COMP5048 VISUAL ANALYTICS 2018

Assignment 2 - Report 2

Global Terrorism

Group Member

Chen Cui	470109940
Greg Van Wyk	480089591
Hugh Purnell	310181941
Melissa Tan	200249191
Terry Meng	470536180
Zhizhi Chai	470259267

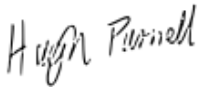
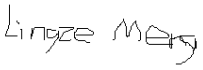
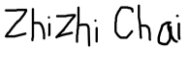
THE UNIVERSITY OF SYDNEY

Assignment Cover sheet – GROUP ASSIGNMENT

Please fill in your details below. Use one form for each group assignment.

Personal Details of Students

Group Name/Number : **13**

Family Name	Given Name	Student No (SID)	Unikey	Contribution + percentage	Signature
Chen	Cui	470109940	ccui8093	Daft visualization and manage files storage. ~ 16.7%	
Van Wyk	Greg	480089591	gvan0627	Planning and Ideation. Generation of "Geographic" visualisations in dashboard. Editorial contributions to report. ~ 16.7%	
Purnell	Hugh	310181941	hpur4163	Preprocessing and generation of US administration column in python. Preprocessing section of report. Generation of vis 1-3 data. Generation of terrorist organisation GraphML network file. Draft visualisation and report documentation of GraphML network. ~ 16.7%	
Tan	Melissa	200249191	mtan2988	Prototype visualisation 1, planning & organisation, prepare powerpoint slide and initial draft, report copywriting on visualisation, implementation and evaluation section ~ 16.7%	
Meng	Terry (Lingze)	470536180	lmen7613	Draft report Writing of all sections except preprocessing and planning ~ 16.7%	
Chai	Zhizhi	470259267	zcha3804	Prototype visualization 1. Ideas implementation. Generation of word cloud visualization. Generation of animation visualization. Description of visualization implementation ~ 16.7%	

Assignment Details:

Assignment Title		Global Terrorism			
Assignment number		2			
Unit of Study Tutor		**Tutor** : Students **Supraja Sridharan** : ZhiZhi Chai & Terry Meng **Marnijati Torkel** : Cui Chen & Hugh Purnell & Greg van Wyk **Jingming Hu :** Melissa Tan			
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Introduction

Data set

The Global Terrorism Database was selected for this project because of its wide range of variables that could be used to derive interesting and meaningful visualisations. The following terrorist dataset description was downloaded from the Kaggle website (START Consortium, 2018)

"The Global Terrorism Database (GTD) is an open-source database including information on terrorist attacks around the world from 1970 through 2016 (with annual updates planned for the future). 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 170,000 cases. The database is maintained by researchers at the National Consortium for the Study of Terrorism and Responses to Terrorism (START), headquartered at the University of Maryland."

The dataset contains 135 columns and over 170k rows of records describing each terrorist attack recorded over the decades. This includes, for example, information on damages caused (both in terms of casualties and financial losses), type of attack, lists of weapons used, location and date of incident, organisations and people responsible. It also contains commentaries, narration on the consequences, source of information and related titles of media articles. In cases of complex coordinated attacks, the data also provides a reference link to the related events.

Tasks

The group decided to approach the project from a high-level overview that formed the first part of the visualization with the aim of identifying possible patterns and trends. The following tasks were identified and addressed by visualisations from the dataset.

Tasks	Description
Detect Temporal Pattern/ Outlier	1. Detect changes in patterns over the decades on : ● Incidence of terrorist attacks (attack vs suicide) ● Types of attacks ● Choice of weapons
Detect Clusters /	2. Temporal analysis to show countries with repeated (clusters of) attacks

Groups / Relations	3. Advanced analysis to detect clusters and 'social' networks between different terrorist organisations
Advanced Correlations	4. Test hypotheses on relationships between property damage, suicide and US administrations.

Aims and Contributions

Aims

To answer the task questions described above using informative, easy-to-understand and aesthetically pleasing visualisations created from the data within the terrorism database.

To discover any hidden or unexpected patterns within the terrorism database, either directly from the individual visualisations or from the links observed between visualisations.

Contributions

The range of visualisations generated in this assignment tell a compelling and concise story of the evolution of global terrorism over the last 47 years. It also shows some hidden trends and patterns within the recorded incidents and unexpected relationships between different terrorist attacks for readers of the report and provide answers to several specific terrorism related questions.

Design and Implementation

Analysis & Visualisation

The analyses conducted for each of the tasks are given in the visualisations below. The first set of visualisations are added to a dashboard given below. The analysis and evaluation of each individual picture is given in the next section.

