W200 - Project 2 - Aug 2017

GLOBAL TERRORISM 1970-2016

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Dataset:

The Global Terrorism Database (GTD) includes information on >170K cases of terrorist attacks around the world in 1970-2016 period. The database is maintained by researchers at the National Consortium for the Study of Terrorism and Responses to Terrorism (START).

Link:

https://www.kaggle.com/START-UMD/gtd/downloads/gtd.zip

Dataset structure:

The dataset contains ~170k entries with 135 columns, describing:
- time of the attack (“iyear”, “imonth”, “iday”),
- location (“region_txt”, “country_txt”, “city”),
- type of attack (“attacktype1”, “attacktype1_txt”)
- weapon used (“weaptype1”, “weaptype1_txt”, “weapsubtype1”)
- # of victims (“nkill”, “nwound”)
- terrorist group (“gname”)

Additional datasets used:

- COLOW dataset of wars: http://www.conflict-data.org/colow/Data-Download/Chojnacki-et-al_-2009-CoLoW-Replication-Data_xlsx.xlsx
- Dataset of political regimes characterisitcs: http://www.systemicpeace.org/inscr/p4v2016.xls

Introduction:

Throughout the years, global terrorism caused a lot of death and pain across the world. History has been marked with different events that will never be forgotten. Terrorists are becoming more creative and are continuously finding new ways to bypass security and cause maximum amount of casualty. In this project, we will be exploring the "Global Terrorism Database" maintained by the National Consortium for the Study of Terrorism and Responses to Terrorism (START). The data contains 135 different columns and around 170K entries. It dates back to 1970 and covers all documented terrorist activities until 2016.The database itself has been updated by new attributes multiple on separate occasion. All details are shared in the GTD Codebook available online on: https://www.start.umd.edu/gtd/downloads/Codebook.pdf

By exploring the Data we are hoping to get more insights into:

1. Brief overview on terrorist attacks around the world:
    a. The deadliest attacks ever recorded

    b. The increase in terrorist attacks pre/post the arab spring
2. How terrorist attacks have shifted / increased from one region to another
3. Who is the most active terrorist group per period/years?
4. How have terrorist attack types changed with time?
5. Did the attacks become more massive in terms of number of victims in recent years compared to 1970th?
6. How did the terrorist attacks change by target (infrastructure, military, citizen)?
7. Suicide attacks vs. non-suicide
8. The first ever documented suicide jacket attack and how it spread across the world
9. Roots of major terrorist groups: how their emergence is linked to conflicts
10. How terrorism is linked to political instability in countries

Housekeeping:

Before starting our analysis, we would like to perform a quick sanity check on the data of the variables, though the data source is infamous for its high quality, we wouldn't be doing our due diligence if we just accept the data blindly. We will limit our data checking to a limited set of variables that we will be using in our analysis:

- "iyear": The data should begin in 1970 and end in 2016
- "nkill": The number of people killed cannot be negative
- "nwound": The number of people killed cannot be negative
- “”country_txt: The country of attack
- "attacktype1_txt": Attack type - Not to be confused with weapon subtype
- "weapsubtype1_txt": Subtype of weapon used during the attack
- “latitude”, “longitude”: coordinates of the attack. Latitude should be within (-90,90), Longitude within (-180,180)
- “gname”: name of terrorist group

```
Max Year: 2016
Min Year: 1970
Number of kills:
 count    160668.000000
mean          2.387246
std          11.327709
min           0.000000
25%           0.000000
50%           0.000000
75%           2.000000
max        1500.000000
Name: nkill, dtype: float64
```

```
Number of Wounded:
 count    155025.000000
mean          3.200239
std          34.647365
min           0.000000
25%           0.000000
50%           0.000000
75%           2.000000
max        7366.000000
Name: nwound, dtype: float64
```

```
Latitude:
 count    165744.000000
mean         23.399774
std          18.844885
min         -53.154613
25%          11.263580
50%          31.472680
75%          34.744167
max          74.633553
Name: latitude, dtype: float64
```

```
Longitude:
 count    165744.000000
mean         26.350909
std          58.570068
min        -176.176447
25%           2.396199
50%          43.130000
75%          68.451297
max         179.366667
Name: longitude, dtype: float64
```

```
region_txt
 ['Central America & Caribbean' 'North America' 'Southeast Asia'
 'Western Europe' 'East Asia' 'South America' 'Eastern Europe'
 'Sub-Saharan Africa' 'Middle East & North Africa' 'Australasia & Oceania'
 'South Asia' 'Central Asia']

attacktype1_txt
 ['Assassination' 'Hostage Taking (Kidnapping)' 'Bombing/Explosion'
 'Facility/Infrastructure Attack' 'Armed Assault' 'Hijacking' 'Unknown'
 'Unarmed Assault' 'Hostage Taking (Barricade Incident)']

weapsubtype1_txt
 [nan 'Unknown Explosive Type' 'Unknown Gun Type' 'Automatic Weapon'
 'Molotov Cocktail/Petrol Bomb' 'Gasoline or Alcohol'
 'Rifle/Shotgun (non-automatic)' 'Arson/Fire'
 'Projectile (rockets, mortars, RPGs, etc.)' 'Vehicle' 'Dynamite/TNT'
 'Other Explosive Type' 'Pressure Trigger' 'Time Fuse' 'Poisoning'
 'Letter Bomb' 'Handgun' 'Blunt Object' 'Sticky Bomb' 'Grenade'
 'Knife or Other Sharp Object' 'Land Mine' 'Hands, Feet, Fists'
 'Remote Trigger' 'Rope or Other Strangling Device' 'Explosive'
 'Unknown Weapon Type' 'Suffocation'
 'Suicide (carried bodily by human being)' 'Other Gun Type']
```

Next, we want to check completeness of data we use. This table shows the # of empty entries out of total 170K total entries:

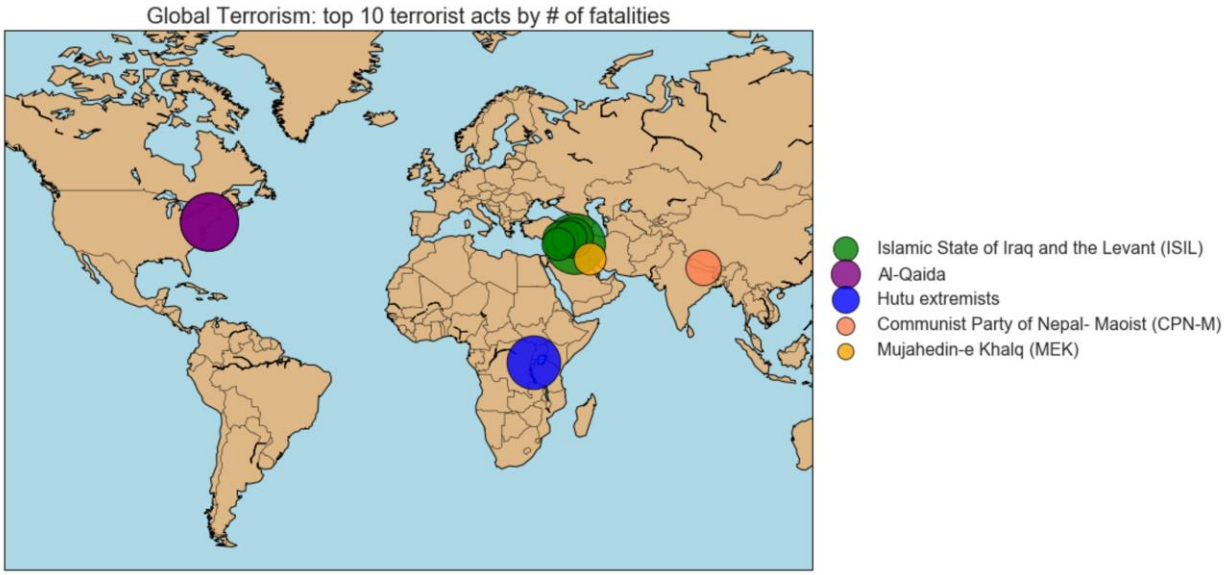
```
iyear : 0
region_txt : 0
country_txt : 0
gname : 0
nkill : 9682
nwound : 15325
attacktype1 : 0
weaptype1_txt : 0
weapsubtype1_txt : 19426
suicide : 0
targtype1_txt : 0
latitude : 4606
longitude : 4606
```

