BattleLens – Exploring the Dynamics of Conflict and Defense Economies

CSE 578: Data Visualization Project (Fall 2024)

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PROJECT GOALS

The **BattleLens** project was initiated with the goal of understanding the complex interplay between global conflicts and the defense economies that sustain them, with a specific focus on the Middle East. Political violence, protests, and strategic violence continue to dominate the geopolitical landscape of this region, which has witnessed escalating instability over the last few decades. This project utilizes interactive data visualizations to explore the connections between conflict events and arms trade dynamics.

Given the increasing importance of transparency and accountability in the global arms trade, our team aimed to create a platform that could provide users with critical insights into how economic forces shape modern warfare. By using real-world datasets like the **Armed Conflict Location** and **Event Data (ACLED)** and defense spending data, BattleLens enables users to explore the relationship between political violence, military spending, and global power dynamics.

Throughout this project, I took on a **leadership role** while contributing to the development of key interactive components, such as the geographic map, timeline panel, and various charts. This reflection will delve into the methodologies used, my specific contributions, and the overall impact of our work, while discussing the skills and insights gained during the process.

CONTRIBUTION

1. Designing the Interactive Conflict Geo Map

For the *BattleLens* project, I led the development and implementation of several key interactive visualizations and ensured seamless integration across all components. My work began with designing an **Interactive Geographic Map** using the Middle East ACLED dataset. This dataset contained records of political violence, protests, battles, and other disorderly events. I implemented a dynamic timeline panel, allowing users to iterate through years of data from 2015 to 2024. Alongside, I added an event type selection panel (e.g., riots, protests, battles), providing flexibility to analyze specific types of events.

On hovering over data points, users could access detailed

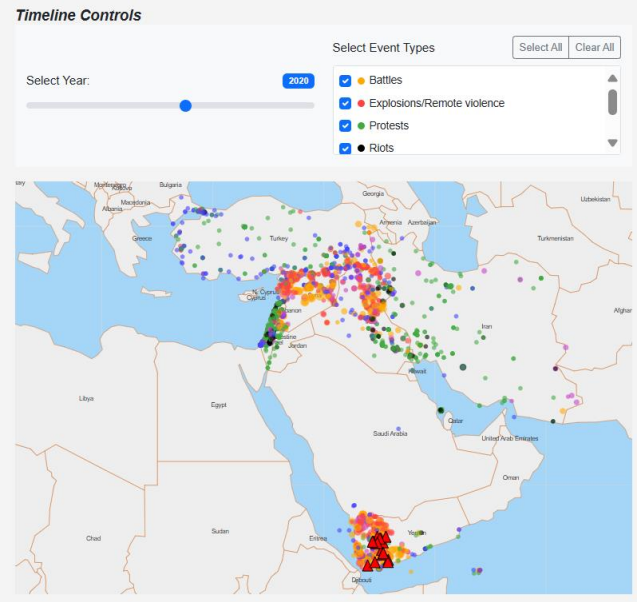

Fig 1. Interactive Conflict Geo Map

insights, including fatalities, event location, date, and a brief description of the event's context and parties involved. The map's interactivity extended to zoom and drag functionalities, enabling users to focus on specific regions effortlessly.

2. Analyzing Trends with an Interactive Line Chart

Additionally, I designed a **Line Chart** summarizing major trends across the years. It depicted variations in fatalities, event frequencies, and specific types of occurrences, highlighting key patterns over time. By analyzing this data, I presented conclusions on why certain peaks or trends occurred, linking them to political or social events. My observations offered users a comprehensive understanding of conflict dynamics in the region. From the data, I concluded that while the frequency and intensity of events fluctuated over the

years, the region has been locked in a persistent state of unrest, driven by systemic instability and geopolitical factors. The analysis highlighted how key political changes and external interventions exacerbated or de-escalated conflicts, emphasizing the need for continuous monitoring and nuanced policymaking to address the root causes of prolonged conflicts effectively.

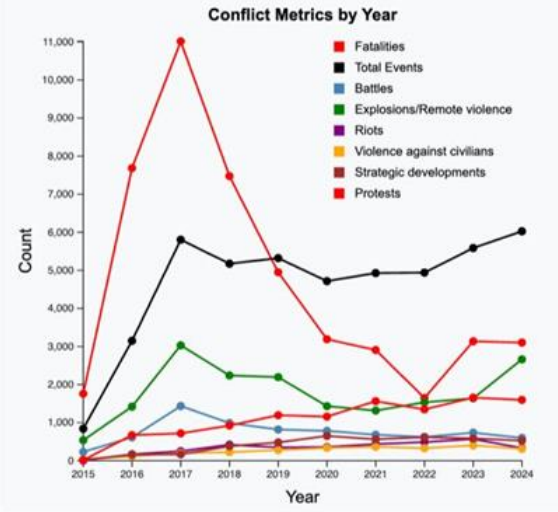

Fig 2. Fatalities Line Chart

3. Animating Arms Revenue with Stacked Bar and Donut Charts

To further enrich the visualization, I implemented an **Animated Stacked Bar Chart** transitioning into a donut pie chart. This chart represented arms revenues for major manufacturers, emphasizing their contribution to global arms trade dynamics. I enhanced user interactivity by integrating hover effects over legends, which highlighted corresponding sections of the chart for better interpretation. These features were designed to improve user engagement and facilitate detailed exploration of defense economy statistics.