Visualisation 1

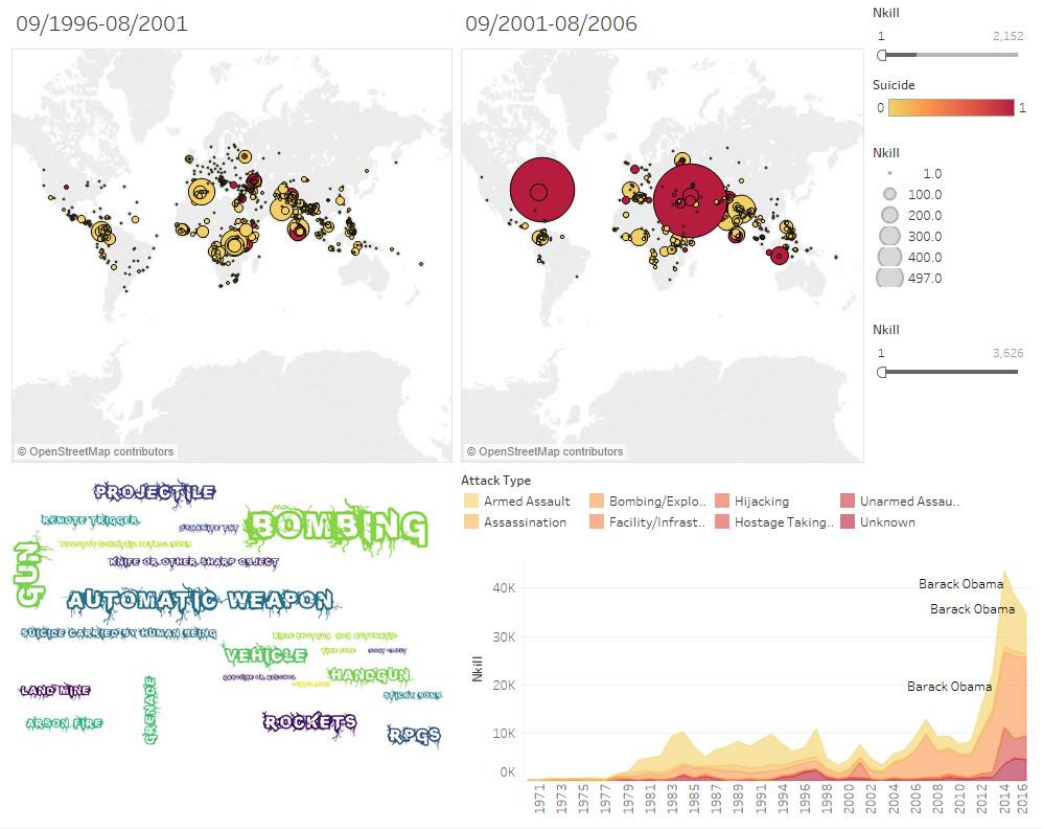

Figure 1 : High level overview of the terrorist attacks

This visualisation aims to identify the temporal patterns for the variables in Task 1 as well as the relative importance of each value in the variables. Figure 1 shows all deadly terrorist attacks, by location, with the size of the bubble depicting the number of fatalities and the red vs yellow colour depicting whether any of the attackers suicided in the process. The top left graph shows the five years leading up to 9/11 and top right graph shows the five years immediately following 9/11. It is striking to see how the method of attack shifted to the inclusion of suicide as a key element in many attacks after 9/11; how the deadliness of attacks increased and also how the concentration of attacks diminished in the Americas, whilst increasing in the middle-east.

