasing greener travel options between tournament locations.

Our primary dataset was directly sourced from the ATP's official website, providing detailed information on tournament dates and locations. Additionally, we utilized data maintained by Jeff Sackmann on [GitHub](#), which includes several CSV files aggregating extensive statistics on tennis players and matches from the 2000's. This dataset provided valuable historical insights that were crucial for our analysis.

To further enhance our story, we incorporated transportation data from various sources, including European rail networks, bus services, and carpooling platforms. This allowed us to propose alternative travel routes that significantly reduce carbon footprints compared to traditional air travel. We also integrated data on carbon emissions for different modes of transportation, enabling us to calculate and compare the environmental impact of each travel option.

The story accompanying the visualizations guides users through the process of selecting alternative travel options, providing insights into the environmental benefits of each choice. By interacting with the visualizations, users can better understand the significance of making sustainable travel decisions and the broader impact these choices can have on the overall sustainability of the ATP Tour.

3. ...TO VISUALIZATIONS

3.1. HISTORICAL ANALYSIS AND COMPARISON

The first visualization we decided to create focuses on a historical analysis and comparison of the global carbon footprint of the ATP Tour. Our goal with this visualization is to provide a comprehensive overview of the environmental impact of the ATP Tour over time, highlighting trends and patterns in travel-related emissions. By examining historical data, we aim to identify areas where sustainable practices can be implemented to reduce the overall carbon footprint of the tour.

The historical analysis features a bar chart that showcases the carbon footprint of the ATP Tour against other sports including MLS, F1 and NBA. Users can interact with the timeline to see specific

years and the corresponding emissions data, providing a clear view of how the tour's environmental impact has evolved.

Additionally, the visualization presents a curve displaying the median CO_2 emissions per player for each year, offering insights into the individual impact of players' travel over time.

Those visualization were implemented in React using the Mui X library.

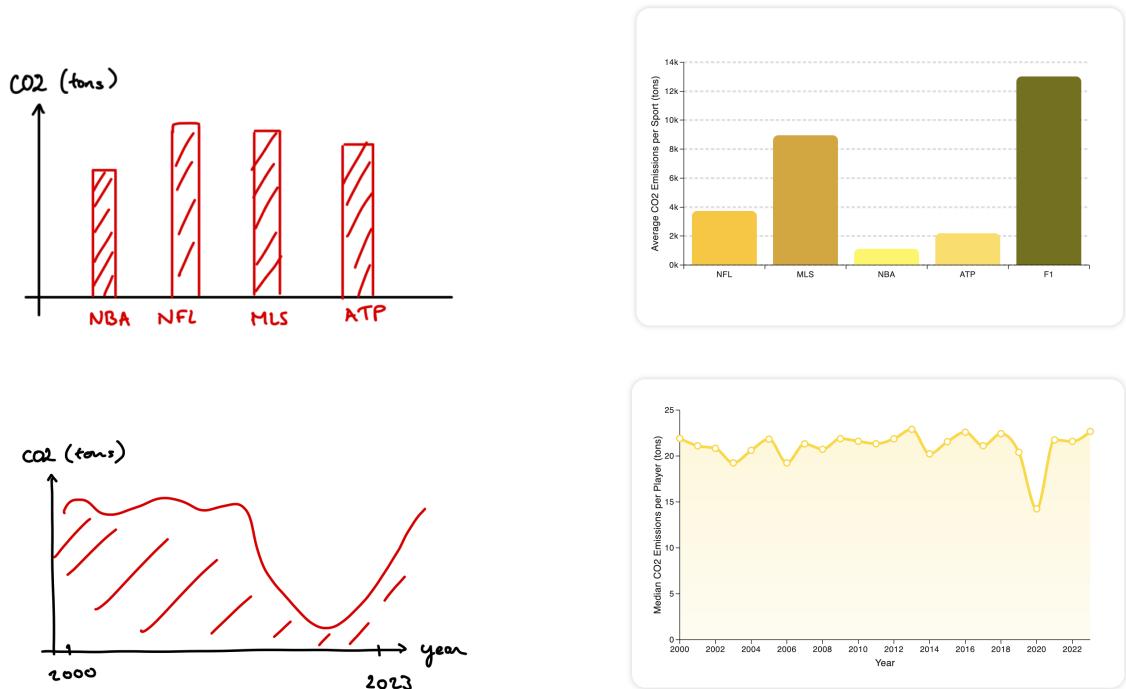


Figure 3.1. Sketches (left) versus final visualization (right)

Related files: `src/components/Chart.js`, `src/components/Evolution.js` and `src/components/BarChart.js`.