Our biggest concern is that “nkill’ data is incomplete, because we often apply it as metrics. It turns out that ‘nkill’ data as an absolute value is mostly incomplete for beginning-80th and 2014-2016, but as percentage of the total it’s mostly incomplete for early-mid 80th, up to 30% of entries. Therefore, we need to keep in mind that number of killed people in 80th is undervalued.

Brief overview on terrorist attacks around the world:

The deadliest top 10 terrorist attacks are unfortunate events that will forever be engraved in the hearts of many.

Two attacks in 2001 (9/11) carried by Al-Qaida in purple and four in 2014 (Syria & Iraq) by the Islamic State in green represent 6 out of the 10 deadliest attacks ever recorded. The data also shows how extremists are responsible for 9 out of 10 attached, ISIL is responsible for 50% of the 10 most deadly attacks recorded in history.



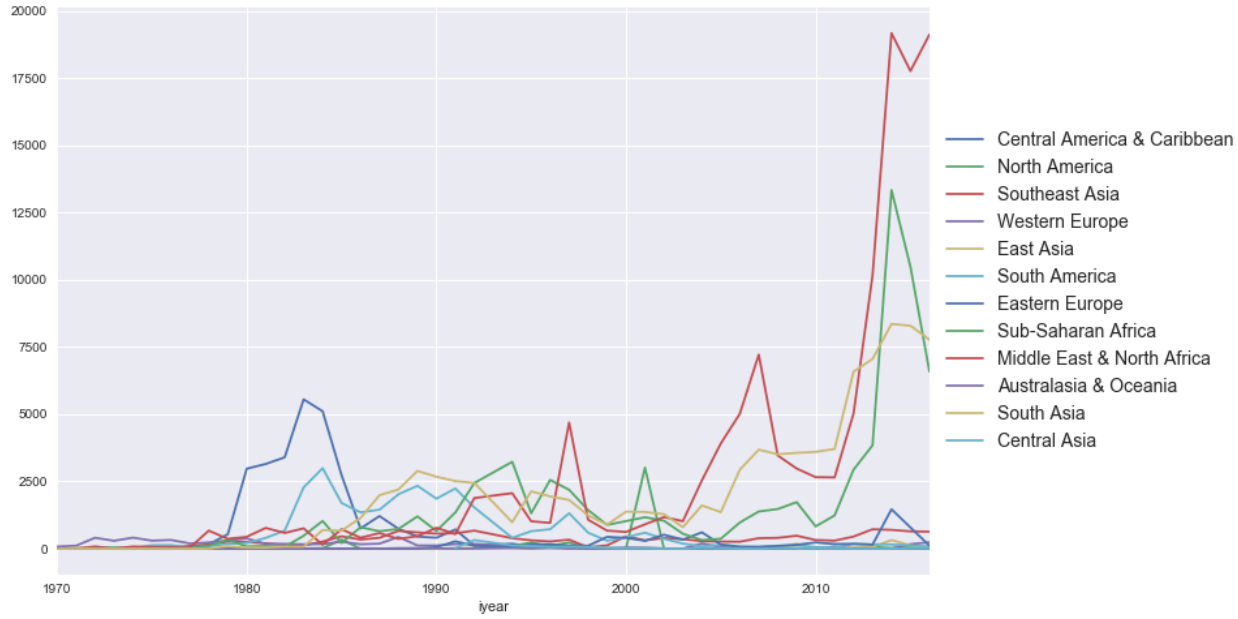
	Terrorist group	Year	Country	# killed
1	Islamic State of Iraq and the Levant (ISIL)	2014	Iraq	1500
2	Al-Qaida	2001	United States	1383
3	Al-Qaida	2001	United States	1382
4	Hutu extremists	1994	Rwanda	1180
5	Islamic State of Iraq and the Levant (ISIL)	2014	Iraq	670
6	Communist Party of Nepal- Maoist (CPN-M)	2004	Nepal	518
7	Islamic State of Iraq and the Levant (ISIL)	2014	Syria	517
8	Islamic State of Iraq and the Levant (ISIL)	2014	Iraq	500
9	Islamic State of Iraq and the Levant (ISIL)	2016	Syria	433
10	Mujahedin-e Khalq (MEK)	1978	Iran	422

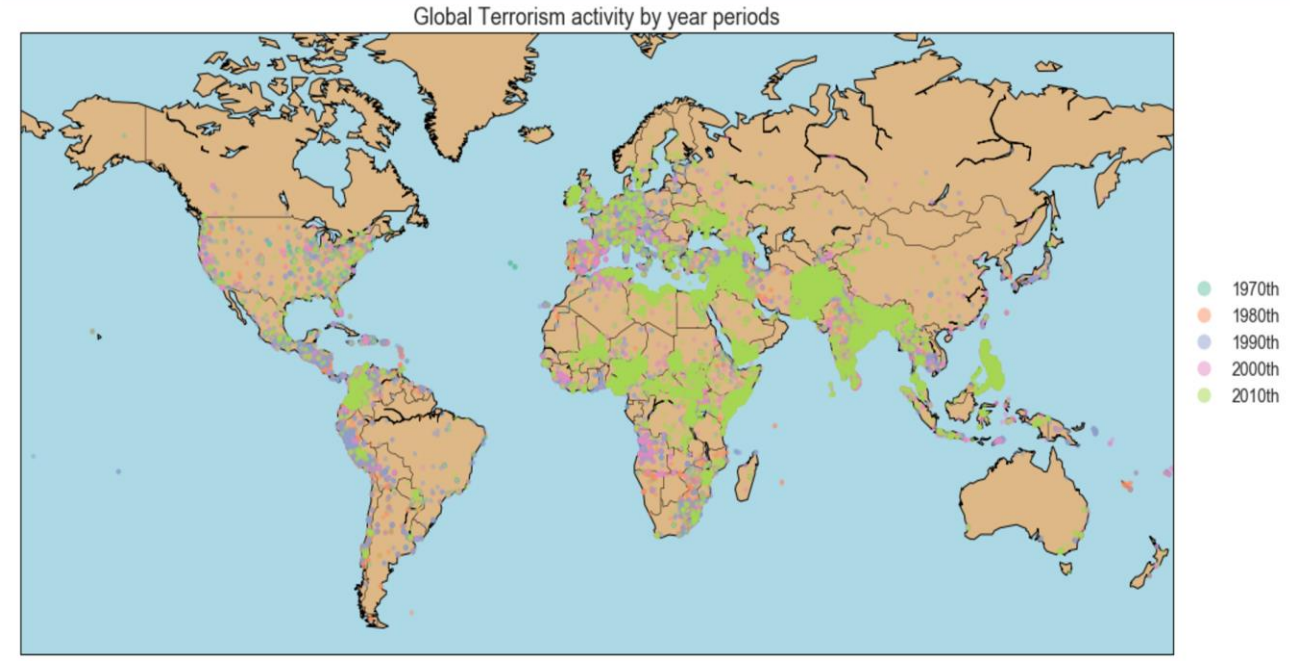
How terrorist attacks have shifted focus from one region to another

From the graph below, we can see how following the "Arab Spring" in 2010 there has been a steep and remarkable spike in the number of terrorist attacks focused in the Middle East.