Visualisation 2

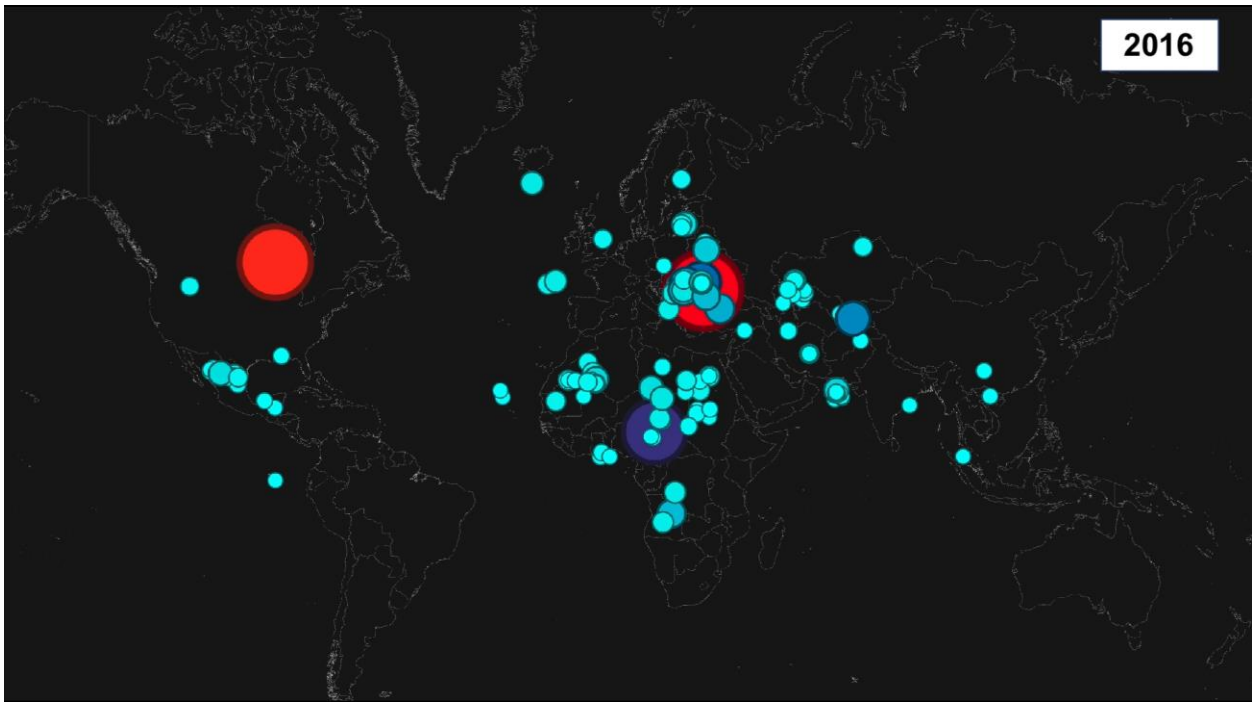

Figure 2 : Animated geospatial analysis of attacks over the decade

This visualisation aims to detect geospatially clustered attacks outlined in Task 2. This animated visualization shows severe terrorist attacks (> 100 fatalities) plotted geographically over the 4 decades time frame. At the same time, through its dynamic effects, it can also explain the frequency of terrorist attacks over periods. The animation shows the time lapse of attacks at two-year intervals at known terrorist attack locations. Each node represents a terrorist attack site with at least 100 deaths. Color and size indicates the extent of the deaths tools with red used for the deadliest attacks and cyan (light blue) the lowest.

Visualisation 3

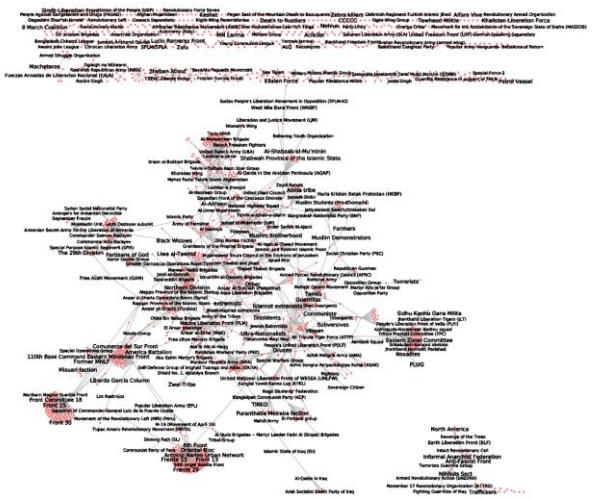

Figure 3a: Social Network analysis rendered using Frutcherman Reingold (OGDF) algorithm

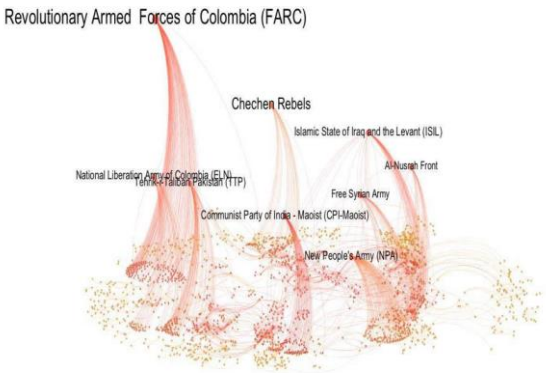

Figure 3b: Social Network analysis rendered using Yifan Hu with network splitter API

This visualisation aims to detect network relations outlined in Task 3 using vertex-edge visualisations. The vertices are the various terrorist organisations or factions and the vertices are the links between them. The relationship is constructed by linking the perpetrator group to its subfactions and is further extended to other groups and subfactions that are associated with the respective event by the “related events” field. Using the perpetrators’ group names and ranking the count of relationship, the above graphs compare two different algorithms drawn from the same data to show the intricate network between terrorists groups. See Implementation section for the detailed algorithm.

