Global Terror Attacks: Dashboard Visualizations

Project Document

Data: Global Terrorism Database via Kaggle (tinyurl.com/1oey23g2)
Tools Used: Tableau, Dashboards
Techniques Used: Static dashboard to visualize descriptive statistics (charts, tree map, text table); Exploratory dashboard to visualize trends (interactive map and interactive trend line)

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Introduction

Purpose of Dashboards

The purpose of a dashboard, according to Stephen Few's Design Principles, is to combine facts derived from visualizations onto a single structure so that the short term memory can compare and comprehend them in a short amount of time. This project contains two dashboards: Explaining Global Terror Attacks and Exploring Global Terror Attacks. Explaining Global Terror Attacks is an explanatory dashboard with the intended goal of highlighting global terror statistics and facts. Exploring Global Terror Attacks is an interactive exploratory dashboard with the intended goal of highlighting terror attack trends over geographical regions and time periods. Both dashboards adhere to Few's Design Principle by combining various visualizations onto one platform for rapid comparison and comprehension.

The data used to create the dashboard visualizations contain information about 170,351 terror attacks around the world. The data spans the years 1970-2016. More information about the data is presented in the subsequent sections.

Audience of Dashboards

The audience of the dashboards include those interested in statistics and trends surrounding global terror attacks. Those in the audience include, but are not limited to, international relations and political science students, government officials, public policy researchers, think tanks, and news organizations.

Data

Dataset Description

The raw dataset used to create the visualizations contain information about 170,351 terror attacks. The raw dataset contains 135 attributes to describe each terrorist attack. The attacks span the years 1970-2016 and the location of the attacks span globally. The researchers define terrorism as "the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation."

The raw dataset is publically available from researchers at the National Consortium for the Study of Terrorism and Responses to Terrorism (START) located at the University of Maryland. Other information, including collection methodology and data dictionary, can be found in the GTD Codebook on their Kaggle website (https://www.kaggle.com/START-UMD/gtd).

Data Preprocessing

After an exploration of the raw dataset, it is determined that it is complete, consistent, and does not contain any erroneous errors. The raw dataset does not require heavy preprocessing.

However, attribute reduction of the raw dataset is needed to consolidate candidate attributes for the visualizations.

Attribute Reduction

The purpose of the dashboards is to find and visualize statistics and trends of global terrorist attacks. To achieve this purpose, the visualizations require attributes of low granularity that contribute to a summary-level exploration. The raw dataset provides 135 attributes, the majority of which contain specific information about the data record that is unnecessary to include in overview/summary visualizations. Furthermore, specific attributes tend to have a large number of *NULL* values for those data records that the specific attribute does not pertain to.

For example, the attribute "approxdate" gives a range of dates that the terrorist attack may have occurred. A range is given for 7,464 (or 4.4%) of the data records, with the remaining records containing a NULL value. For the records with an "approxdate" range, the attributes "year", "month", and "day" for those records give the approximate middle date of the range, which is sufficient for the dashboard purposes. Thus, "approxdate" is repetitive and can be removed from the dataset. Another example are the attributes "ishostkid" (Is the attack a hostage or kidnapping?), "nhostkid" (number of hostages or kidnapped victims), "nhostkidus" (number of hostages or kidnapped victims who are American), which only pertain to attacks that are of the type hostage or kidnap (11,134 or 6.5% of the total data records). Those attributes are thus removed. **Appendix A** contains a glimpse of 16 out of the 112 attributes removed from the dataset and the reason for removal.

Data Attributes

The following 23 attributes are candidates for the visualizations. The majority of the attributes are categorical. A more detailed overview of the attributes can be found in **Appendix B**.

Attribute	Data type	Meaning
Eventid	Numeric (ID)	Identifier of each data record. Will not be used in visualizations.
Year	Numeric – Periodic	Year the attack occurred.
Month	Numeric – Periodic	Month of the year the attack occurred
Day	Numeric – Periodic	Day of the month the attack occurred
Extended	Categorical - Coded	Whether the attack lasted beyond 24 hours or not.
Country_txt	Categorical - Nominal	Geographical country the attack occurred. Includes countries no longer existing (i.e. East Germany, USSR, Yugoslavia) and an indicator if the attack spanned several countries (International).
Region_text	Categorical - Nominal	Geographical region where the attack occurred.
City	Categorical - Nominal	City/village/town where attack occurred.
Latitude	Numeric	Latitude of the location where the attack occurred.
Longitude	Numeric	Longitude of the location where the attack occurred.
Crit1	Categorical - Coded	Intention of the terrorist attack adheres to Criteria 1 – POLITICAL, ECONOMIC, RELIGIOUS, OR SOCIAL GOAL

Crit2	Categorical - Coded	Intention of the terrorist attack adheres to Criteria 2 – INTENTION TO COERCE, INTIMIDATE OR PUBLICIZE TO LARGER AUDIENCE(S)
Crit3	Categorical - Coded	Intention of the terrorist attack adheres to Criteria 3 - OUTSIDE INTERNATIONAL HUMANITARIAN LAW
Success	Categorical - Coded	Whether or not the terrorist attack was successful or not. Success is defined as the attack taking place (i.e. a bomb going off in a building or the target of an assassination is killed).
Suicide	Categorical - Coded	Whether or not the perpetrator(s) of the attack intended to escape the attack alive.
Attacktype1_txt	Categorical - Nominal	General method of attack. Up to three attack types are defined for each incident in the raw dataset; only the first attack type is considered as a candidate variable.
Targtype1_txt	Categorical - Nominal	The type of the target of the attack.
Natlty1_txt	Categorical - Nominal	Nationality of target by country.
Individual	Categorical - Coded	Whether or not the attack was carried out by an individual or organized group.
Gname	Categorical – Nominal	Given "Individual"=0=No. Name of the group that carried out the attack.
Weaptype1	Categorical – Nominal	General type of weapon used in the attack.
Nkill	Numerical – Continuous	Total number of victims killed in attack.
Nwound	Numerical - Continuous	Total number of victims wounded in attack.

Analytic Questions

The following five questions are answered by the dashboard visualizations:

Explaining Global Terror Attacks

(1) What weapons are used in terror attacks and which are the deadliest?

(2) Who are the targeted victims of terror attacks?

(3) Who are the main perpetrators of terror attacks?

