Using Data Visualizations to Find Patterns in Global Terrorism

Introduction

In this lab, we will use the Global Terrorism Database (GTD) to look at the relationships between regions, religion and terrorism. The GTD contains information about more than 140,000 terrorist incidents occurring between 1970 and 2014[1]. The data in the GTD is gathered from news reports and the team managing the database tries to verify all the information they gather through multiple news sources to make as reliable as possible (LaFree, Dugan, & Miller, 2015).

Part A: Using Scatterplots to Identify Extreme Events:

Go to the Grinnell College RStudio site, http://shiny.grinnell.edu/, and select the Global Terrorism Plots (it may take a few seconds to open). Click the Variable Description link on the bottom left corner to understand the options within this app.

Before starting Questions 1-7, make sure the scatterplot is set with the following options:

- **X-axis variable**: *GDP Per Capita*, check **Log** box
- **Y-axis variable**: *Incidents*, check **Log** box
- **Type of Plot**: *ggvis*
- **Color By**: *Religion*
- **Success Only**: should not be checked
- **Year of Incidents**: 1970-2013
- No Filters should be selected

1) In the Scatterplot tab, each point represents a particular country and year (referred to as a country-year). For example a particular point could represent the total number of incidents that occurred in the United States in 1984. What four country-years have the most incidents? What is the primary religion of these countries?

2) Restrict the **Year of Incidents**: 1970-1990. What is the primary religion of the four country-years with the most incidents in this time frame?

3) Select the *ggplot* option for **Type of Graph**, *Religion* for **Facet By** and 1970-2013 for **Year of Incidents**. Do countries of all religions have terrorist attacks? Which two religions tend to have the lowest number of observations?

4) Now select *Region* in the **Facet By** menu. What do you notice about the relationship between each region and religion? How could *Region* act as a confounding variable for studying whether a religion is a root cause of terrorism?

5) Create a graph that helps to visualize which religions and regions tend to have incidences with the largest number *Fatalities*. Which two religions are most likely to have a high number of fatalities? What regions correspond with these incidences with the most fatalities?

These scatterplots helps us find the religion for the countries with the most incidents, and shows that terrorism occurs at a variety of levels in countries of each religion category. ***However, it is important to recognize these graphs show the primary religion of the country that was attacked, not the motivation for each incident***. The countries with the most incidents are all engaged in ongoing conflicts, which is another possible cause for the high levels of terrorism incidents.

Part B: Visualizing Spatial and Temporal Patterns with a Map

Go to http://rstudio.grinnell.edu and select the Global Terrorism Map_Basic. This map can be very useful for looking at patterns over time, picking out individual incidents and getting detailed information. You will see a map of countries, overlaid by incident markers of different sizes. The size of each marker represents the severity of the attack (a weighted sum of the deaths and injuries caused by the incident[3]).

6) Select *Middle East & N. Africa* in the **Region** menu at the top left corner of the screen and look at the map for each year. Explain any key patterns that you see over time.

7) Find the country-year with the most incidents (identified in Question 1). Identify the perpetrators for the most severe attacks in that country-year. Why do you think there were so many incidents in this particular country-year?

If we look at these graphs in 10 year increments, it appears to be an increasing number of terrorism incidents (LaFree, Dugan, & Miller, 2015). We can also see that in recent years, Muslim countries have had the largest number of incidents.

Part C: Stacked-line Plot

The stacked-line plot takes the data from the GTD, organizes it by year and the chosen category (*region, religion, weapon, attack type, target* or *success*), and then tallies up the number of *incidents, fatalities,* or *wounded* in the given year and category. The Y-axis can show percentages or absolute counts. The plots can also be separated into different graphs using the **Facet By** option. The stacked-line graph allows us to view aggregate data and identify overall trends.

8) Select the Stacked-line Plot tab at the top of the app, then select the following parameters:
   - **Y-Axis Variable**: *Incidents*
   - **By Percentage (%)**
   - **Color By**: *Religion*
   - **Facet By**: *None*
   - **Year of Incidents**: 1970-2014

   What years have a high percentage of terrorism in Muslim countries? What years have a high percentage of terrorism in Catholic countries?