Visualisation 4

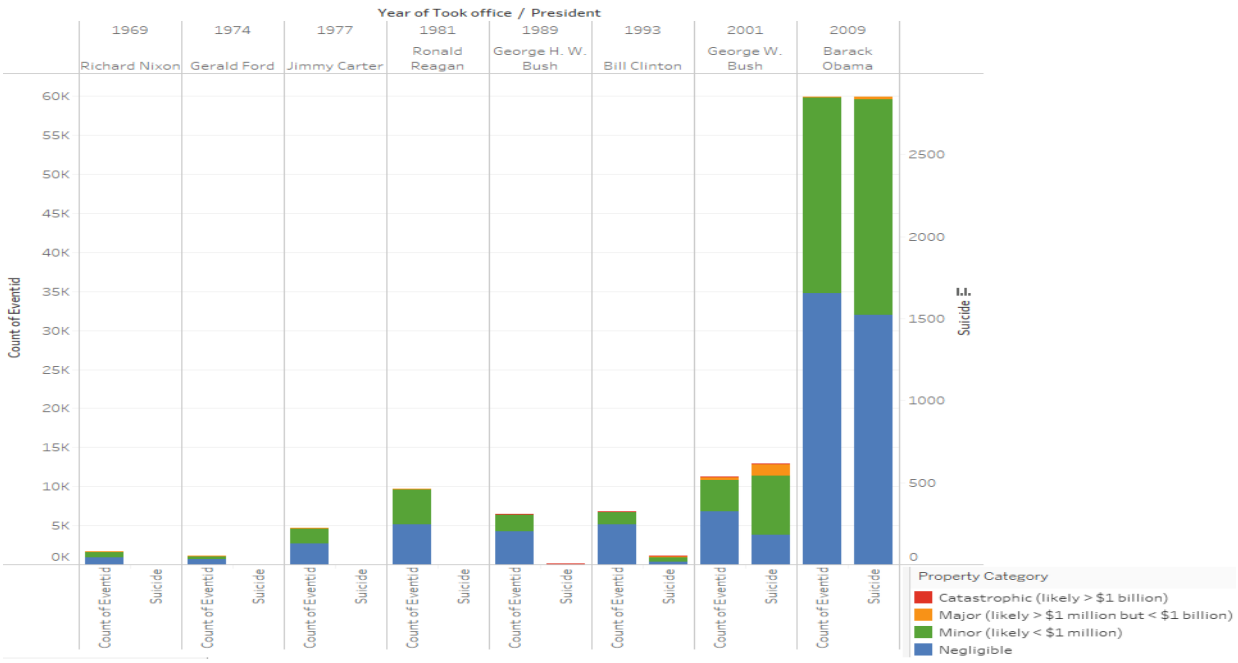

Figure 4: Damages Analysis

This visualisation aims to address the advance analysis outlined in Task 4 between property damage, suicide attacks and different US presidents. The double stacked bar chart shows the very uneven distribution of terrorism incidents and suicide attacks within different US administrations. The overall number of attacks are shown by the first bar within each presidency whilst suicide attacks are shown by the second bar within each presidency. The colour sections within each bar represents the severity of the property damage caused ranging from negligible (blue) to catastrophic (red).

Implementation

Pre-processing of the dataset used in all visualisations involved extraction of fields-of-interest, such as eventid, start_date, end_date, gname, subname, latitude and longitude using python and applicable libraries such as pandas and csv. After creating the visualisations it is also necessary to refine the visualisations to improve their aesthetics and effectiveness in answering the task questions. This involves adjusting the different parameters and settings either through program codes or using the menu interface. Sometimes it also requires a change in the software used for the visualisation if the initial software is shown to be ineffective.

Visualisation 1 - Data was imported from csv into Tableau, which was selected due to its flexibility in creating many different types of graphs and in the case of geographic visualisations, rendering them vividly. The ease of use of Tableau enabled us to answer the questions we posed during this project. It also enabled us to rapidly iterate visualisations, which facilitated subsequent enquiries. This is particularly the case for, which render beautifully in Tableau. A word cloud picture is created by using python and some libraries such as jieba, wordcloud, matplotlib, scipy, numpy, pandas to clearly show the usage frequency of various weapon types in all attacks.

Visualisation 2 - Created using Gephi, Python, Tableau and Quicktime. Then, we use the Tableau prep to clean the dirty data and use the Gephi to show it dynamically. The timeline in Gephi was created using the interval between start_date field and end_date field. At the same time, we called the Geo layout APIs and Map of countries APIs to locate each point and outline the world map respectively. After fine tuning parameters in the animation, we used Quicktime to record it.

Visualisation 3 - Visualisation 3a and b are created from a GraphML network file containing node & edge information which represents the direct and indirect relationships between terrorist organisations. This graph data is generated from the GTD event information in two phases: group and subgroup networks (direct relationship), and secondly the "related events" field each event carries (a more indirect relationship). A rough pseudo-code algorithm to generate this graph is as follows:

1. Def Graph G, undirected
2. Def Set R, this contains (unordered) pairs of related events.
3. For each event e:
    For each gnamek: Add node gnamek to graph G if it doesn't already exist.
    For each gsubnamek: Add node gsubnamek to graph G if it doesn't already exist.
4. For each event e:
    1. Add a edge to G for each gnamek and gsubnamek pair belonging to e if both exist. (gnamek, gsubnamek)
    2. For each gsubnamek and gsubnamej belonging to e where k is not equal to j, add a (gsubnamek gsubnamej) edge to G. If either gsubnamej or gsubnamek is not defined, use gnamej/k correspondingly instead.
    3. For each event r in related field of e:
        Add (e, r) to R
5. For each (e,r) pair in R:
    For each gnamej in e:

For each gnamek in r:

If gsubnamej is not defined in e:

let u = gnamej

Else: let u = gsubnamej

If gsubnamek is not defined in r:

let v = gnamek

Else: let v = gsubnamek

Add edge (u, v) to G.

The graph data structure was implemented in Python with the following:

In [4]:
```
nodes = dict()
node_name_id_map = dict()
node_guid = 0
def addnode(name):
    global node_guid
    if name is None:
        return
    if name in nodes:
        return
    node_id = node_guid
    node = {"id": node_id, "name": name}
    nodes[node_id] = node
    node_name_id_map[name] = node_id
    node_guid = node_guid + 1
    return node_id

edges = dict()
def addedge(name1, name2):
    if name1 is None:
        return
    if name2 is None:
        return
    if name1 == name2:
        return
    if name1 not in node_name_id_map:
        addnode(name1)
    if name2 not in node_name_id_map:
        addnode(name2)

    u = node_name_id_map[name1]
    v = node_name_id_map[name2]

    key = tuple(sorted([u, v]))
    if key not in edges:
        edges[key] = { "count": 1 }
    else:
        edges[key]["count"] += 1
```