Combining the graph below with the top 10 deadliest attacks, one can deduce that most people killed around the world by the Islamic Extremists are people from the Middle East with a Muslim majority. In other words, the largest number of death are Muslims killed by Islamic Extremists (Kind of Ironic).

Sub-Saharan Africa is the second highest region which is also saw a steep spike right around the time after the "Arab Spring":

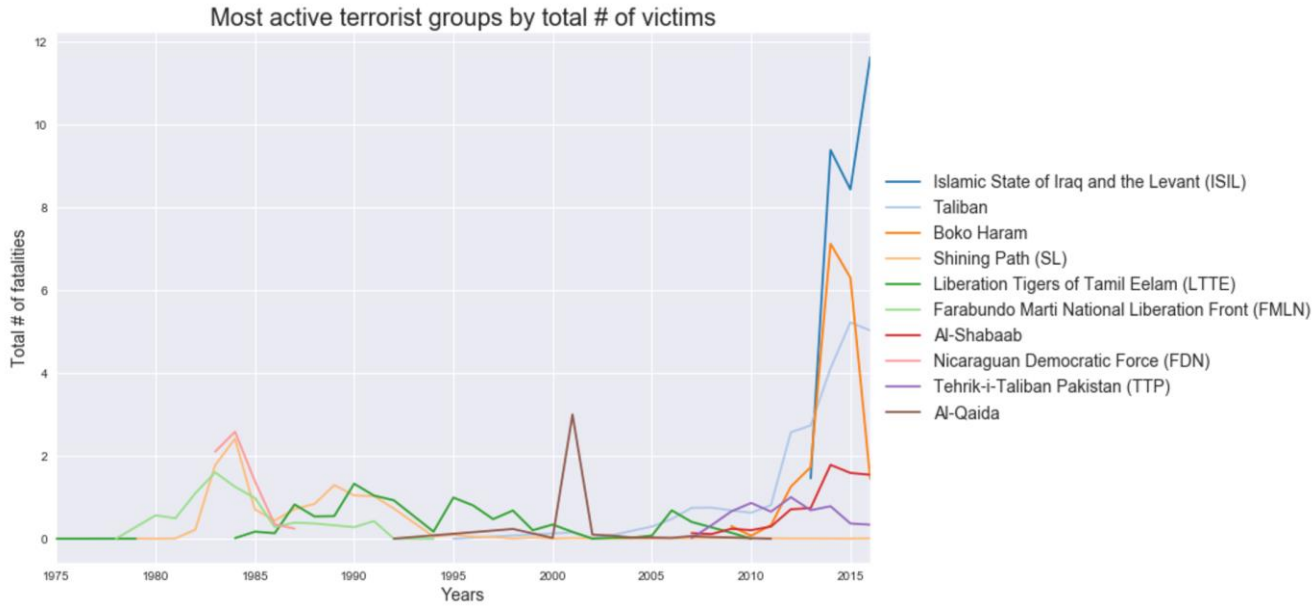




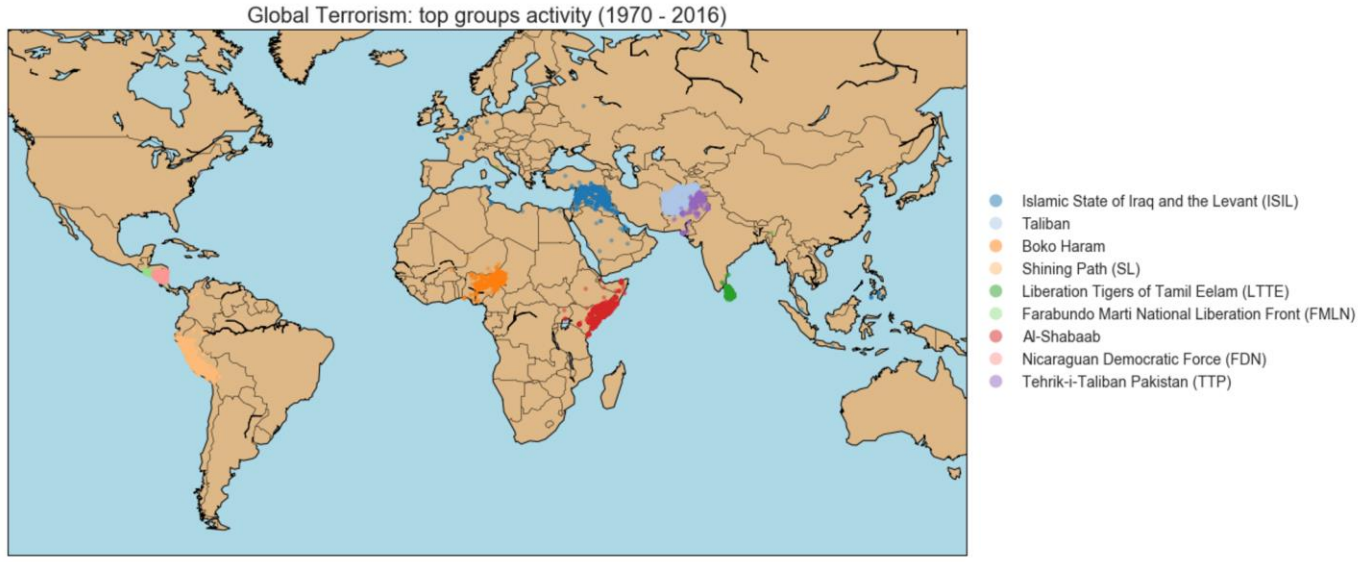
Who is the most active terrorist group per period/years

The Arab Spring has also empowered a lot of new Islamic Extremist Terrorist Groups who have led most terrorist attacks, the graph below shows how the top 3 terrorist groups are all Islamic Extremist with increased activities after the "Arab Spring".

We should remember, however, that 1980th were even bloodier than it appears in the chart since the number of victims is unknown in almost ~1/3 of attacks during this period.



