CSCI339001 Visualization Project
Global Terrorism

Duanchen Liu, Xuheng Duan,
Xinyu Yao, Juliana Fakhoury

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1 Introduction

As four international students, we are interested in gaining a better understanding of one of the most important and difficult issues in the world: terrorism. As we have seen in the media in recent years, the rise of terrorism and violence has impacted people around the world. Terrorism implies the use of violence to terrorize a population or government for certain political, religious or ideological purposes. The threat of terrorism has become a worldwide concern with several parts of the world reeling under frequent terrorist strikes.

During our four years studying in the US, we have seen multiple terrorist attacks across, not only American cities, but also different countries and continents. Unfortunately, we also noticed, through the dataset we explored in this analysis, that the number of terrorist attacks - and deaths due to terrorism - has increased throughout the years. Therefore, to shine a light on this issue - hoping to bring further awareness and help - we decided to tackle the following questions through visualizations:

1. Is our world becoming more chaotic or peaceful?
2. How many people died across the years in different parts of the world due to terrorism?
3. From 1970 to 2018, did the number of deaths due to terrorist attacks increase across the years?

4. What are the most common weapons used in terrorist attacks?
5. Who are the main targets of the attacks?
6. What are the most notorious terrorist groups in history?
7. What does the influence of these groups change throughout time?
8. What are the 10 worst attacks in history?

Introduction to our dataset:

The Global Terrorism Database (GTD), maintained by researchers at the US National Consortium for the Study of Terrorism and Responses to Terrorism (START), is an open-source database including information on terrorist attacks around the world from 1970 through 2018. The GTD includes systematic data on domestic as well as international terrorist incidents that have occurred during this time period and now includes more than 180,000 attacks.

The link to our dataset: https://drive.google.com/file/d/1yefa0Wy8HZl0wj5LIf53fn7gYUVvOI6R/view?usp=sharing

Fields in our dataset:

date, region, country, city, latitude and longitude, success or not, attack type, target type, terrorist group name, weapon, and the number of people killed.

2 Related Work

Fortunately, this is a fairly famous dataset from Kaggle, which enabled us to look at different related projects to feed our imagination and better the scope of our ideas and inquiries. The work that most inspired our ideas - not for the sake of visualization, but for dataset picking and storytelling - was "Terrorism with false Islamic Religion Motive." In this work, the author delved into why terrorism attacks by Muslims receive 357% more US press attention and coverage compared to other communities, according to The Guardian. He aimed to understand if indeed most of the attacks were committed

by Islamic communities - and what details surrounding the attacks. By the end of the analysis, the author realized that there was an increase in Islamic attacks (which could be also due to population growth), but still, only 1.56% of the terror attacks were actually from their communities. Furthermore, the US is not even in the top 10 countries affected by Islamic terror. This analysis was very interesting because it changed our view about terrorism distribution, motives, and frequency, and it highlighted the bias current media has.

We thought this was a great dataset to answer, not only religion questions about terrorist attacks but also explore different lens about such events. Thus, we aim to explore more about the trend in terrorism in the global stage, and also dive into the details of the attacks to gain a better understanding of who committed the attacks, which weapons they used, and who are the actual targets.

3 Approach

3.1 Potential Problems:

There is a significant amount of missing information. For example, there are 4557 missing longitude values and 4556 missing latitude values. For only 19083 events is recorded a type of claim and only 514 ransom notes are recorded. We will search on the web and fill in the missing information and use python to facilitate the merge of the new data. We will also make sure that all the column titles are clean, without whitespaces or indistinguishable characters. Furthermore, to format the data as we want (as an example, "deaths per year and per country due to terrorist attacks"), we will use excel pivot table as it is a great tool for data aggregations.

3.2 Visualization techniques & potential outcomes:

We decided to structure our project into three sections: introduction, high-level analysis (overview and trends), and low-level analysis. We will start by having an introduction section, in which we will bring up aspects such as the role of terrorism in global history. We will use a line chart to explore the number trend of attacks

and deaths across the years. Our group observed that there is an increasing trend in attacks, therefore, the line chart will serve as motivation to further analyze the details of this unfortunate trend throughout our project.