This algorithm was implemented in Python3 / Jupyer Notebook and was used to generate a GraphML file by the NetworkX library:

In [10]:
```
import networkx as nx
G = nx.Graph()

for id in nodes.keys():
    node = nodes[id]
    G.add_node(id, label=node["name"])

for key in edges.keys():
    edge = edges[key]
    G.add_edge(key[0], key[1], count=edge["count"])

nx.write_graphml(G, "globalterrorismdb.graphml")
```

Figure 3a was created using Tulip and rendered using the Frutcherman Reingold (OGDF) algorithm. This layout uses the force-directed algorithm which positions the nodes in a 2D

or 3D space such that the edges are of more or less equal length and using their relative positions, forces are assigned between the nodes and edges to simulate the motion of the edges and nodes with the purpose of reducing edge crossings. However, as the nodes count increases, the visualisation becomes cluttered.

Figure 3b was created using Gephi and rendered using Yifan Hu with network splitter API. Similar to the Force Atlas, Yifan Hu's algorithm computes the layout of the network by optimizing the overall internode repulsions but it only considers the pair of adjacent nodes for the computation of forces which makes its computation faster. After splitting the nodes with the optimal distance by YIfang Hu, selecting the Network Splitter 3D to layer all nodes in the 0 z-layer, the splitted z-layer has been regarded as the attributes from a numeric node column in Gephi data laboratory. Simply run the degree metric in statistics, which uses the degrees of each node to generate later z-clusters. In the Gephi data laboratory, select the nodes tab and duplicate the degree column, it needs to append a [Z] tag in the copied column name in order to generate z-clusters by degree values.

Network splitter 3D is used to split all nodes in the 0 z-layer into double layers, based on the generated z-clusters after setting 2 z-maximum level in the property of Network splitter 3D. The degree value determines z-clusters, splitting the nodes of higher relative organizations from the 0 z-layers with the z-maximum factor set to 13. This setup enabled the higher ranked terrorist groups to be projected to a different layer thus emphasising their prominence in the network of terrorist groups.

Visualisation 4 - The double stacked bar graph was created in Tableau due to its ease at creating the graph in the specified format, namely comparing the number of attacks and suicide attacks side-by-side for each US presidency whilst also splitting the attacks by property damage. A hypothesis test on the relationship between the suicide status of the attacks and property damage caused in the attacks (measured using an ordinal, discrete variable) was conducted using a limited set of features within the statistical software SAS.

A relationship exists between them if the distribution of one variable changes when the level (or value) of the other variable changes. A frequency table that shows the number of attacks in each property damage category for both suicidal and non-suicidal attacks is generated using the statistical software called SAS. Each cell within the table represents a different suicide attack status and property damage combination. Note the expected value within each cell represents the number of attacks that should occur if suicide status and property damage are statistically independent of one another.

Evaluation

Results and Discussion

Visualisation 1 - Each of the visualisations selected in the dashboard is evaluated for its effectiveness in answering the task question posed. The two map visualisations on the top section of the dashboard are designed to answer the following questions:

-Which countries have seen the greatest number of people killed due to terrorism?

-Have there been changes in the incidence of terrorist attacks and people killed over time?

-Which countries have the largest number of terrorist attacks?

The main type of attacks causing death were dominated in the early years of the GTD by armed assaults. This evolved during 1990s, with bombings and explosions growing in frequency to become a distinct second method overall. From the map visualisations it can be shown that the September 11 attacks represent a natural delineating point in the nature global terrorist attacks. In 2001, there is a huge one-off spike in the number of deaths due to hijacking, which occurred as a result of the September 11 attacks. This spike was so large that the death toll was almost equal to that from armed assaults for the whole of 2001. However, in the post September 11 world, bombing became the most prevalent method of attack causing death, mainly due to the attacks happening within the Middle East region. There was also been a resurgence in the number of deaths caused by armed assaults in the last two years of the Obama administration, but not quite to the level of deaths caused by bombings. Attacks and number of deaths within the Middle East region have increased sharply over the same period after the September 11 attacks compared with before. This is most likely caused by the re-ignition of American interventionist policies in the region as a result of the declaration of the “war on terror”. On the other hand, number of deaths in certain European terrorism hot-spots, such as Northern Ireland and the Balkans, have decreased after September 11 as those regions became more peaceful. In central Africa, Rwanda has become more peaceful after September 11 as a result of leaving its devastating civil war behind while Uganda has become less peaceful. Finally certain countries that have a turbulent and volatile history like Colombia, Pakistan, India, Sri Lanka and Algeria have seen a relatively constant level of attacks and deaths.

The word cloud is designed to answer the following question:
-What weapons are used in attacks?

It can be seen that each word cloud represents a separate category of weapon and the size of the word clouds indicates the number of attacks that occurred with each type of

weapon. Therefore the bigger the cloud size, the more attacks occurred under that type of weapon.

From the word cloud, it can be seen that bombing, automatic weapon and guns are the biggest offenders.

The time series area chart is designed to answer the following task question:

-Have the different types of terrorist attacks been changing over time?