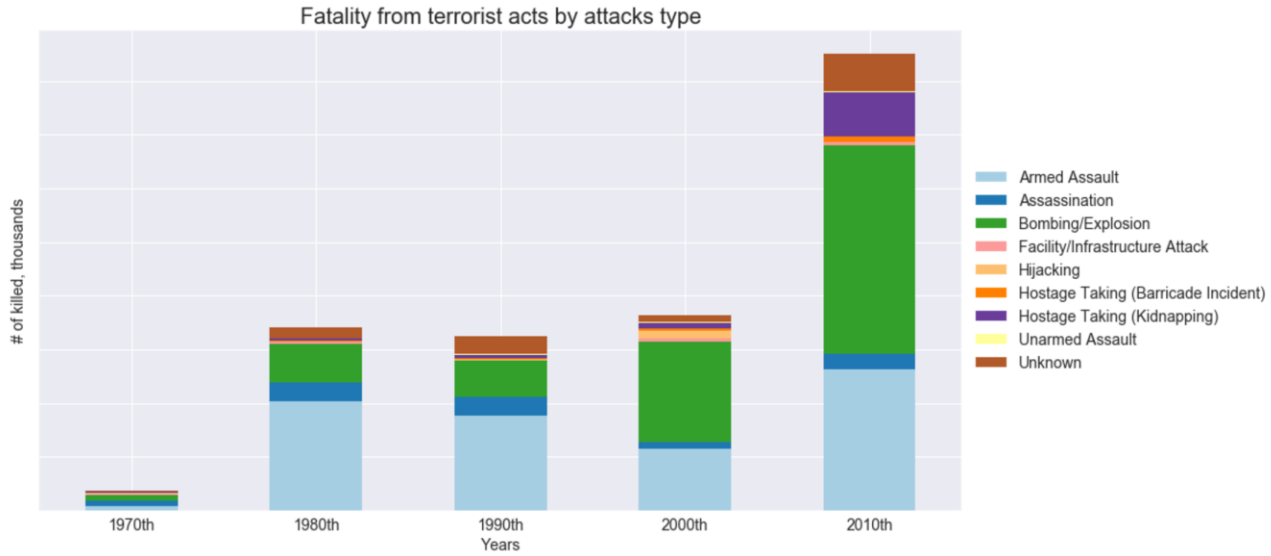
From the map below we see that most of top terror group acts are regionally focused.



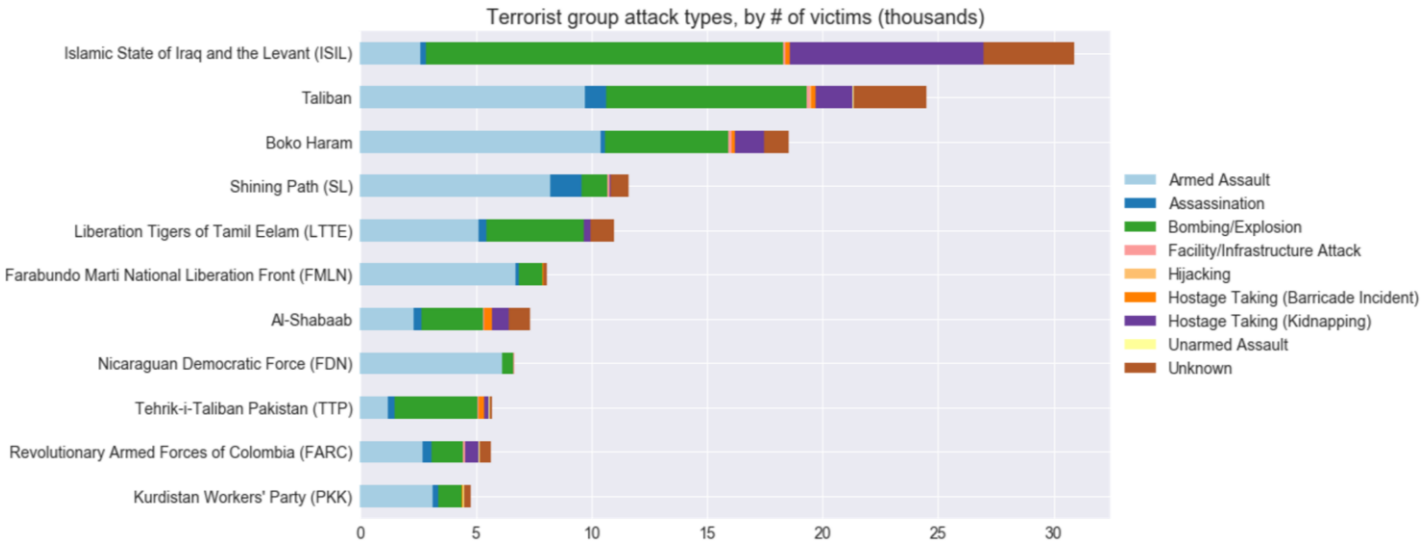
How have terrorist attack types changed with time?

With the creation and increased activity of the top 3 terrorist groups, the deadliest terrorist attack types shifted from "Armed Assault" being the #1 attack type responsible for 47% of all casualties up until end of 2009 to Bombing/Explosion (including suicide) as the #1 attack type adopted by terrorists responsible for 46% of all casualties since 2010

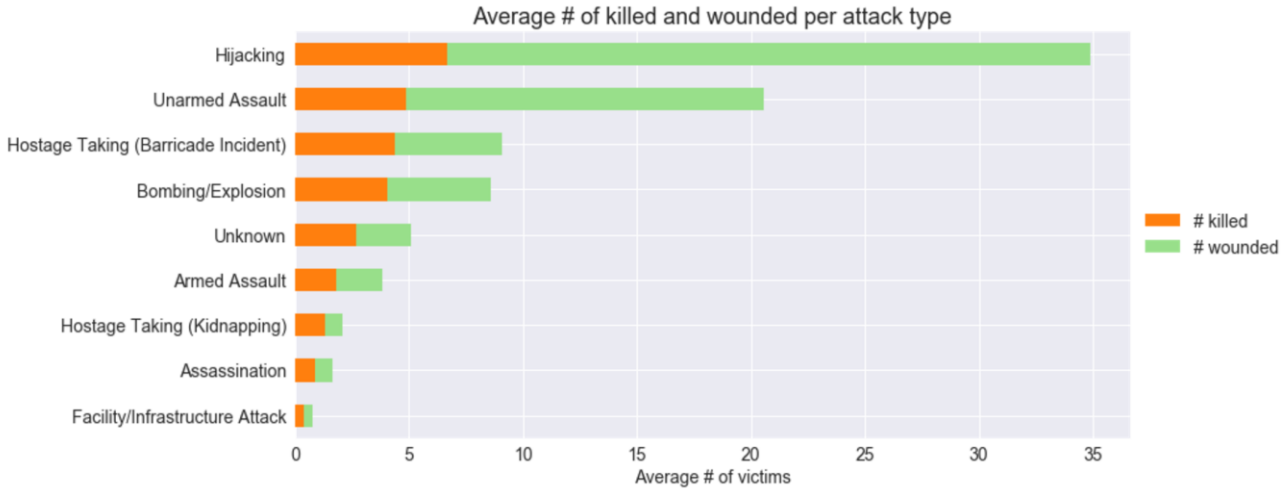
	Pre-2010 Number of Casualties	Pre-2010 % of Casualties	2010 - 2016 Number of Casualties	2010 - 2016 % of Casualties
attacktype1_txt				
Armed Assault	100462.0	47.12%	52669.0	30.92%
Bombing/Explosion	67317.0	31.57%	78009.0	45.80%
Assassination	18582.0	8.71%	5448.0	3.20%
Unknown	14042.0	6.59%	14275.0	8.38%
Hostage Taking (Kidnapping)	4537.0	2.13%	16730.0	9.82%
Hijacking	3562.0	1.67%	123.0	0.07%
Facility/Infrastructure Attack	2515.0	1.18%	961.0	0.56%
Hostage Taking (Barricade Incident)	1537.0	0.72%	1997.0	1.17%
Unarmed Assault	669.0	0.31%	119.0	0.07%