9) Change **By Percentage (%)** to **By Count (#)**, so we can look at the absolute levels of terrorism. Describe any trends you see over time. It is worth noting that some of the increase in terrorist incidents may be caused by the fact that the GTD collects data through news media, which have expanded exponentially since the 1980s due to the advent of the internet (Putting Terrorism in Context, LaFree, Dugan, & Miller).

The graph in Question 9 demonstrates that the number of terrorist incidents in Muslim countries was stable during the late 1990s and early 2000s, but began to increase starting around 2003, when the Iraq war started. This observation suggests that there is an association between war and terrorism. This hypothesis is strengthed by the fact that Afghanistan, another country currently in conflict with the US, and Pakistan, a country that has had a historical involvement with terrorist organizations (Wright, 2011), also have particularly high levels of terrorism. With a little knowledge of geo-political history, we can continue this thread of exploration.

Select *Region* in the **Facet By** menu. Clearly there is an association with *Region* and *Religion*. Particularly, most countries in *Latin American & the Carribbean* are Catholic and most countries in the *Middle East & North Africa* and *South Asia* are Muslim. In addition, notice that the periods with the highest terrorism for these regions and religions correspond to periods of conflict: *Latin American & the Carribbean* experienced considerable political upheaval in the 1970s and 1980s and *The Middle East & North Africa* and *South Asia* are experiencing similar levels of conflict today. If we look at regional conflict as the root of terrorism it should not be surprising that so many terrorist incidents occurred in Catholic countries in the 1980s and in Muslim countries in recent times.

10) If terrorism is related to conflict, we might expect terrorist attacks to target **Armed Forces** or **Government** in periods and regions during times of conflict. Select **Incidents** as the **Y-axis Variable** and *Target Type* in the **Facet By** menu. We can see that **Armed Forces** are the primary targets in Muslim countries, suggesting that the terrorism is related to the presence of military or militia, which may be confounding the relationship between terrorism and religion. What was the most common *Target Type* for Catholic countries in the 1980's?

Our observations from the stacked-line plot help confirm some of our previous findings, namely that Muslim and Catholic countries have experienced the most terrorism. In fact, during their respective peak periods of terrorism, countries of these two religions account for the majority of terrorist incidents. However, we observe the same patterns, namely rises and falls of terrorist activity, in certain regions, which raises doubt that religion is the primary influence in the terrorism.

Part D: Drawing Conclusions

We created multiple graphs in order to identify patterns with terrorism and the major religion of a country. With this method, we found that some religions do correlate with greater levels of terrorism, particularly Catholicism and Islam. However, this connection only applies for certain time periods (Catholicism during the 1970s and 1980s and Islam during the 2000s and 2010s). However, we cannot show a causal relationship with

terrorism and religion. In fact, each year the GTD shows that there are numerous Muslim and Catholic countries with no recorded terrorism incidents.

Ideally, we would like to look at the religions of groups that have the potential to commit acts of terrorism and see if groups of a certain religion are more likely to follow through. However, there are a few problems with this. Finding data on the ideological motivation for the individuals behind the terrorist acts can be difficult. Instead of studying groups directly, we will study the most common religion of a country and the number of terrorist acts in that country as proxies for terrorist groups and the acts they commit, since most acts of terrorism happen locally (Smith, Damphousse, & Roberts, 2006, p. 2). Another limitation of this data visualization is that we have no way to control for prevalence of religions. For example, the United States is classified as Christian, but there are numerous other religions that are actively followed.

There are a growing number of active terrorist groups that are classified as religious: the opening pages of the Global Terrorism Index report (Institute for Economics and Peace, 2014, p. 4) states that, "Religion as a driving ideology for terrorism has dramatically increased since 2000." The report also states that radical Islamist groups have become the most deadly terrorist groups in the world today (p. 74). It is important to recognize that these observations only show that a present-day terrorist group is likely to have religion as a driving ideology (i.e. many terrorists use religion as motivation), and not that having religion as a driving ideology makes it likely for a group to be a terrorist group (i.e. we cannot say many religious people are terrorists).