Findings: Terrorism attacks, in particular suicidal attacks and bombings, increased sharply in the aftermath of September 11. We hypothesize that terrorists learn from the successes of other terrorists by replicating successful 'new' methods of attack. This learning may well be enhanced by the significant networking between organisations that is elucidated in Visualisation 3.

Visualisation 2 - The animation shows attacks are concentrated in North Africa, Middle East and the Caucasus region due to the respective wars that occurred within those regions. There is also a sizeable portion of attacks within Central America in the earlier period of the database. The most serious incidents, such as the September 11 attack, could be easily seen pre-attentively due to their red colour and the information is presented on a map, a format that is familiar and easily understandable to most viewers.

However, due to the time constraints present on the animations it was not possible to show the details of each attack. In addition, the standard map format could misrepresent the distance between the location of terrorist attacks due to the fact that the world is a sphere rather than a rectangle.

Visualisation 3 - Several well-known organisations such as FARC and Chechen Rebels have connections to other terrorist organisations. Shared ideology between groups is not a necessary condition (e.g. FARC↔Islamic terrorist groups) for a relationship to exist. This is particularly prominent in visualisation 3b, where organisations with many connections are elevated and emphasised.

The majority of organisations are the value of "unknown or null", which does not be included in this visualization because of no contribution into relationship network analysis. However, the connection between unknown and well-known organisations could deserve the further network analysis.

The figure 3b emphasises and reveals the well connected organisations instead of the overall network. On the contrary, the figure 3a exactly reflects the connection of various organisation as the other main insight into network graphs.

Visualisation 4 - Suicides as a proportion of total attacks were negligible until the presidency of George W. Bush. Afterwards it became a noticeable contributing factor to the attacks overall.

The overall number of attacks within each presidency has moved in a cyclic format between Reagan and George W Bush. However, within the Obama administration, the number of total attacks increased by five-fold showing the clear and undeniable increase in the number of terrorist attacks during recent years.

It can be seen that the differences in property damage caused by the terrorist attacks between different administrations are negligible, since the number of attacks labelled in red and orange, as compared to green and blue, are very small regardless of the presidency in question.

Finding: Null hypothesis rejected. Under later US administrations the relative percentage of suicide attacks and property damage caused increased sharply. The attack frequency increased as well but the property damage per attack remained relatively constant.

Within the chi-squared test conducted in SAS, the cell chi-square value represents the contribution of that particular cell to the overall test statistic for the null hypothesis test that there is no association between the suicide status and property damage. If there is no relationship the test statistic should be a chi-squared distribution with a degree of freedom of 1. The higher the value the greater the overall test statistic value (which is the sum of all cell chi-square values - see appendix for more details) and more likely the null hypothesis is rejected. In fact, the p-value for this null hypothesis test using a Mantel-Haenszel Chi-Square test with a chi-squared test statistic of 1 degree of freedom is less than 0.01% meaning that if the null hypothesis is true there is less than 0.01% chance that the test statistic will be as extreme as or more than that calculated in the test statistic. Therefore the null hypothesis is rejected and we conclude there is a relationship between suicidal attacks and property damage caused.

Quantitative Evaluation

Figure 3a uses force directed algorithm to reduce edge crossing. However, this method alone may not be be ideal for large graphs. As illustrated in Figure 3a, the most prominent perpetrator is not easily identifiable compared to Figure 3b which uses 3D to enhance the dimensionality of the visualisation.

Crossings: Unfortunately Visualisation 3a have large number of crossings between the different edges when they are linked to the different vertices (organisations) due to the need to illustrate the extensive relationships between them. This makes it harder to follow the edge connections between the vertices. To alleviate this issue, in visualisation 3b vertices with higher edges are elevated to distinguish them from other vertices.

Area: The graphs are drawn in regular squares or rectangles with relatively low aspect ratio so they are well-drawn by this criteria.

Aspect Ratio: Due to the relatively equal width and length of visualisation 3 they have decent aspect ratios, meaning they allow extensive relationships between different terrorist organisations to be examined in a compact space and effectively clusters organisations that are related to one another.

Angular resolution: Most of the angles made between different edges are relatively high which makes viewing the different edges easier

Qualitative Evaluation

For the visualisations that cannot be quantitatively evaluated (1,2,4), we would ideally have conducted surveys or designed empirical research to assess the usability of our visualisations subjected to ethics approval, but within the various constraints of this assignment the most practical solution for assessment is a modified version of analytic inspection. This modification involves the team taking on the role of 'experts' and performing Heuristic evaluations of each visualisation using Nielsen's heuristics (Nielsen, 2018). In the interests of brevity only the most interesting (and applicable) aspects of these evaluations are noted in the report.

Advantages:

Visualisation 1 and 4 are are created using Tableau which allows for Human-Computer Interaction (HCI) such as filtering on the area of interest and drag and drop to add more details. Whilst evaluating Tableau is not the main interest, it should be pointed out that the navigation structure such the filtering section and the drag and drop structure allows for ease of use and learning.