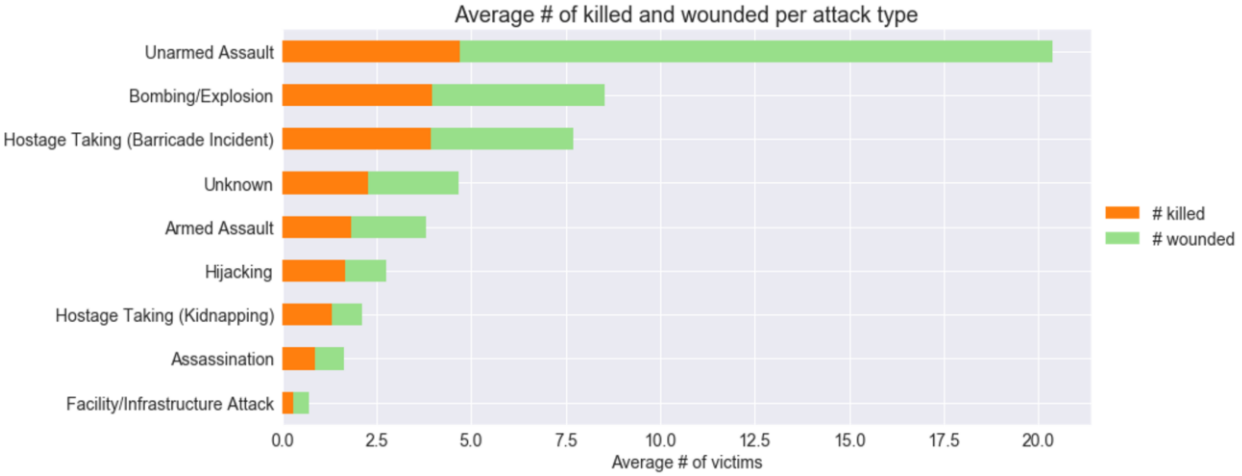
Each terrorist group has adapted a preferred type of attack. We see from below chart that top 3 Islamic terrorist groups apply bombing much more frequently compared to other terrorist groups, especially ISIL. Top terrorist groups of 1980-90th in Central America ("Shining Path", "FMLN", "FDN") rather used armed attacks.



When we look at fatality of attack types, it turns out that hijacking and unarmed attack, even though very uncommon, lead on average to high number of killed and wounded victims than even explosion. The average, is of course, is skewed by 2001/9/11 hijacking attacks.



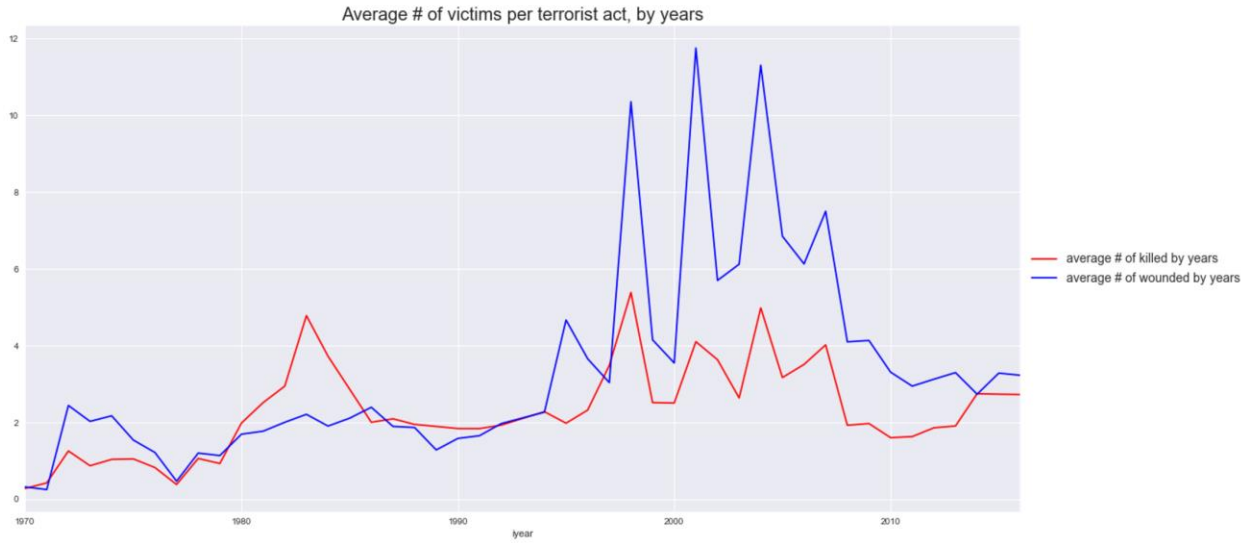
If we remove the top 20 events, including 9/11 attacks, the average of killed+wounded landscape looks different.



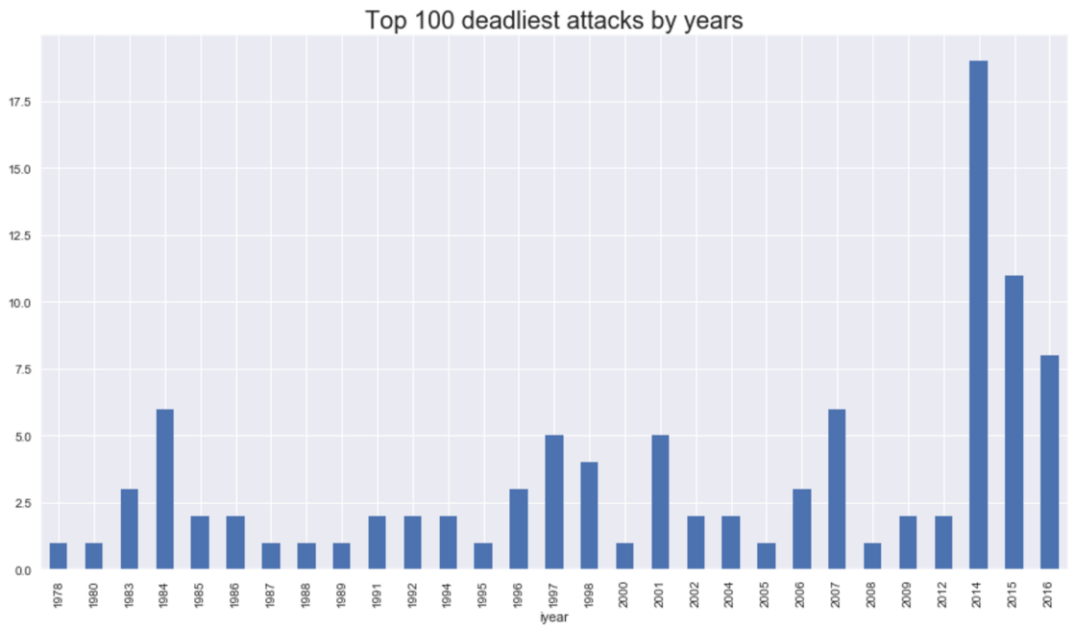
The reason why Unarmed Assault average fatality is so high is because Knives are included, which were used to kill many people during Tutsi genocide and Algerian Civil war, for example.

Did the attacks become more massive in terms of number of victims in recent years compared to 1970th?

Though 2010 to 2016 represent the last 6 years of the last 46 years of data captured, it also represents 45% of the total number of casualties. As we can see from below chart, the average number of victims per attack hasn't really increased, the reason is overall increased # of attacks.