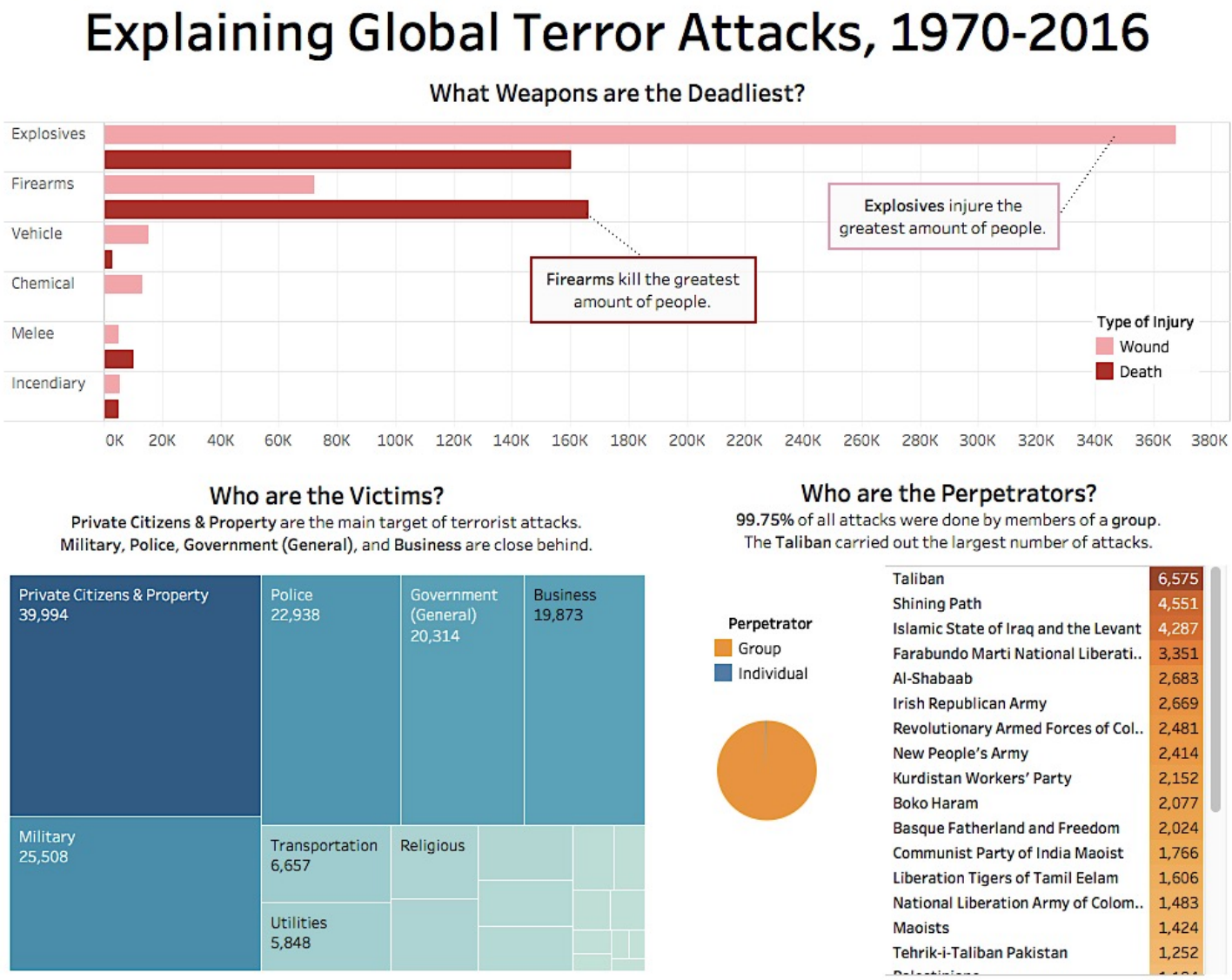
Exploring Global Terror Attacks

(4) Where were terror attacks taking place over the span of 1970-2016?

(5) What types of terror attacks were taking place over the span of 1970-2016?

Dashboards

Explaining Global Terror Attacks Dashboard



Design Principles and Techniques

The intended effect is a cohesive explanatory dashboard with diverse use of visualizations. The content of the dashboard explains global terror attacks by presenting findings and statistics in the data. The dashboard answers the questions "What weapons are the deadliest?", "Who are the victims?" and "Who are the perpetrators?". Three color schemes are used on the dashboard to differentiate the questions and the visualizations that help answer them. There are limited interaction capabilities on the dashboard.

Visualization 1: What Weapons are the Deadliest? Double Bar Chart

A double bar chart is used to show the distribution of dead and wounded victims across the type of weapon used in the terrorist attack. The length and positioning of the bars on a 2D graph (preattentive attributes) relate to the human ability to perceive quantitative data. The x-axis scale starts at 0 with 20K-unit increments to accurately represent the differences in the number of victims.

The red color hue is used to distinguish this visualization from the others on the dashboard. The two intensities of red is used to distinguish the dead distribution from the wounded distribution. Two annotations fill the empty space created by the distributions and highlight the key take-aways.

Visualization 2: Who are the Victims? Treemap

The size and sequential color scheme of the treemap aid comparison across victim types. They correspond to the amount of cases the particular victim is targeted. Larger size and higher blue intensity pertain to a greater number of victims. A count of the total victims of each type is provided.

The blue color hue is used to distinguish this visualization from the others on the dashboard. Note that this space-filling treemap is used because it is aesthetically attention-grabbing. The goal is to compare the amount/size of the victim types. It is not used for a hierarchical purpose.

Visualization 3: Who are the Perpetrators? Pie chart

This pie chart is included for a drastic effect. The viewer can barely see the wedge that represents the amount of attacks perpetrated by individuals, which is 0.25% of the whole. The large wedge, 99.75% of the whole, represents the amount of attacks perpetrated by members of a terrorist group.