3.2. HALL OF SHAME

The second visualization is a top 10 ranking of the players with the highest carbon footprint. This visualization aims to highlight the environmental impact of individual players' travel habits, showcasing the top contributors to the overall carbon footprint of the ATP Tour. The goal of this visualization is to raise awareness among players and fans about the significant impact of travel on carbon emissions, encouraging more sustainable practices in the future.

This visualization was made with React and `slick-carousel.js`.

Related files: `src/components/Slider.js` and `src/components/PlayerCard.js`.

3.3. CORRELATION

The third visualization we created focuses on the correlation between the carbon footprint of players and other covariates such as the number of match played and the ranking of the player. This goal of this visualization is to assess that the carbon footprint of a player is correlated with the number of matches played and the ranking of the player. In general, we expect that the less matches a player plays, the higher his carbon footprint will be, because the player has to travel to play another tournament. Similarly, we expect that the higher the ranking of a player, the lower his carbon

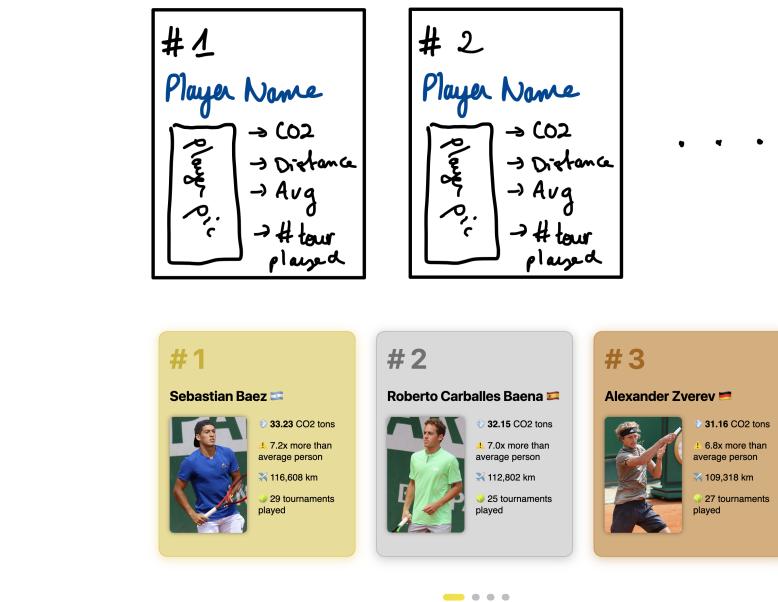


Figure 3.2. Comparison of early sketches (top) versus final visualization (bottom)

footprint will be, because a player with a higher ranking will, in average, play more matches but at the same tournament and thus travel less.

The visualization is interactive and allows the user to select the player to visualize. We present those result in a radar chart because it is a good way to represent the correlation between multiple variables, and one can easily catch the relation between measured variables.

This visualization was made with React and react-chart.js.