The geographic visualisations in the dashboard (visualisation 1) and in visualisation 2, provide a strong connection between the system and the real-world. In addition, incidents within the same locality could be easily compared as they are all simultaneously present on the same map. The well-known format of the word-cloud in visualisation 1, along with its uncluttered layout places little load on users' working memory, thus facilitating recognition. The stacked-area chart in visualization 1 conveys a great deal of information using a minimal number of design parameters. The word cloud of weapon choices used is great for broad comparison of different weapon types. In visualisation 2, the most serious incidents could be easily seen pre-attentively due to their red colour. In addition, incidents within the same locality could be easily compared as they are all simultaneously present on the same map and avoids the need to memorise location of dots for comparison. Visualisation 2 also leverage time-lapse, which intuitively conveys temporal sequencing.

The double stacked bar for visualisation 4 uses red and green to illustrate in the starkest terms possible the differences in severity of the property damages and allows easy side-to-side comparison between the total number of attacks and suicide attacks within each US presidency.

Disadvantages

*D*ue to the time constraints present on the animations in visualisation 2, it was not possible to show the details of each attack. The standard map format used in visualisation 1 and 2, could misrepresent the distance between the location of terrorist attacks due to the fact that the world is a sphere rather than a rectangle. The occlusion of the incident dots within the maps in visualisation 1 and in the latter half of the visualisation 2 animation is also an issue meaning that not all incidents within a certain geographical area could be shown effectively. The maps do not show details of attacks including any other damage caused such as people wounded and financial damage. The word cloud in the visualisation 1 dashboard also does not allow effective quantitative comparison on the number of deaths caused by each weapon as humans tend to compare and evaluate different area sizes less effectively than other magnitude measurement tools such as straight lines.

In addition to the characteristics of visualisation 3 discussed above, the occlusion of organisations' names reduces its clarity as well.

The different colours of the bar chart used in visualisation 4 shows contrast in property damage caused in different attacks but the red and green colour will not be as effective in illustrating the difference for a minority (around 8%) of men suffering from colour blindness issues (Wickline, 2018). One of the drawbacks of comparing attacks occurring under different US presidents is that the different presidents do not hold office for the

same length of period. Gerald Ford, for instance, served less than one full-term compared with the last three presidents Bill Clinton, George W. Bush and Barack Obama who all served two full-terms of office. This makes any comparison of attacks occurred per day, month or year more difficult and requires some mental adjustment of the bar lengths to make the comparison.

Conclusion

Full appreciation of the nature, extent and evolution of global terrorism over the past 47 years requires sophisticated visual analytic implementations using multiple software applications. We have already uncovered some of the insights already such as the previously unexpected relations between terrorism groups seen in visualisation 3 or the relatively constant level of property damage per terrorist attack over time seen in visualisation 4. This is in part due to the sheer quantity of available data, the quality and completeness of data collected from different regions of the world and also because of the myriad of patterns and trends in the data that emerge from the complex societal processes that produced these data. Indeed, whilst we are pleased with the insights we have been able to generate from the data, more prolonged study of these data and potential linkages to other data would likely yield even more insight. Future work should, for example, consider autocorrelation and lag effects between measurements of variables at different time-points and sensitivity of the results to missing terrorism incidence records.

References

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Appendix

Graph settings

Id	Label	Interval	Splitter Z-Level	Degree
62	Revolutionary Armed Forces of Col...		2	132
96	New People's Army (NPA)		1	93
959	Tehrik-i-Taliban Pakistan (TTP)		1	73
1297	Islamic State of Iraq and the Levan...		1	59
1003	Communist Party of India - Maoist...		1	54
113	National Liberation Army of Colom...		1	45
1182	Free Syrian Army		1	43
573	Chechen Rebels		1	33
1216	Al-Nusrah Front		1	33
699	Al-Aqsa Martyrs Brigade		0	29
1223	Ahrar al-Sham		0	28
623	Lashkar-e-Jhangvi		0	26
363	Kurdistan Workers' Party (PKK)		0	24
850	Al-Qaida in the Islamic Maghreb (...		0	24
565	Taliban		0	21
663	Lashkar-e-Taiba (LeT)		0	21
395	Hamas (Islamic Resistance Movem...		0	18
128	Maoists		0	17
683	Abu Sayyaf Group (ASG)		0	16
701	United Liberation Front of Assam (...		0	16
433	Palestinian Islamic Jihad (PIJ)		0	15
721	Salafist Group for Preaching and Fi...		0	15
872	Al-Shabaab		0	15
1095	Al-Qaida in the Arabian Peninsula ...		0	15
13	Rebels		0	14
359	Moro Islamic Liberation Front (MILF)		0	14
359	Moro Islamic Liberation Front (MILF)		0	14
546	Hizbul Mujahideen (HM)		0	14
737	Al-Qaida		0	14
1403	Southern Front		0	14
1574	Shamiya Front		0	14
15	Popular Front for the Liberation of ...		0	13
241	Hezbollah		0	13
49	Guerrillas		0	12
145	Militants		0	12
520	National Democratic Front of Bodo...		0	12
803	Informal Anarchist Federation		0	12
929	National Socialist Council of Nagal...		0	12