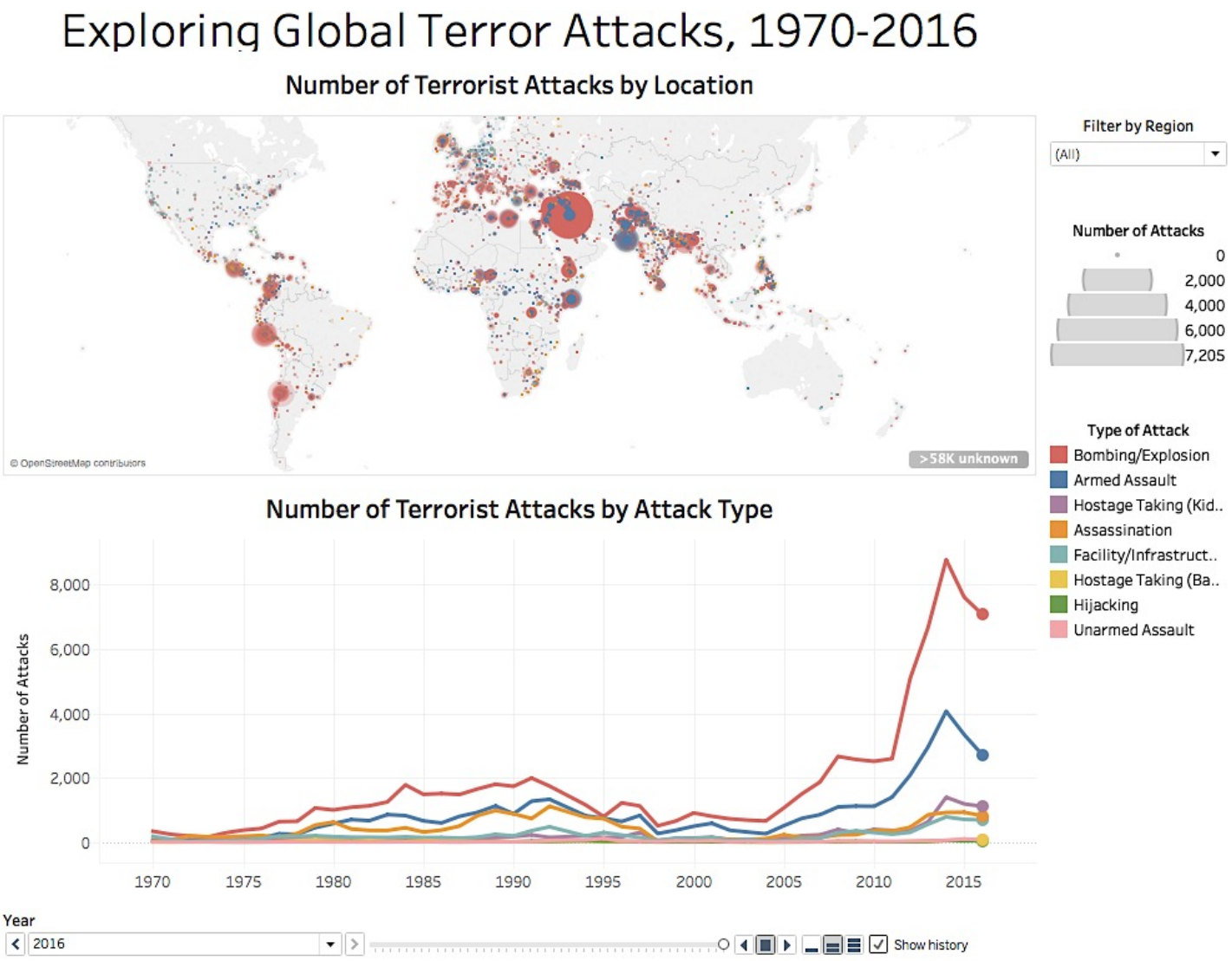
The orange color hue is used to distinguish two visualizations from the others on the dashboard. In the pie chart, orange highlights the large proportion of perpetrators that are members of a group. Orange is also used to associate that proportion to the list of the terrorist groups in *Visualization 4*.

Visualization 4: Who are the Perpetrators? Text table

This visualization is a text table that supplements the pie chart in *Visualization 3*. The pie chart highlights the drastic proportion of terrorist attacks perpetrated by groups as compared to individuals. The text table provides further information about the terrorist group perpetrators.

The filter option is used to display only the groups who have claimed responsibility for over 600 crimes during the years 1970-2016. Color intensity and an ascending order of groups by number of attacks is used to show the most dangerous terrorist groups. The viewer can scroll through the list, which is the only interactive capability of the Explaining Global Terror Attacks dashboard.

Exploring Global Terror Attacks Dashboard



Design Principles and Techniques

The intended effect is an interactive dashboard with two visualizations that give trend information corresponding to the user's input. The content of the dashboard allows the user to explore trends on global terror attacks by manipulating region and year parameters. The dashboard answers the broad questions "Where were terror attacks taking place over the span of 1970-2016?" and "What types of terror attacks were taking place over the span of 1970-2016?", along with any specific question the user may ask.

Visualization 1: Number of Terrorist Attacks by Location Interactive Map

A dot density geospatial map displays count distributions of terrorist attacks relative to the geographic location where the attack occurred. The latitude and longitude attributes created

the map. The size of the dot corresponds to the number of attacks that occurred in that geographic area and is intended to be compared among geographical areas. The larger the dot, the greater number of attacks. The color of the dot corresponds to the type of attack. Two legends, "Number of Attacks" and "Type of Attacks", are provided that give information about dot size and dot color.

This map is interactive by the following filters: region and time. The viewer can specify one or more regions of the map to explore while temporarily removing the data for the other regions. The viewer can also explore terror attacks of geographical areas over time. If the "Show history" feature is on, the map will display the number of terror attacks accumulated in geographical areas over time. If the "Show history" feature is not on, the map will display the terror attacks that occurred in that specific year only in the geographical locations.

Visualization 2: Number of Terrorist Attacks by Attack Type Interactive Trend Line

A line chart displays the trends of terror attack types over time. This trend line is interactive by the time filter. When viewed together, this trend line is used to supplement the color of the dots in the interactive map at the top of the dashboard. The trend line gives the viewer the exact number of attack types used per year; the map gives the viewer the location of where the attack types were perpetrated. The visualizations share the dot color "Type of Attack" legend. This demonstrates the cohesiveness between the two visualizations on the dashboard.

Please see the **Project Demonstration** document for interactive capabilities and examples of the kind of information that can be derived from the Exploring Global Terror Attacks dashboard.

Conclusion

A variety of visualizations and design principles and techniques are used over two dashboards to give an explanatory and exploratory view of global terror attacks spanning the years 1970-2016. The explanatory aspect of Explaining Global Terror Attacks dashboard comes from fact-driven visualizations. The exploratory aspect of Exploring Global Terror Attacks dashboard comes from the interactive region and time filtering component that the viewer can utilize to fine-tune the results on the dashboard.