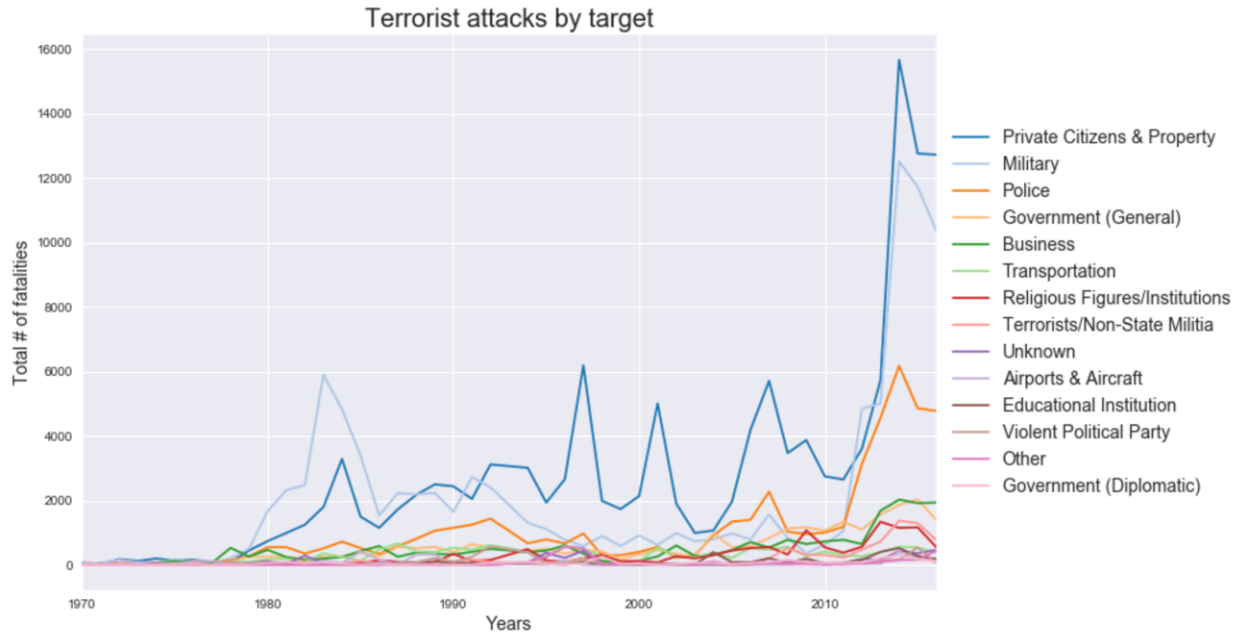


Therefore, as we can see from below chart the number of large attacks is growing. Out of top 100 biggest terrorist attacks throughout 1970-2016, 37 attacks happened just in 3 years of 2014-2016.



How did the terrorist attacks change by target (infrastructure, military, citizen)?

The increase in number of casualties can also be linked to the terrorist increased focused on Private citizens and properties. In the last three decades, since 1990, the graph shows that to create maximum casualty, private citizens and properties is the easiest to target and create maximum damage:

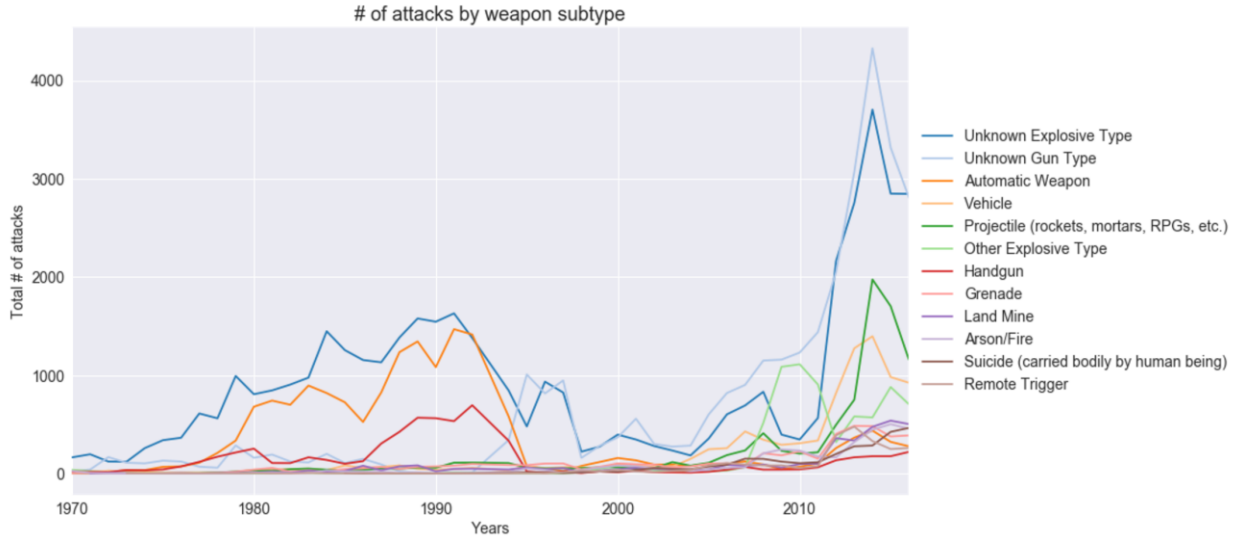


Private citizen and military have been almost constantly the top targets of terrorist groups. In 2010th citizen has become primary target of top 3 Islamic groups. Military attacks were very

common in 1980th during civil wars in Latin America (Nikaragua, El Salvador, Peru), and also now because of Islamic groups. After 2010th police attacks became more common again because of Islamic groups.