Figure 5: Network G

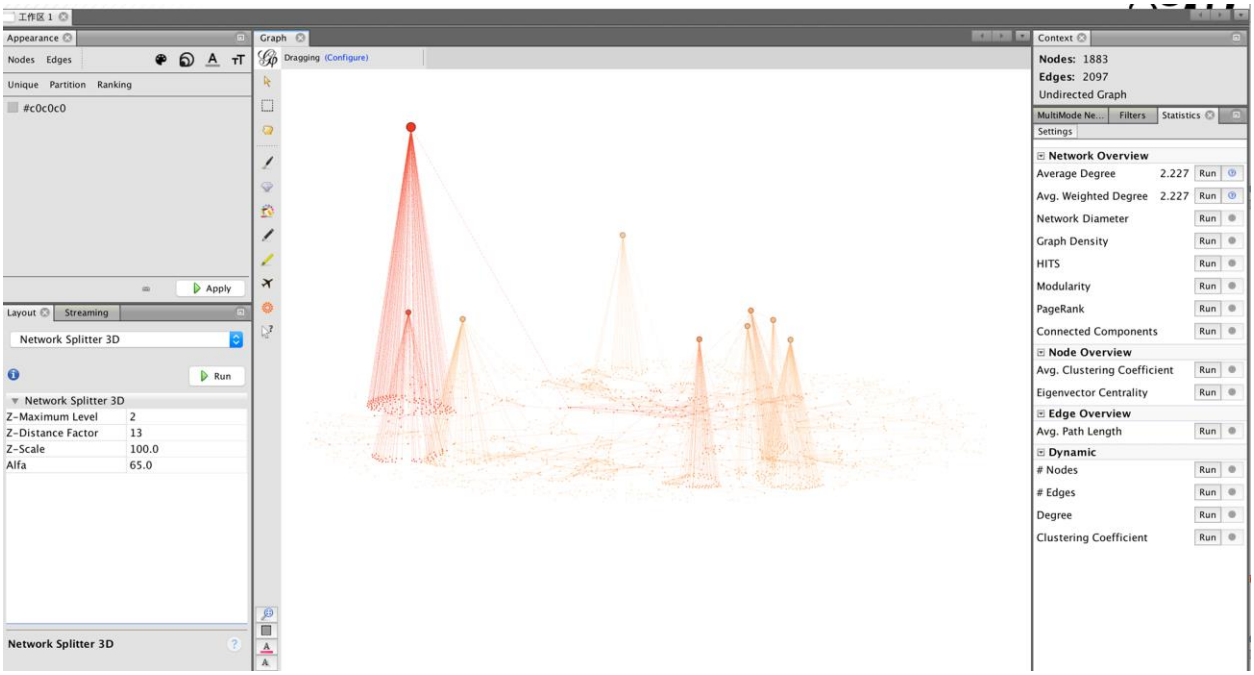

Figure 6: Yifan Hu Settings

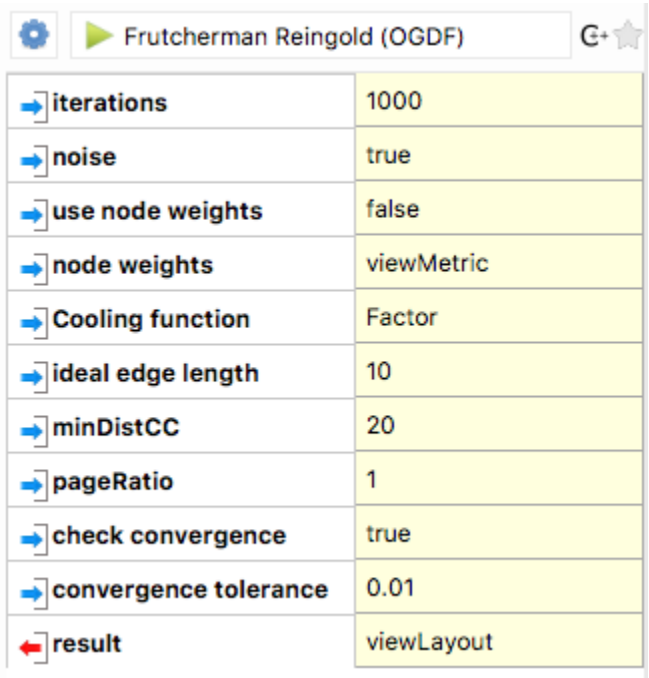

Figure 7: Frutcherman Reingold (OGDF) - Tulip settings for graph render

Relationship between suicide attacks and property damage value

Frequency Expected Cell Chi-Square Row Pct			
Table of value by suicide			
	suicide		
value	0	1	Total
1	2 5.7918 2.4825 33.33	4 0.2082 69.066 66.67	6
2	811 870.7 4.0939 89.91	91 31.296 113.9 10.09	902
3	38557 38866 2.457 95.76	1706 1397 68.358 4.24	40263
4	58673 58300 2.3803 97.15	1723 2095.5 66.222 2.85	60396
Total	98043	3524	101567
Frequency Missing = 67892			

Value 1: Catastrophic 2: Major 3: Minor 4: Negligible
Suicide 0: No 1 : Yes

Figure 8: A frequency table that shows the number of attacks in each property damage category for both suicidal and non-suicidal attacks

Group Meeting

Refer to **\Meeting Notes*.***

Codes

Refer to **\Code*.***

Data Processing

Refer to previous submission **Group 13 - Assignment 2- Report 1.pdf**