Appendix

A

Some attributes removed from the raw dataset and the reason for removal.

Attribute	Meaning	Reason for Removal
Approxdate	Approximate date of terror attack (range of dates).	Data provided in "year", "month", and "day" variables sufficient.
Resolution	Date of attack resolution given the attack lasted over 24 hours ("Extended" = 1)	Too many NULL values. Date only given for 30% of "Extended" = 1 records.
Country	ID identifier of the country. Mapping documentation included in data dictionary.	Repetitive data. "Country_txt" sufficient.
Region	Coded identifier of the region. Mapping documentation included in data dictionary.	Repetitive data. "Region_txt" sufficient.
Provstate	Administrative region the attack occurred.	Unnecessary data for visualization. Contains detailed information.
Specificity	Location details; details about the latitude/longitude measurements	Unnecessary data for visualization. Contains detailed information.
Vicinity	Location details; if the attack was in the vicinity of the city or outside of the city	Unnecessary data for visualization. Contains detailed information.
Location	Text summary; details of the location of the attack	Unnecessary data for visualization. Many NULL values.
Attacktype1 Attacktype2 Attacktype3	Coded identifiers of the method of the attack.	Repetitive data.
Attacktype2_txt Attacktype3_txt	Text data of the method of the attack.	Only attacktype1 will be considered in the visualization.
Doubtterr	Indicates if there is any doubt that the attack qualifies as terrorism.	Unnecessary data for visualization. Contains detailed information.
Alternative Alternative_txt	Indicates a possible reason for attack if not terrorism (if doubtterr=Yes)	Unnecessary data for visualization. Contains detailed information.

B

Candidate attributes for the visualizations.

Attribute	Data type	Possible Values	Meaning
Eventid	Numeric (ID)	-	Identifier of each data record. Will not be used in visualizations.
Year	Numeric – Periodic	1970-2016	Year the attack occurred.
Month	Numeric – Periodic	1-12	Month of the year the attack occurred
Day	Numeric – Periodic	1-31	Day of the month the attack occurred
Extended	Categorical - Coded	1=Yes 0=No	Whether the attack lasted beyond 24 hours or not.
Country_txt	Categorical - Nominal	Many possible values.	Geographical country the attack occurred. Includes countries no longer existing (i.e.

			East Germany, USSR, Yugoslavia) and an indicator if the attack spanned several countries (International).
Region_text	Categorical - Nominal	North America Central America & Caribbean South America East Asia Southeast Asia South Asia Central Asia Western Europe Eastern Europe Middle East & North Africa Sub-Saharan Africa Australia & Oceania	Geographical region where the attack occurred.
City	Categorical - Nominal	Many possible values.	City/village/town where attack occurred.
Latitude	Numeric	-	Latitude of the location where the attack occurred.
Longitude	Numeric	-	Longitude of the location where the attack occurred.
Crit1	Categorical - Coded	1=Meets criteria 1 for purpose of the attack 0=Does not meet criteria	Intention of the terrorist attack adheres to Criteria 1 – POLITICAL, ECONOMIC, RELIGIOUS, OR SOCIAL GOAL
Crit2	Categorical - Coded	1=Meets criteria 2 for purpose of the attack 0=Does not meet criteria	Intention of the terrorist attack adheres to Criteria 2 – INTENTION TO COERCE, INTIMIDATE OR PUBLICIZE TO LARGER AUDIENCE(S)
Crit3	Categorical - Coded	1=Meets criteria 3 for purpose of the attack 0=Does not meet criteria	Intention of the terrorist attack adheres to Criteria 3 - OUTSIDE INTERNATIONAL HUMANITARIAN LAW
Success	Categorical - Coded	1 = Successful attack 0 = Unsuccessful attack	Whether or not the terrorist attack was successful or not. Success is defined as the attack taking place (i.e. a bomb going off in a building or the target of an assassination is killed).
Suicide	Categorical - Coded	1 = Incident resulted in the perpetrator(s) committing suicide 0 = No indication of suicide	Whether or not the perpetrator(s) of the attack intended to escape the attack alive.
Attacktype1_txt	Categorical - Nominal	Assassination Hijacking Kidnapping Barricade Incident Bombing/Explosion Armed Assault Unarmed Assault Facility/Infrastructure Attack Unknown	General method of attack. Up to three attack types are defined for each incident in the raw dataset; only the first attack type is considered as a candidate variable.

Targtype1_txt	Categorical - Nominal	Business Government (General) Police Military Abortion related Airports & Aircraft Government (Diplomatic) Educational Institutions Food or Water Supply Journalists & Media Maritime NGO Other Private Citizens & Property Religious Figures/Institutions Telecommunication Terrorists/Non-State Militias Tourists Transportation (Other than Aviation) Unknown Utilities Violent Political Parties	The type of the target of the attack. "Other" includes ambulances, firefighters, refugee camps, and other targets that do not fit into the other categories.
Natlty1_txt	Categorical - Nominal	Many possible values.	Nationality of target by country.
Individual	Categorical - Coded	1 = Perpetrator(s) individuals 0 = Perpetrator(s) known to be part of a group	Whether or not the attack was carried out by an individual or organized group.
Gname	Categorical – Nominal	Many possible values.	Given "Individual"=0. Name of the group that carried out the attack.
Weaptype1	Categorical – Nominal	Biological Chemical Radiological Nuclear Explosives/Bombs/Dynamite Fake Weapons Incendiary Melee Vehicle Sabotage Equipment Other Unknown	General type of weapon used in the attack.
Nkill	Numerical – Continuous	-	Total number of victims killed in attack.
Nwound	Numerical - Continuous	-	Total number of victims wounded in attack.