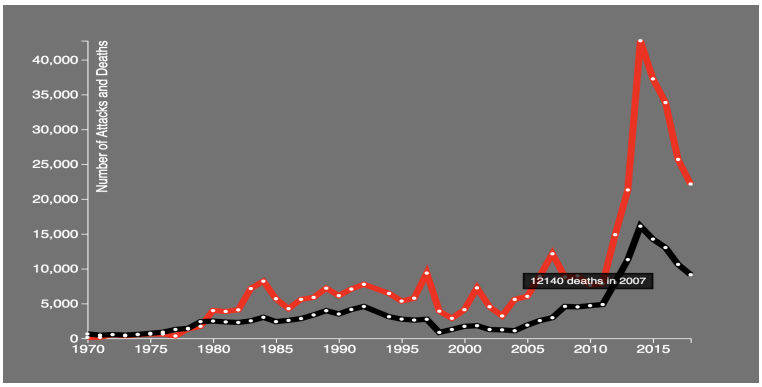

Figure 1: Linechart picture

Then, we will jump into the high-level view of terrorism. We will utilize a sunburst to show which parts of the world or country have more terrorist attacks, and a spinning globe to show the number of deaths in each country in different years.

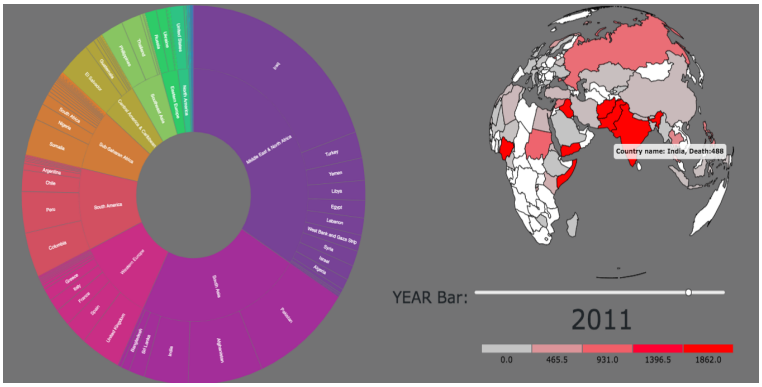

Figure 2: Sunburst + globe picture

Next, for the low-level analysis, we are looking to understand the following factors and their role in the increase of attacks: who (groups that might be committing the attacks), what (what weapons are being used for the attack), and whom (targets). So, we focused our low-level analysis on: target type, weapon type, and terrorist groups. We utilized bar charts to identify the top ten target types and terrorist groups, and top nine weapon types. We also added stack area chart to explore the use of weapon across time, and added multi-line chart to explore the trend and vitality of the terrorist groups across time.