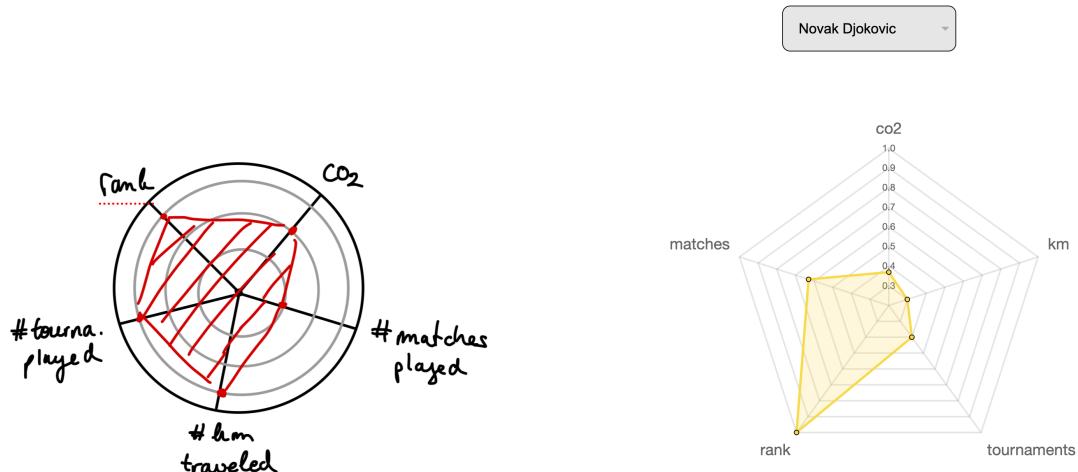


Figure 3.3. Comparison of early sketches (left) versus final visualization (right)

Related files: `src/components/Spider.js` and `src/components/Correlation.js`.

3.4. MAP

This is our main visualization. It is a 3D interactive globe that displays the best travel routes to take between tournaments. The goal of this visualization is to provide players with a visual representation of the most efficient travel routes between tournaments, helping them to reduce their carbon footprint by optimizing their travel schedules.

The globe is interactive, allowing users to hover over different routes to see the distance and carbon emissions associated with each route.

The best path were selected using the Dijkstra algorithm, which is a graph search algorithm that finds the shortest path between two nodes in a graph.

We use this to compute weights of the edges of the graph. The weights are computed using the following formula:

$$W = \alpha C + \beta D \quad (3.1)$$

where C and D are the quantity of CO_2 and the duration of the journey respectively. For each transportation mode, we have the following

Weights for Transportation Modes

Transportation Mode	CO2 Weight (α)	Duration Weight (β)
Airplane	0.6	2.0
Train	0.8	1.2
Car	0.5	1.5

This visualization was made with React and `mapbox.js`.

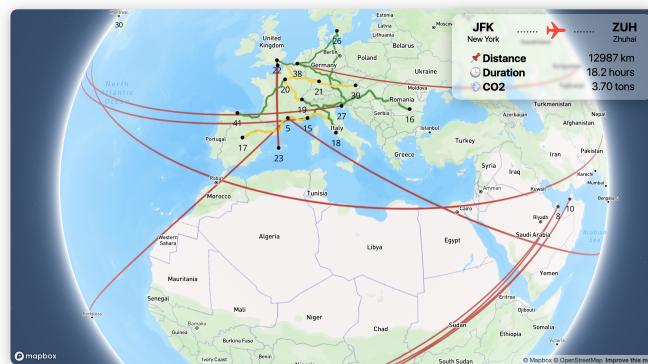
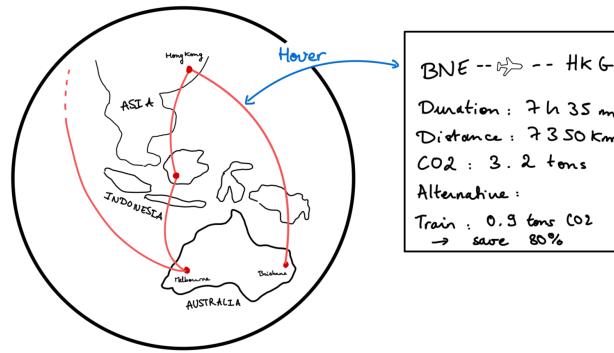


Figure 3.4. Comparison of early sketches (top) versus final visualization (bottom)

Related files: `src/components/Map.js` and `src/components/MapInfo.js`.

3.5. EXTRA: TOUR PLANNER

Thanks to a good team organization, we had time to add an extra visualization. The fifth and last visualization is a tour planner. The goal of this visualization is to provide players with a tool to plan their travel schedules more efficiently. It is meant to be used in conjunction with the map, as a decision tool based on the exploratory data provided by the map visualization.

The final schedule is displayed on a timeline, showing the player's travel itinerary and the associated carbon footprint for each leg of the journey.