4. Exploring Economic Correlations with a Stream Chart

Another significant contribution was the **Stream Chart**, which analyzed the relationship between a country's GDP and its arms sales. By correlating GDP variations (visualized as chart thickness) with weapon revenues (on the y-axis), I uncovered a striking positive relationship. My analysis showed that over 70% of global arms sales revenues were dominated by countries like the USA, Russia, and France. These nations, despite being UN Security Council members, profited immensely from arms sales, indirectly fueling conflicts. My conclusions raised critical questions about the ethical implications of such economic dependencies, highlighting the paradox of peacekeeping nations driving warfare economies.

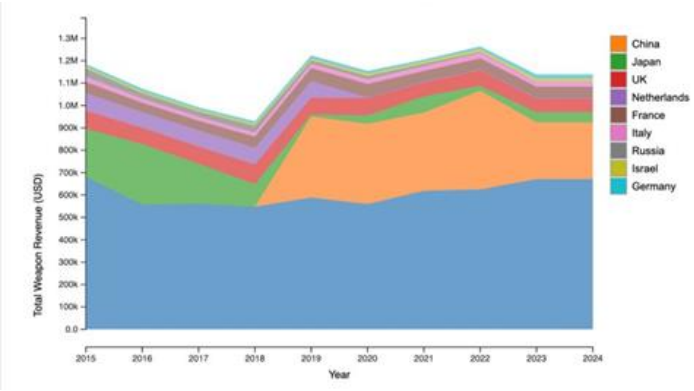

Fig 3. Streamgraph depicting the relation between the GDP of a country and arms sales.

5. Crafting a Seamless Narrative with Scrollytelling

To create a cohesive user experience, I integrated **Scrollytelling** using Scrollama, blending narrative storytelling with dynamic visualizations. I also incorporated horizontal scrolling mechanics to guide users seamlessly through different sections of the project. This narrative style allowed users to engage deeply with the story behind the data.

6. Leading the Team to Successful Project Completion

As the **Group Leader**, I facilitated effective collaboration by organizing meetings, setting deadlines, and ensuring smooth communication within the team. I brainstormed ideas, explored diverse methodologies, and guided the team toward implementing optimal solutions. I took responsibility for drafting the final project report, detailing our methodologies and insights.

7. Delivering the Final Report and Demo Video

Lastly, I created the **Demo Video**, providing an overview of the project and its core functionalities to ensure clarity and showcase our work effectively. Through these efforts, I ensured the project was not only informative but also visually captivating and easy to navigate, offering users an immersive exploration of conflict and defense economies.

KNOWLEDGE ACQUIRED

Working on this project significantly enhanced my understanding of interactive data visualization techniques and their ability to transform complex datasets into accessible insights. I learned to integrate diverse visualization tools to design user-friendly interfaces, such as geographic maps and

interactive charts, that not only display data but also engage users in exploring patterns and correlations. For instance, I deepened my knowledge of how to effectively use scrollytelling to blend narrative storytelling with dynamic visualizations, offering a seamless experience to users while guiding them through intricate narratives. Additionally, analyzing datasets like ACLED helped me better understand the interplay between socio-political dynamics, such as protests and strategic violence, and the factors influencing these events over time.

Beyond visualization, I gained critical insights into global arms trade patterns and the ethical concerns surrounding them. Analyzing the correlation between GDP and arms sales revenue sharpened my ability to explore causations in multi-dimensional datasets. Furthermore, by examining global trends and their implications on peacekeeping efforts, I developed a nuanced understanding of how economic interests can conflict with the goals of global stability. This project emphasized the value of data-driven analysis in uncovering systemic inequities and sparked my curiosity to further explore the use of AI and visual analytics in socio-political research.

CHALLENGES

Technical

a. **Horizontal Scrolling Difficulty:** Implementing horizontal scrolling using scrollytelling tools posed challenges due to uncontrolled behavior and difficulty in maintaining smooth transitions. Achieving the desired fluidity required significant debugging and testing, making this one of the more time-consuming aspects of the project.
b. **Dynamic Integration of Charts**: Integrating various charts, such as the geographic map, line charts, and stream charts, with the central control panel was complex. It involved synchronizing multiple data visualizations to dynamically update based on user inputs, requiring substantial effort in coordinating interactivity and functionality.
c. **Storytelling Design and Refinement**: A considerable amount of brainstorming was necessary to determine the best way to present the story of the Middle East. This required balancing historical context, trends, and interactivity, ensuring the narrative was both informative and engaging without overwhelming users.

Non-Technical

a. **Ensuring Equal Contribution**: Managing the distribution of tasks so that everyone contributed equitably posed a challenge. Ensuring fairness while aligning tasks with each team member's strengths and expertise required careful planning and open communication.
b. **Adapting to Diverse Working Styles**: The team consisted of individuals with different working styles and preferences, which sometimes led to inefficiencies. Adjusting workflows to accommodate these differences while maintaining project momentum was a non-trivial task.

Results and Conclusion

The project produced several insightful results that highlight the dynamics of political unrest and arms trade economics. The line chart revealed distinct trends, such as the sharp increase in fatalities during 2015-2016, attributed to escalations in the Syrian Civil War, and a significant surge in protests during 2019, reflecting the Arab Spring's long-term effects. The stacked bar chart and stream chart showed a striking disparity in arms sales revenue, with countries like the USA, Russia, and France collectively accounting for over 70% of global sales. These results illuminated the paradoxical role of these nations as both peacekeepers and primary beneficiaries of global conflicts.

Through the analysis, I concluded that the persistence of unrest in the Middle East is not only a consequence of local factors but also influenced by global economic dynamics, including the arms trade. The positive correlation between GDP and arms sales reinforced the argument that economic interests often drive policies that may prolong conflicts. These findings call for global accountability and the need for more stringent measures to align economic practices with the principles of peace and stability. The project underlined the potential of data visualizations in fostering transparency and driving meaningful discussions on complex global issues.

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