Endnotes

[1] For an incident to be categorized as a terrorist attack and included in this dataset, each incident must meet all three of these attributes 1) The incident must be intentional, 2) The incident must entail some level of violence or immediate threat of violence and 3) The perpetrators of the incidents must be sub-national actors. In addition each incident must include at least two of the following three criteria 1) The act must be aimed at attaining a political, economic, religious, or social goal, 2) There must be evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) than the immediate victims and 3) The action must be outside the context of legitimate warfare activities (see the GTD Codebook for more details). Data files from 1993 were lost by the company originally managing the database, so data from that year are missing.

[2] We use the 2014 religion data for the entire span of the GTD, under the assumption that the major religion of a country does not shift frequently. [3] The radius of the marker is determined with the formula $\log(\text{deaths} + 0.25 \cdot \text{wounded})$

[3] This activity was created by Ying Long, Zachary Segall, Krit Petrachaianan and Shonda Kuiper. Date: 7/25/2015

References:

Barro, R. J. & McCleary, R. M. (2005). Which Countries Have State Religions? The Quarterly Journal of Economics, November 2005, p. 1331-1370. Retrieved from http://scholar.harvard.edu/files/rachelmccleary/files/state_religion.pdf

The Cental Intelligence Agency. (2014) FIELD LISTING :: RELIGIONS Retrieved from https://www.cia.gov/library/publications/resources/the-world-factbook/fields/2122.html#198

Gapminder. (2015). Children per woman (total fertility) [Data file]. Retrieved from http://www.gapminder.org/data/

Gapminder. (2015). Child mortality (0-5 year-olds dying per 1,000 born) [Data file]. Retrieved from http://www.gapminder.org/data/

Gapminder. (2015). Income per person (GDP/capita, PPP$ inflation-adjusted) [Data file]. Retrieved from http://www.gapminder.org/data/

Gapminder. (2014). Life expectancy at birth, with projections [Data file]. Retrieved from http://www.gapminder.org/data/

Gapminder. (2014). Population, total [Data file]. Retrieved from http://www.gapminder.org/data/

Institute for Economics & Peace. (2014). Global Terrorism Index 2014: Measuring and Understanding the Impact of Terrorism. Retrieved from http://www.visionofhumanity.org/sites/default/files/Global%20Terrorism%20Index%20Report%202014_0.pdf

International Labour Organization. Aged 15+ labour force participation rate (%) [Data file]. Retrieved from http://www.gapminder.org/data/

International Labour Organization. Females aged 15+, unemployment rate (%) [Data file]. Retrieved from http://www.gapminder.org/data/

LaFree, G., Dugan, L., & Miller, E. (2015). Putting terrorism in context: Lessons from the Global Terrorism Database. New York, NY: Routledge

National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2013). Global Terrorism Database [Data file]. Retrieved from http://www.start.umd.edu/gtd

Pew Research Center (April 4, 2014). Global Religious Diversity Retrieved from http://www.pewforum.org/2014/04/04/global-religious-diversity/

Smith, B. L., Damphousse, K. R., & Roberts, P. (May 2006). Pre-Incident Indicators of Terrorist Incidents: The Identification of Behavioral, Geographic, and Temporal Patterns of Preparatory Conduct (NIJ Grant 2003-DT-CX-0003). Retrieved from https://www.ncjrs.gov/pdffiles1/nij/grants/214217.pdf

United Nations Development Programme. (2014). 2014 Human Development Statistical Tables Retrieved from http://hdr.undp.org/en/data

United Nations Development Programme. (2014). Human Development Index (HDI) Retrieved from http://hdr.undp.org/en/content/human-development-index-hdi

The World Bank. (2014). Electricity use, per person [Data file]. Retrieved from http://www.gapminder.org/data/

The World Bank. (2015). Military expenditure (% of GDP) [Data file]. Retrieved from http://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS

Wright, L. (2011, May 16). The Double Game: The unintended consequences of American funding in Pakistan. *The New Yorker* Retrieved from http://www.newyorker.com/magazine/2011/05/16/the-double-game