First, the user has to enter the cities where he wants to start and finish his season.

Plan your season!

Imagine planning a tennis season where every decision not only strategizes for victory but also champions sustainability. Our Player's Calendar feature empowers athletes and teams to visualize the environmental impact of their chosen tournaments throughout the ATP season. This tool aims to help player in choosing a greener season. Select your starting and ending points. Select the tournaments you want to attend. That's all. Our tools will compute the best path for you.

1. Select the cities where you want to start and end your season

Enter your starting city: **Lausanne** Enter your ending city: **Doha**

You will start your season at Lausanne. You will end your season at Doha.

2. Select the tournaments you want to attend

ATP 250

Brisbane 31/12/2023 - 07/01/2024 Hong Kong 01/01/2024 - 07/01/2024 Adelaide 08/01/2024 - 13/01/2024 Auckland 08/01/2024 - 13/01/2024 Montpellier 29/01/2024 - 04/02/2024

Figure 3.5. Tour planner

After that, the user can select the tournaments he wants to play. The tool will then calculate the best travel route to take between the selected tournaments, optimizing the player's travel schedule to minimize carbon emissions.

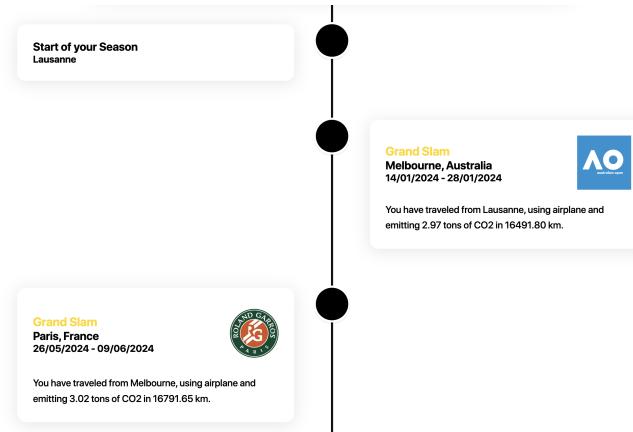


Figure 3.6. Timeline

This visualization was made with React and react-vertical-timeline.js.

Related files: [src/components/Calendar.js](#).

4. BREAKDOWN

4.1. FRANÇOIS

François focused on the initial stages of data collection and analysis. He was responsible for scraping, which involved gathering the necessary data through automated techniques from various online sources. Once the data was collected, he proceeded with data analysis to process and interpret the information effectively. His work contributed directly to the website development, by integrating smooth design and animation elements that enhanced the user experience. Additionally, François worked on the map and calendar visualizations, to help users easily understand and navigate through the complex data related to tennis players travel schedules.



4.2. ALEXANDRE



Alexandre enhanced the project's interactive elements and user engagement through his work on visualizations specifically focused on rankings and correlations. These visual tools allowed users to explore rankings in an intuitive and accessible format. He also produced a screencast (sorry for the length!); this video content served as a tutorial or guide helping users to understand how to navigate the website and make the most of the available data and tools. Furthermore, Alexandre played a significant role in the broader scope of website contribution, assisting in the layout and the integration of elements to create a cohesive and engaging online experience.

4.3. EDOUARD

Edouard's role centered around advanced data interpretation and presentation. He developed the historical analysis visualizations in order to provide deeper insights into the data and uncovering trends over time. This involved graphical representations that highlighted relationships and historical developments in tennis travel patterns. In addition to his visualization work, Edouard was mainly involved in developing the website, ensuring that all analytical tools and graphics were seamlessly incorporated into the final project. His long experience in web development, and notably with React, was a key asset in the successful completion of the project. He also conducted some notebook analysis, utilizing computational notebooks to perform detailed and complex analyses. This process helped in further understanding the nuances of the data, contributing to the overall depth and accuracy of the project.



4.4. THE FINAL WORD

The project was a great opportunity for us to work together and combine our skills in data analysis, web development, and design. We are proud of the final result, which we believe is a comprehensive and engaging tool for tennis enthusiasts and data analysts alike. Enjoy !