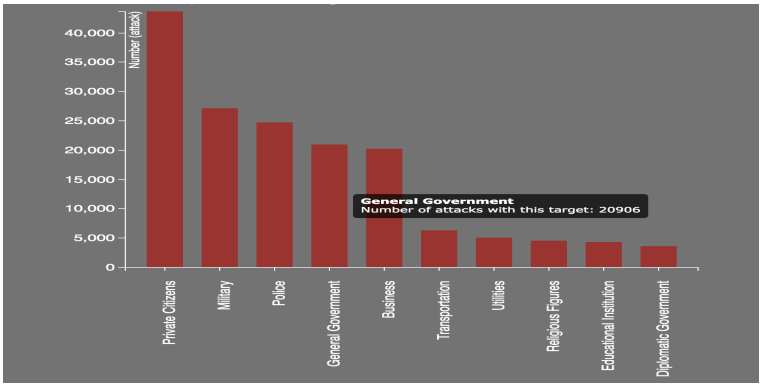

Figure 3: First barchart picture

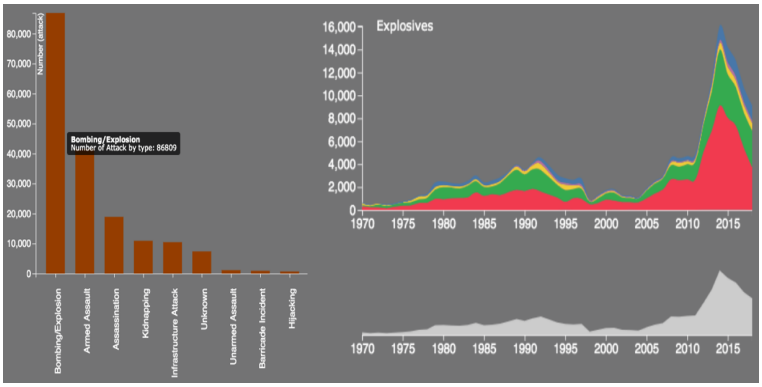

Figure 4: Second barchart and stack area picture

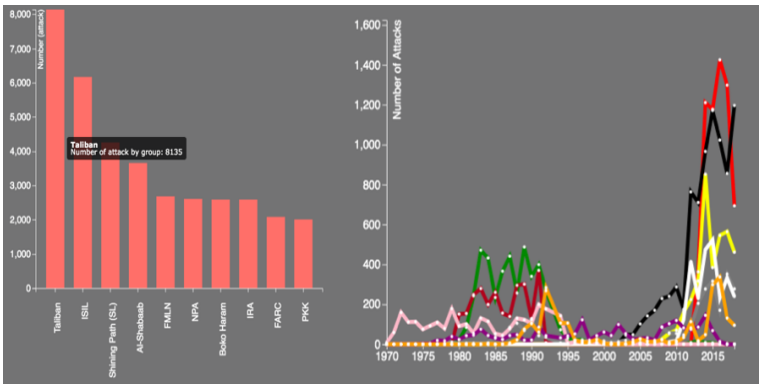

Figure 5: Third barchart and multiline

Lastly, we wanted to bring all factors we explored in the low-level analysis into exploring the top ten attacks in history. We utilized a world map to show the top ten attacks (circles on the map) and encoded the number of deaths of the attacks with the size and color of the circles.

Figure 6: Top ten map

4 Evaluation

Overall, we had a pretty positive feedback. Users felt that the topic was an important issue in our society, therefore making the project relevant and interesting. Furthermore, they thought that the project was very interactive, which allowed them to explore the

visualizations as they like. On the other side, our peers and Dr. Kim also suggested that:

- We build a stronger storyline given the fact we were focusing on telling the readers the stories behind terrorism. To address this issue, we completely restructured our webpage to add section breaks and guiding question on top of each page. As we pointed out in the Design Rationale section, we structured our analysis into three main sections: introduction, high-level analysis, and low-level analysis.

- We adopt consistent layout and coloring. To work on this feedback, we implemented a scrolling interaction for our webpage in which each section becomes a "slide," helping the reader understand the order of events. We also adjusted our color scheme for most of our visualizations and highlighted words in titles and texts in colors that match the graphs.

- We reduce a level from our sunburst. Dr. Kim explained that visualizations should not have more than three levels as it can harm the user experience, therefore, we decided to indeed cut off one of the sunburst layers.

- We add labels to our graphs so users could better understand the meaning behind the graphs. We added tooltip for all our graphs with their respective information.

These were the main feedback we received so far. However, we also decided to add some extra features to improve our project:

- Right in the beginning, we added a quiz to make our project more interactive. The user will be able to assess his/her knowledge on the topic of terrorism and learn some interesting facts about the topic.

- We added a world map that displays the ten worst terrorist attacks in history and their details to tie the topics together and allow users to explore.

- We also added a page to introduce the organizations that help the victims of terrorism. We linked the donate information at the end for people who would like to help.

5 Results and Discussion

5.1 Project result and lessons learned about terrorism:

We structured our project strictly around our initial questions. With the line charts, we were able to identify the increasing trend of the number of attacks and deaths due to terrorism. The later visualizations aimed to explore from a high-level (attacks across the world and across time) to a more detailed view of the topic. For the high-level section, our Sunburst showed that terrorism attacks exist in almost every part of the world, although the number is imbalanced, with the Middle East, North Africa, and South Asia has more than half of all the attacks. Accompanying Sunburst, the globe showed the changes in the number of death due to terrorism in each country across time. Unfortunately, we have seen more countries with an increasing number of death (darker color) across time, which corresponded with the increasing trend in the line chart.