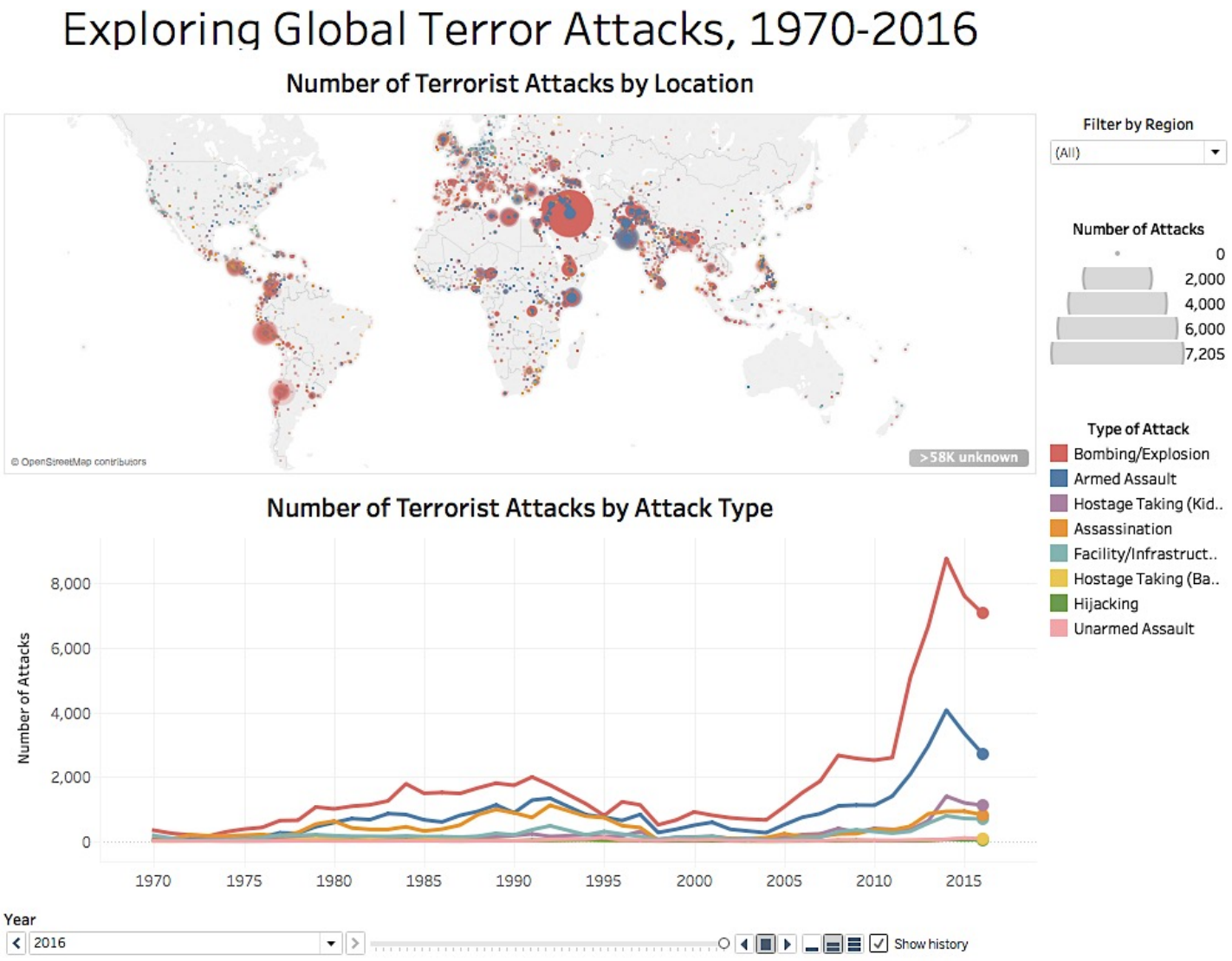
Global Terror Attacks: Dashboard Visualizations

Project Demonstration

Introduction

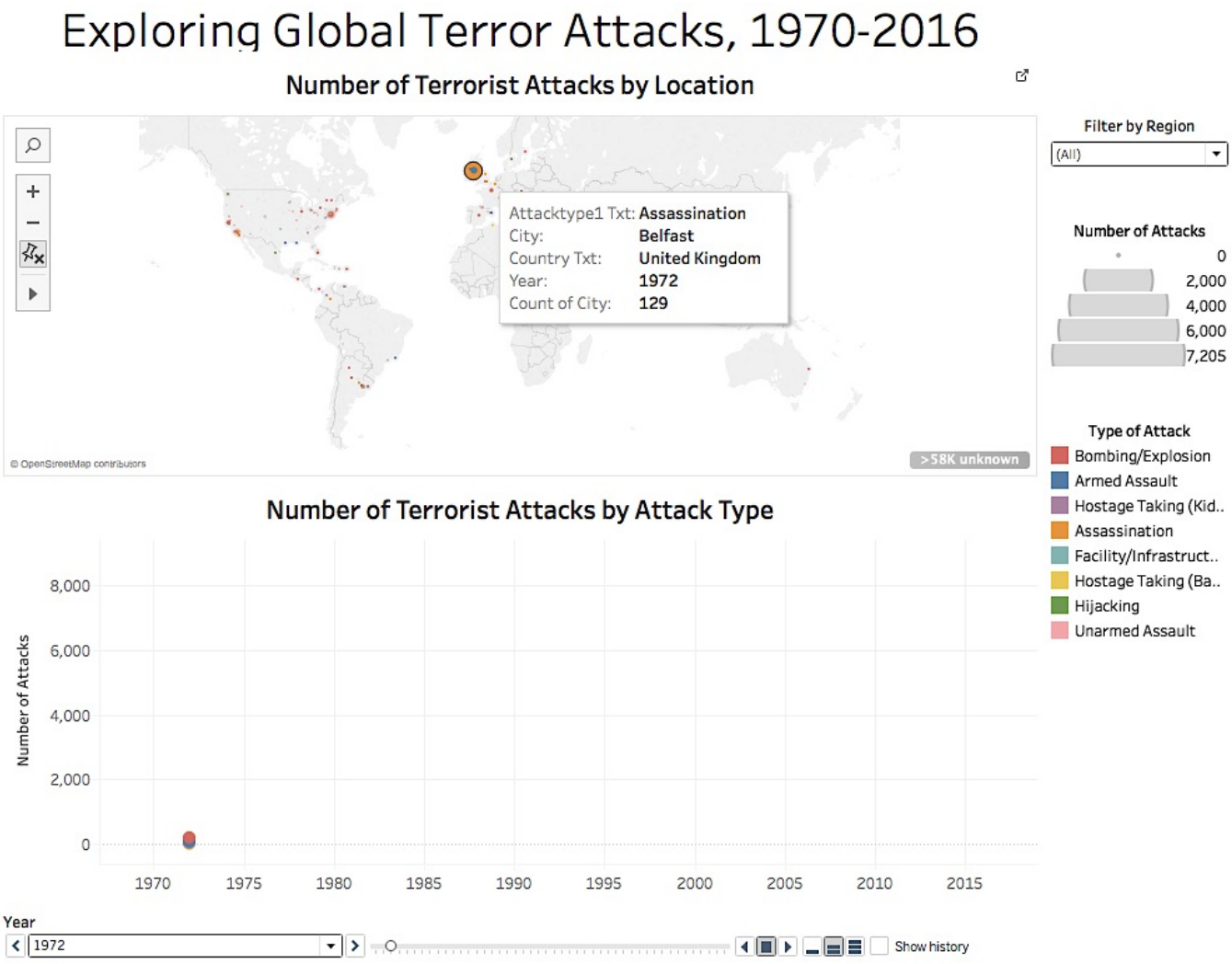
This document is a supplement to the **Project Document**. The purpose of this document is to show the interactive capabilities of the Exploring Global Terror Attacks dashboard. In doing so, examples of the kind of information a user can derive from the dashboard will be presented.