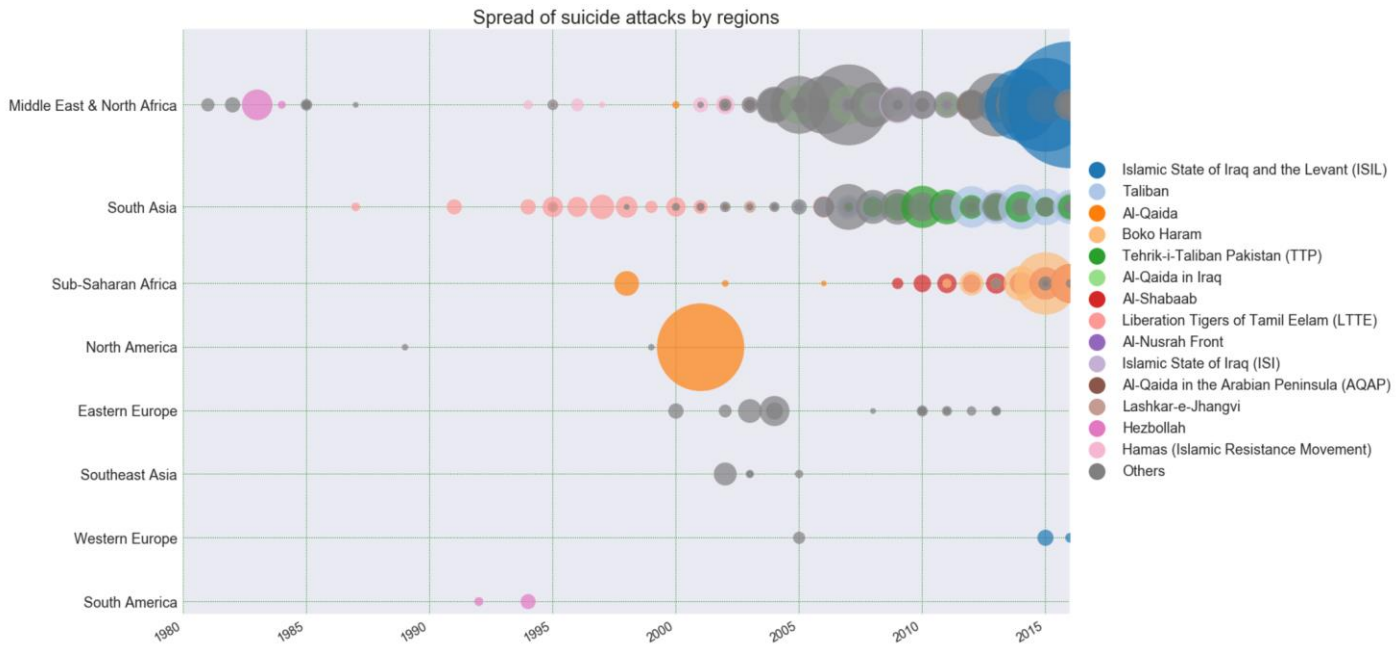
Attacks by weapon applied

To create maximum casualties in Military or Private Citizens and Property as targets, we see an increased number of explosives, projectile weapon and vehicles usage. Automatic weapon and Handgun which used to be the most used weapon during 1980-90th today are quite rarely used by terrorist. We have seen this trend at high level when explored attack types of top terrorist groups. Surprisingly suicide methods only as ranks #10 as the most common method used this could be potentially due to the facts that it may not be as impactful as the rest of the methods and less people are willing to carry out terrorist acts and dying vs. just committing terrorist acts and getting away with it. However, upon further exploration we see definite upward trend.



Development of suicide attacks and how they spread across the world (LTG)

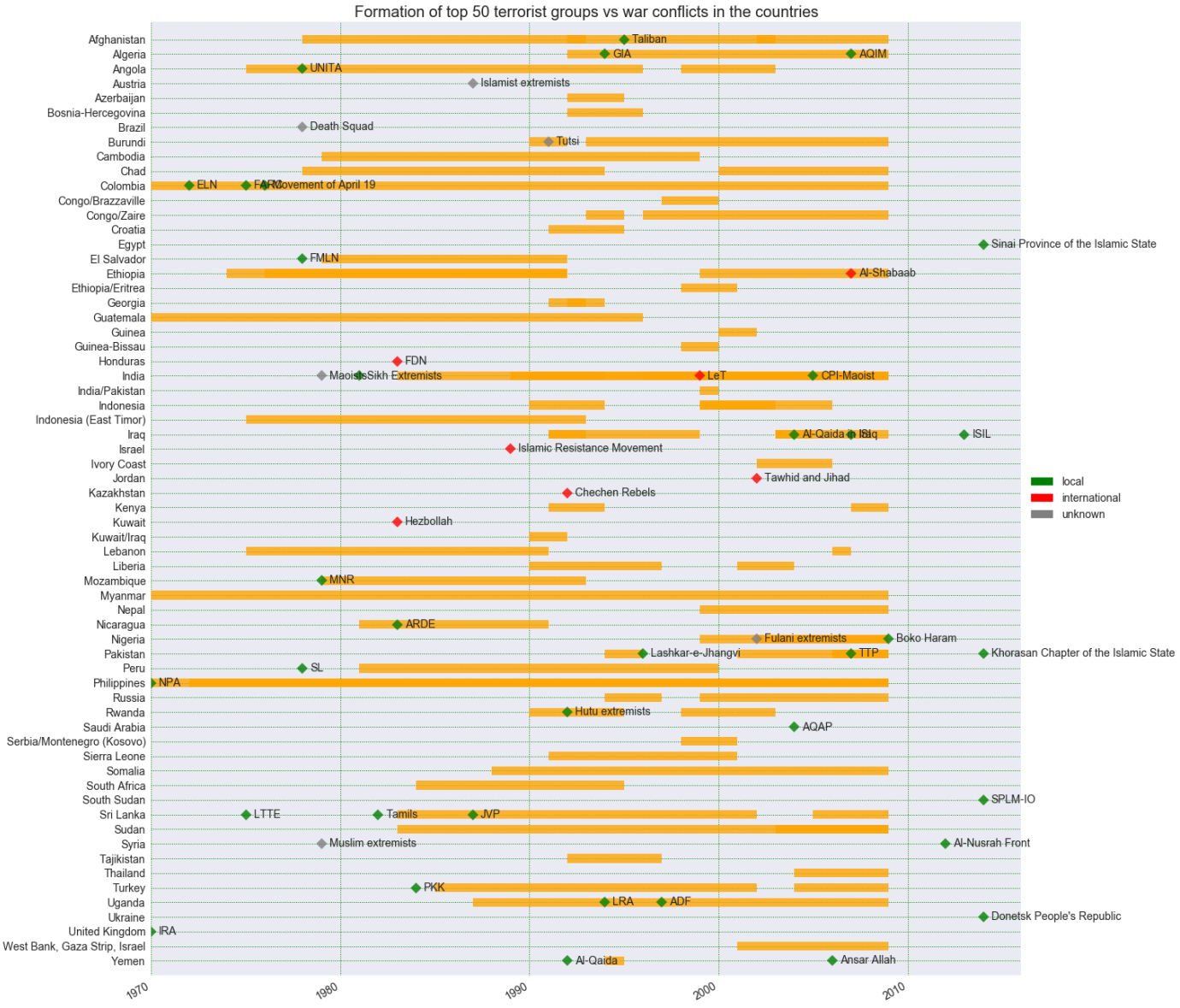
The first big suicide attacks were implemented in the beginning of 1980th by Hezbollah in the Middle East countries. Throughout 1990th they were applied by Liberation Tigers of Tamil in South Asia. But overall, suicide attacks were not common till 2011/9/11 in USA. After that we observe huge increase in suicide attacks, especially in Middle East, South Asia and Sub-Saharan Africa. Mainly executed by ISIL, Taliban and Boko Haram.



Formation of major terrorist groups

Literal research shows that often emergence of terrorism groups is connected to political and wars conflict in countries. To study this relation we have downloaded the Consolidated List of Wars (CoLoW) for the period of 1970-2009.

The resulting chart shows formation of top 50 terrorist groups, by formation we show their first terrorist act by country *the color means whether the terror act was done in their home country – green or abroad – red), and the major war conflicts till 2009 (orange line).