With the troubling trend in mind, we dive into the details of the attacks from the past fifty years. Using bar charts, we answered the questions about the top ten target types, nine different weapon types, and the top ten notorious terrorist groups. For the topic of target types, we learned that although these groups aimed to demonstrate their power over government officials or military forces they are more likely to choose private citizens as targets. This is because other targets have been fortified and the terrorists sought greater carnage to demonstrate their abilities. More importantly, authorities are more successful at stopping attacks against government officials, buildings, and the military. Therefore, private citizens become the preferred target type. For the topic of weapon, the bar chart showed that bombs are the most commonly used weapons (contributing to nearly half of all attacks) due to their low cost and high impact. As a consequence of globalization, the relative ease of access to the chemicals used to make explosives has made improvised explosive devices increasingly prominent. To explore the trend of the use of weapons across time, we utilized the stack area chart. We realized that not only did the bomb dominated the attacks, it also had an increasing trend in usage. Firearms also showed an increasing trend in usage. Understanding the use of weapons can help governments develop plans to better identify real threats and com-

bat terrorist attacks. For the topic of terrorist groups, we identified the Taliban as the group that contributed to the highest number of attacks across the years. Although the group PKK committed the least number of attacks, they still organized over 2,000 attacks over the years, which is still a troubling number. We also utilized a line chart to explore how active these terrorist groups were across the years. Although the Taliban (founded in 1994) and ISIL (founded in 1999) are relatively younger groups compare to IRA and PKK, they are much more active than the other groups in the 2010s, and they are the top two most notorious terrorist groups. So we believe we need to be more careful about the newer terrorist groups which have more vitality and are more extreme or radical.

Lastly, we utilized the world map to represent the top ten terrorist attacks in history. Most of them are centered in the Middle East (Iraq, Iran, Syria) area while we can also see the United States on the list for the 911 attack. The disturbing truth behind the top ten attacks was the fact that almost all of these attacks have different target types (police, government, private citizen, business, and military) and use different kinds of weapons (explosives, firearms, and vehicles). This showed how multifaceted the issue of terrorism is and how difficult it is for countries to tackle this issue.

5.2 Lessons learned about the project in general

5.2.1 Teamwork

Cooperation on coding has been a trouble for us at the beginning. Most of us are unfamiliar with Github and terminal command. Initially, we pushed our codes all on the master branch which causes a lot of trouble. Later on, we each create a branch and push works on our branch which guarantees the correctness on the master branch. Moreover, every one of us is in charge of specific parts of the project. We each work on our own part, and we have a general meeting in each week to combine our work and discuss our goals and plans for the future steps. We help each other debug and provide suggestions so that we could maximize our efficiency.

5.2.2 Importance of detailed planning

We found that the checkpoints you gave us are really helpful since it prevented us from procrastinating. With these deadlines, we could have more time to revise and improve our visualizations. In the past month, we learned the importance of detailed planning through the multiple checkpoints and would cherish the lessons we learned in future projects. Limitations of the current work and opportunities for future work For this project, we mainly focus on the explanation of our visualization and the results we got from what we visualized. For the next step, we could focus more on improving user interaction and experiences. We could connect our graphs together and let the users explore the data themselves and turn our explanatory website into exploratory. For future work, we think it is important to utilize machine learning algorithms to learn from past terrorist attack data and try to predict the details of potential future attacks, in regards to who (terrorist group), when (date of attack), where (location of attack), and how (weapon type, target type, and attack type).

5.2.3 Limitations of the current work and opportunities for future work

For this project, we mainly focus on the explanation of our visualization and the results we got from what we visualized. For the next step, we could focus more on improving user interaction and experiences. We could connect our graphs together and let the users explore the data themselves and turn our explanatory website into exploratory. For future work, we think it is important to utilize machine learning algorithms to learn from past terrorist attack data and try to predict the details of potential future attacks, in regards to who (terrorist group), when (date of attack), where (location of attack), and how (weapon type, target type, and attack type).