Exploring Global Terror Attacks Dashboard

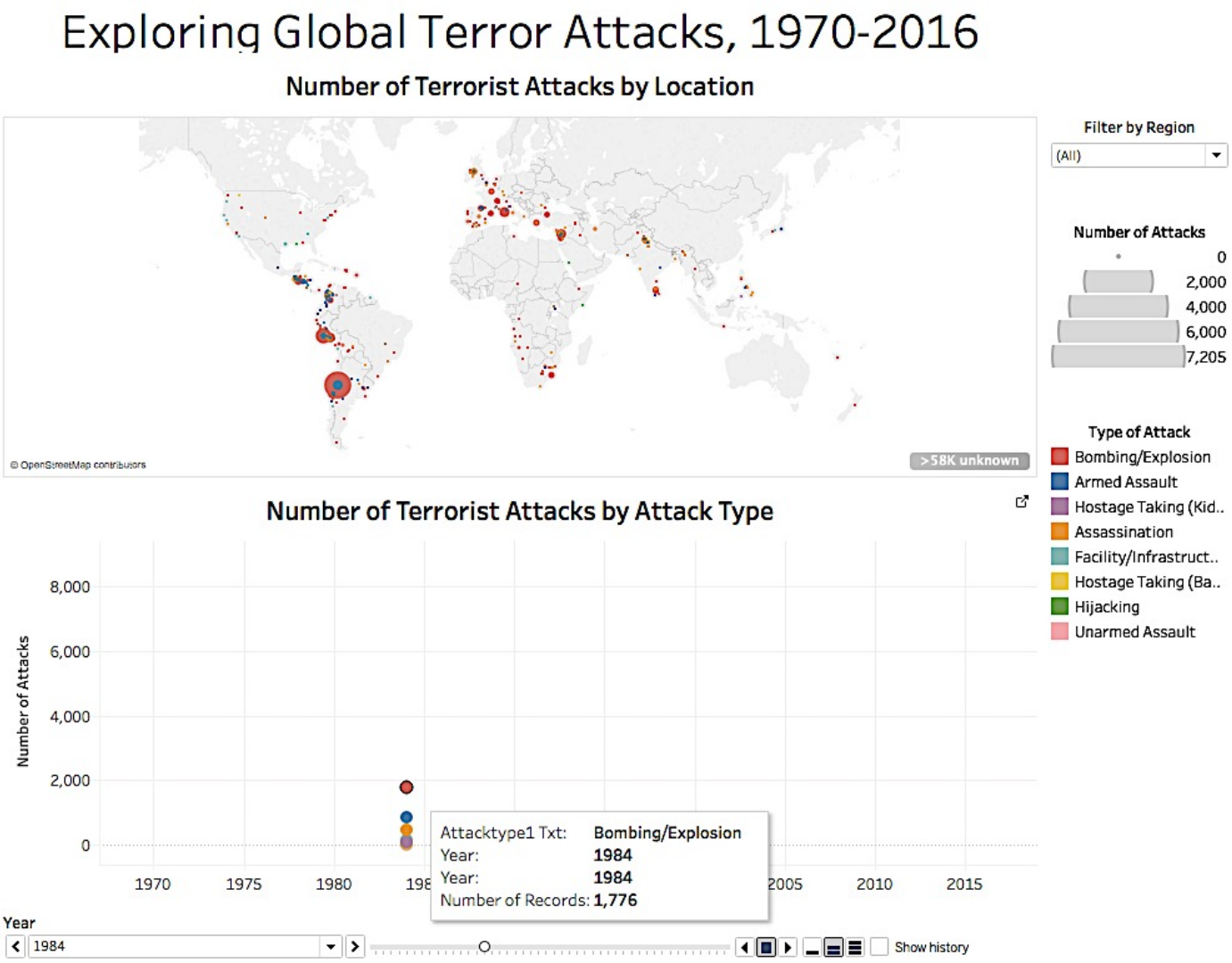


Interaction

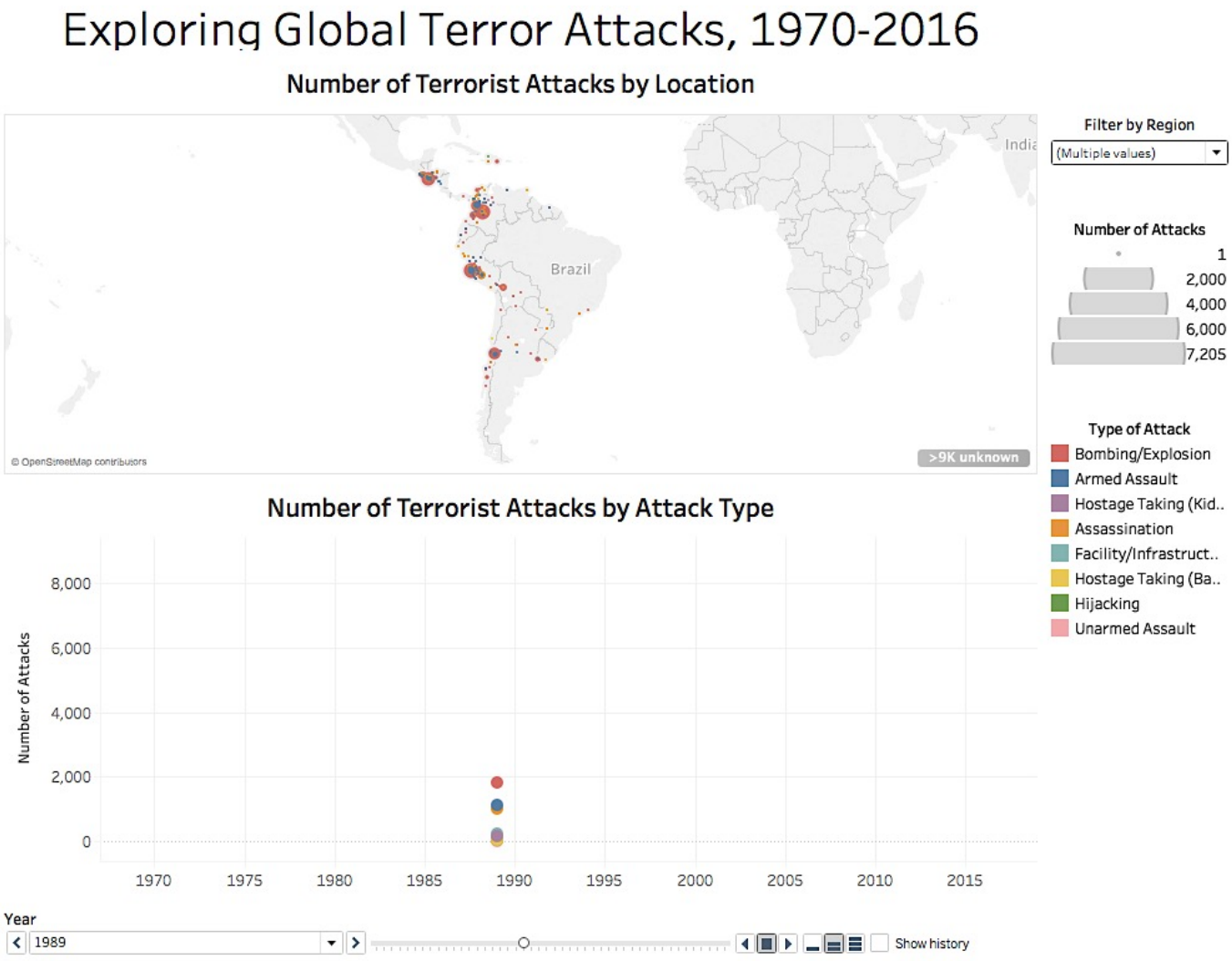
Time and Region filters



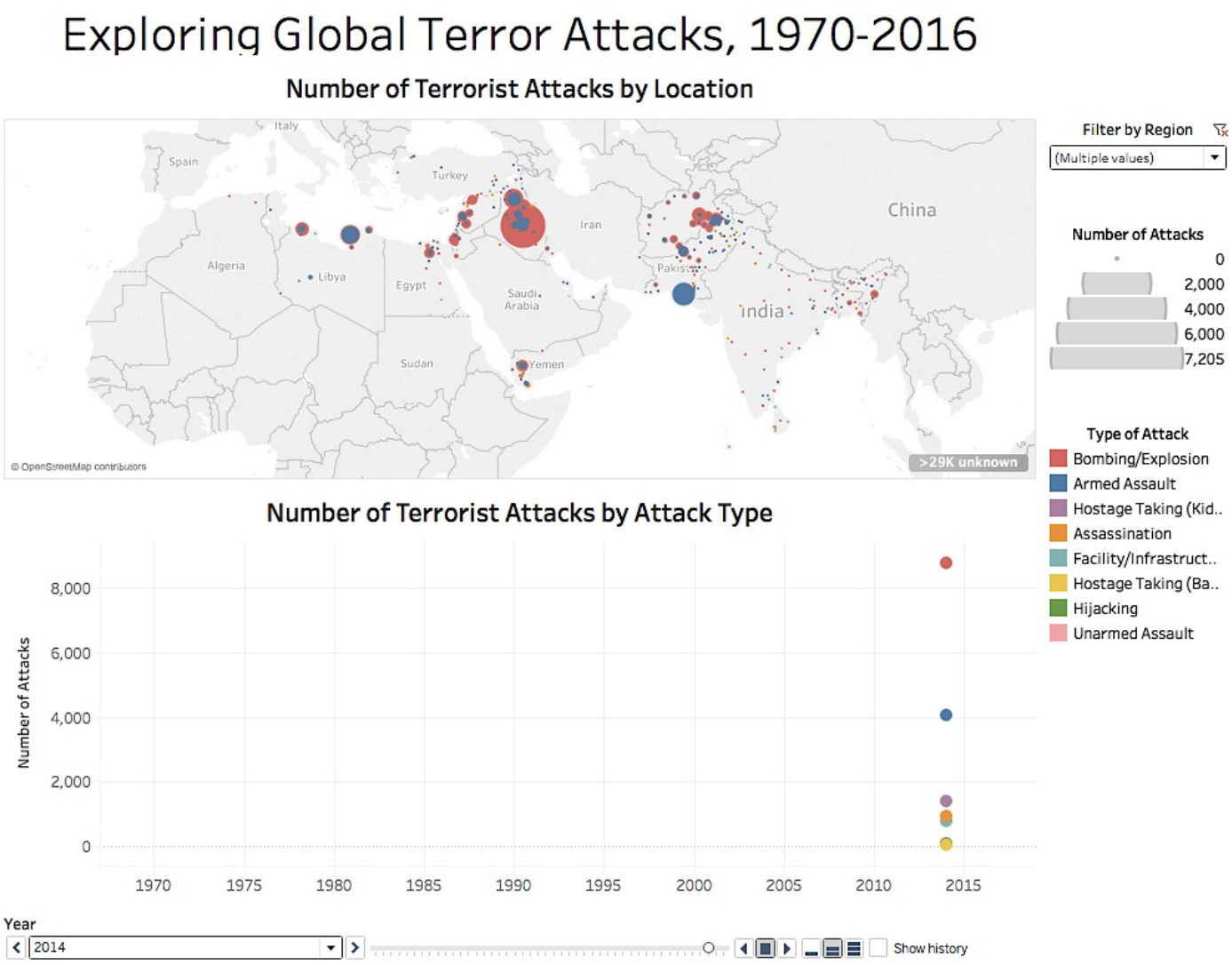
When the user sets the time filter to the beginning years of the dataset, 1973, the user can see that there are a significant number of bombings/explosions in California, New York, and various cities in Turkey (not shown). What is most notable, however, is that the largest number of attacks during the year are assassinations and armed assaults in Belfast, Northern Ireland, UK. This corresponds to the year that the Northern Ireland conflict peaked in violence. The Irish Republican Army, a party in the conflict, is one of the top perpetrators in terms of number of attacks from the Explaining Global Terror Attacks dashboard (a snapshot is shown to the right).