What we see from the above:

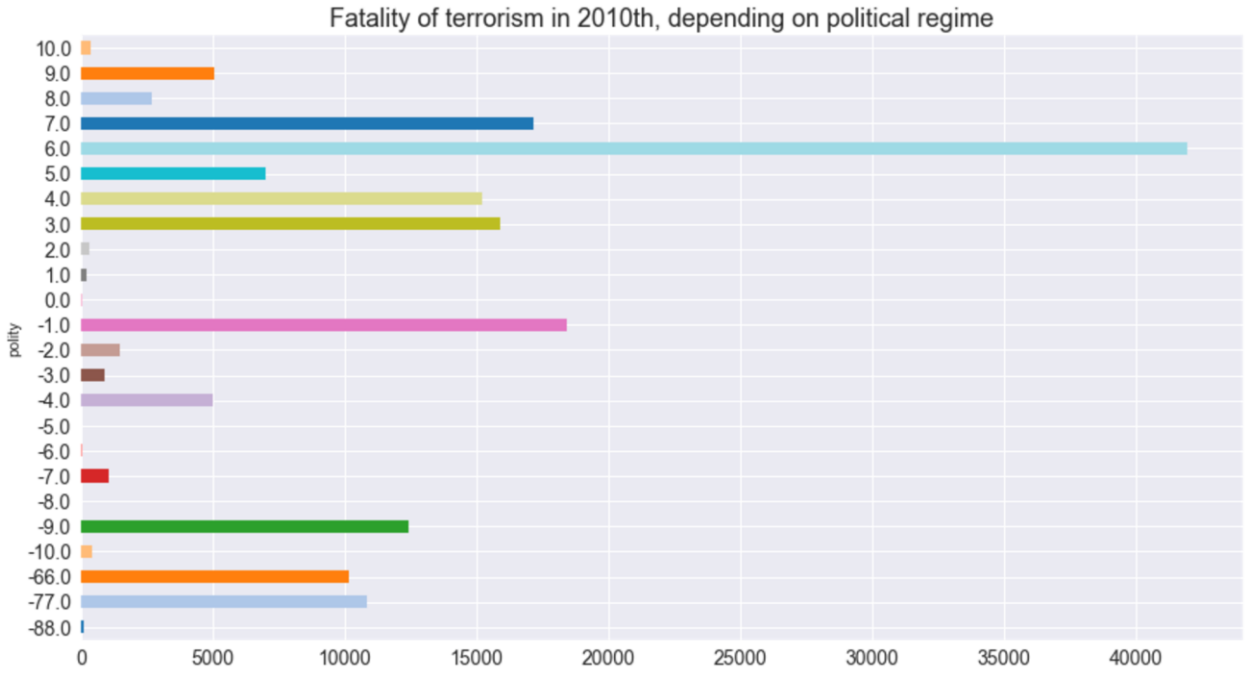
- The majority of terrorist groups started with local terrorist acts (green dots)
- Terrorist groups in many cases either formated as rebellion movement which further led to war (Phillipines, Turkey, India, Peru, Sri Lanka) or during/after long-term conflicts in the country (Afganistan – Taliban, Iraq – Al-Qaida, ISL). We rarely see cases when a big terrorist group emerged in a peaceful country, unless it was an international terrorist act. If the data continued after 2009, we would see that Syria, Ukraine, Egypt terrorist groups also emerged during major war conflicts.

Link between number of terrorist attacks and periods of political instability in countries

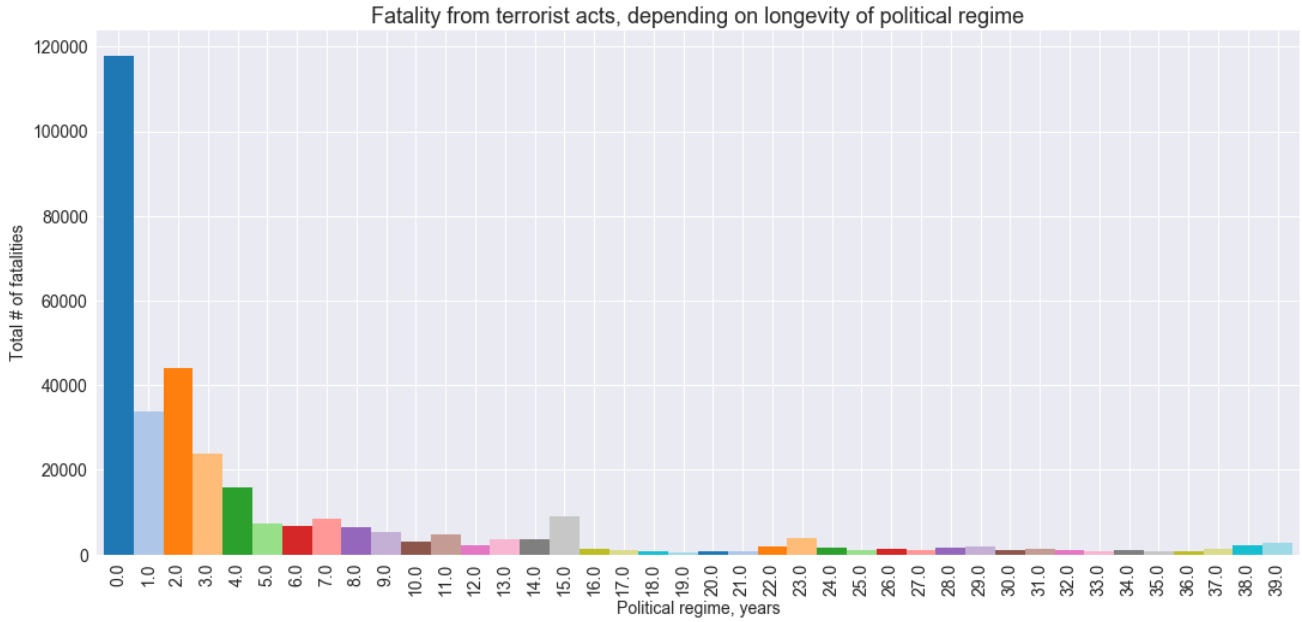
We also wanted to test our hypothesis on whether terrorism activity is linked to certain types of political regimes and periods of political instability and power shift. For this purpose we have

download the database of political regimes “Polity IV Project, Political Regime Characteristics and Transitions, 1800-2016”.

Below chart on fatality from terrorism depending on political regime (-10 totalitarian, +10 democracy) shows that terrorism happens everywhere. Therefore, we havent’ found the link.



However, we found interesting connection between change of political regimes and terrorism. It turns our that the majority of attacks and fatalities occur during the period of power transition, including internal conflicts and foreign invasion. Besides, terrorism activity stays high during the next 4 years after the new power is settled.



Conclusions

1. As our analysis shows, terrorism is highly connected to wars and rarely appears from nothing in a peaceful ground. Major terrorist groups either started as 1) rebellion/guerilla movements in opposition to government which further lead to large civil wars (Tamils in Sri Lanka, most terrorist groups in 1980th-1990th in Latin America, GIA in Algeria) 2) or formed during prolonged military conflicts in the countries (Taliban in Afganistan, ISL in Iraq), that includes foreign military invasions. Therefore, when planning military invasion the risk of huge terror increase and new terrorist groups formation should be considered.

2. Terrorists activity are very concentrated in the primary place of their operations. Contrary to popular belief than Islamic terrorist groups aim at killing non-Muslims, in fact their first victims are Muslim population in the primary location terror: Iraq and Syria for ISIL, Pakistan and Afganistan for Taliban, Nigeria for Boko Haram.

3. Besides wars terrorism is strongly connected to periods of political instability and power shifts (although these might lead to wars in many cases). The more durable political regime, the less terrorist acts we see even for totalitarian and autocratic regimes. We have observed the highest number of terrorism acts during power transitions period

4. Despite terror acts in North America and Europe receive most media attention, the major terror happen in Middle East, Asia and Sub-Saharan Africa. It's amazing that killings of more than thousands people often goes unnoticed in our environment. While analyzing the dataset, we found out executions of hundreds people by Islamic group of which we haven't heard.

5. The methods of terror are evolving. Methods applied now by ISIL (bombing and hijacking) are different from methods in 1980-1990th (knives and guns). The upward trends on certain type of attacks, including emerging ones (including use of vehicles and suicide attacks) should be tracked to develop preventive measures.