The 1980's proved to be a problematic time for Chile, Peru, and (later in the decade) Columbia with a spike in bombing/explosions and armed assaults. The next visualization concentrates on the Central and South American regions.

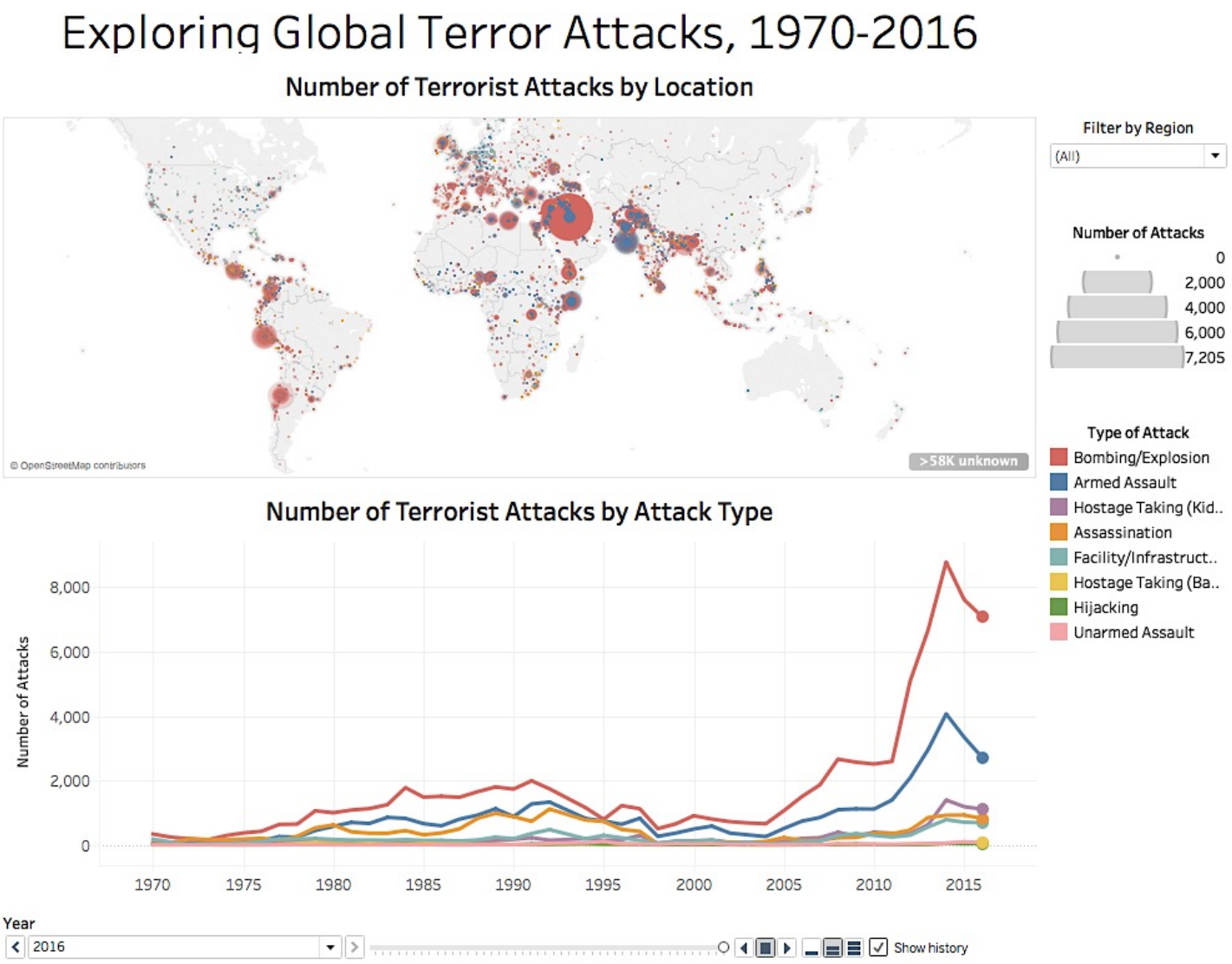


The region filter is applied to display only the data for Central America and South America. In 1989, there are a large number of terrorist attacks in El Salvador, Columbia, Peru, and Chile compared to the rest of the world. The majority of the attacks are bombings/explosions, armed assaults, and assassinations. Top perpetrator groups from the Explaining Global Terror Attacks dashboard that hail from these countries include Shining Path (Peru), Farabundo Marti National Liberation Front (El Salvador), Revolutionary Armed Forces of Columbia (Columbia) and National Liberation Army of Colombia (Columbia).



In more recent years, the spike of bombs/explosions in 2014 shown by the Number of Terrorist Attacks by Attack Type visualization can be examined in greater detail by filtering out all regions except the Middle East and South Asia. Tracing US intervention in the Middle East after 9/11 is especially interesting in this dashboard.

When the “Show History” feature is on, a different kind of analysis can be made: one that accumulates the terrorist attacks in each geographical area.



The visualization above shows the most violent areas in the world in terms of the number of terrorist attacks from 1970-2016. It also shows the most used attack type per year.

Conclusions

This document showed the interactive capabilities of the Exploring Global Terror Attacks dashboard. The information derived from the interactions include, but are not limited to, the following:

- The most commonly used attack types are Bombing/Explosives and Armed Assault. This is consistent with *Visualization 1* from the Explaining Global Terror Attacks dashboard, which concludes that explosives and firearms have injured and killed the largest amount of people in terror attacks.
- The geographical locations that are most heavily-hit with terror attacks correspond to the origin country of the perpetrator groups who have carried out the largest number of attacks from *Visualization 4* in the Explaining Global Terror Attacks dashboard.
- Domestic and global conflicts can be correlated to the number of terrorist attacks in each geographical area. The Northern Ireland Conflict, the Colombian Conflict, and the Iraqi War are shown above.

One last thing…

If the count of the number killed variable is used instead of the count of the number of terrorist attacks, the effect of 9/11 on the geographical map looks like this: