Fighting for Space: A GIS-based Spatiotemporal Analysis of Terrorism in Israel and Palestine

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By

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Dedication

This thesis is dedicated to my family. This work would have been more difficult without your support. No words can express how much I care for all of you. Thank you for everything.

You are always on my thoughts and heart.

Esta tesis está dedicada a mi familia. Esto hubiera sido más difícil sin su infinito apoyo, cariño, y amor. Ningunas palabras podrían exprimir cuanto los quiero. Gracias por todo lo que me han dado.

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Fighting for Space: A GIS-based Spatiotemporal Analysis of Terrorism in Israel and Palestine

By

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Master of Arts in Geography, GIS Program

Terrorism is a new reality for much of the Western World today. For others, living under the threat violence stretches back generations. In an effort to extend what has been learned about terroristic threats, this thesis seeks to supplement long-standing qualitative approaches, with an advanced analysis of the spatial and temporal patterns of attacks in Israel and Palestine, using a variety of GIS-based statistical methodologies. Data from the Global Terrorism Database (GTD) was extracted and analyzed in the context of Rapoport’s Four-Wave model of terrorism, which suggests that attacks in each historical epoch exhibit unique characteristics, in part because terrorists’ ideologies and objectives evolve over time. Although Rapoport states that terrorism in Israel and Palestine may not follow his model, this analysis suggests that some attack characteristics of the Third and Fourth Waves hold true for Israel and Palestine. GIS results suggest that most cities are not attacked repeatedly; only a few cities appear to be high priority targets. The most important implications of this study is that attack frequency and lethality
increased during the Fourth Wave, and that cities which are seldom targeted are
nevertheless victims of infrequent, but highly lethal attacks.
Chapter 1: Introduction

1.1 Background

The September 11, 2001 terrorist attacks sent shockwaves throughout the world. It was the deadliest terrorist attack of all time. Today media coverage has convinced many that we live in a post 9/11 world that is more dangerous because a larger part of the world’s population is at greater risk of becoming victims of terrorist attacks. While a legitimate argument can be made for such claims, quantitative research on terrorism indicates that those beliefs are not entirely accurate, but are instead ideas inspired by irregular large-scale attacks like the ones of 9/11, the 2004 Madrid train bombings, and the 2002 bombings in Bali (LaFree 2010, 2012).

Unfortunately, empirically driven research studies that reinforce that claim have not been widespread as most terrorism analysis before the events of 9/11 was approached differently (LaFree and Freilich 2012; Bahgat and Median 2013). Scholarly research on terrorism prior to 9/11 relied heavily on qualitative data and anecdotal accounts to justify certain positions, often concentrating on the descriptive and philosophical to reinforce claims (Foster 2008). Those studies and their contributions cannot be entirely discounted, especially their theoretical perspectives, but they do little in terms of identifying discernible and measurable patterns of the phenomenon.

The purpose of this thesis is to expand our understanding of how terrorists operate by exploring the spatial and temporal patterns of terrorism in Israel and Palestine using Rapoport’s (2004) Four-Wave model. The goal is to analyze attack characteristics through statistical analysis and GIS-based methodologies. The focus is squarely on the
Third and Fourth Waves identified by Rapoport because data for the First and Second Waves is not available for the study area. Additionally, both Palestinian Intifadas are analyzed in order to see if parallels between the waves could be drawn.

The results for this study concluded that some things outlined in the Four-Wave model are correct, but not all of its claims. While some differences between Third and Fourth Wave attacks were found to be significant, others were not. For example, tactics used between both periods changed, but did not always fit with Rapoport’s model. Unfortunately, statistic results indicate that attacks and their lethality have increased during the Fourth Wave (1990 - present). In that regard, notions that terrorism has become more rampant and dangerous in the modern era cannot be discounted – at least, for the study area. GIS models proved exceptionally useful in identifying the spatial distribution of attacks and highlighting their intensity. Results show that terrorists attacked most of the same locations during both eras. However, GIS tests that analyzed their intensity revealed that some cities which are rarely targeted sustained very lethal attacks.

1.2 Significance of the Study

There are many myths about terrorism and terrorists. The media certainly helps promulgate them and quality scholarship is the only effective antidote. Although different disciplines have contributed to terrorism studies, the discipline of geography has much to offer in analyzing complex patterns of the terrorism. The emphasis on space and place are vital elements of both terrorism studies and geographic theory, see for example (Relph 1976; Tuan 1977; Cresswell 2004). Coupled with descriptive, inferential statistics and geographic information systems (GIS) methodologies, a formidable set of tools help
elucidate how terrorists operated in the past and offer some promise of predicting how they may operate in the near future.

1.3 Study Area

The ongoing conflict between Israel and Palestine offers a unique scenario in which the terrorist phenomenon can be explored. The length of the conflict and the persistence of attacks from both sides make the study area an ideal candidate to explore the characteristics of terrorist attacks over a long temporal frame. The religious affiliations of many individuals in both nations further make this area an ideal location to explore religious terrorism. In this light, addressing the religious element is important because religious conflicts have been found to have long, dangerous, and very difficult resolutions (Jergensmeyer 2000; Radil and Flint 2015). The conflict between Israel and Palestine would certainly fall under that category. Although religion may not be considered as a primary driving force of terrorism in Israel and Palestine (Rapoport 2004), it is worth addressing it since it is closely tied to ethnic identity and has been used as a tool for recruitment and to carry out attacks against both nations (Jergensmeyer 2000; Schbley 2003).

Israel’s predominantly Jewish population lay their claim to the land of Israel based on religious scripture (Genesis 15:18-21 and Genesis 28-13), but also on events that transpired after the British Mandate for Palestine ended. Muslims, largely of Arab descent, claim their right to inhabit the same region on the grounds of past Arab conquests, historical religious events, and their long occupation of the area. To further complicate things, some of the most sacred sites for Jews, Muslims, and Christians are situated within disputed areas. Considering the factors, it is not difficult to comprehend...
the extremity of this conflict. Another interesting feature about the study area is the physical division that exists between the Palestinian territories of the Gaza Strip and the West Bank. The analyses conducted for this study provide interesting insights into how a nation with non-contiguous territories experiences terrorism. Lastly, scholars recognize that terrorism has played a significant role in shaping each nation’s history (Rapoport 2004; Berrebi and Lakdawalla 2007).

1.4 Research Question and Hypothesis

The purpose of this thesis is to analyze the terrorist phenomenon in Israel and Palestine through Rapoport’s (2004) Four-Wave model and establish whether the characteristics of the Third and Fourth Waves can be identified. This thesis will attempt to answer the following questions:

1) Were terrorist attacks significantly different in frequency and intensity during the Third and Fourth Wave?
2) Did terrorists attack different targets during the Third and Fourth Wave?
3) Can GIS methodologies be used to create predictive models that highlight different aspects of terrorist attacks?

The analyses were repeated for the First and Second Palestinian Intifadas. Although parallels between the waves and intifadas are drawn in the concluding remarks of this thesis, the main focus of this research was to compare the waves and intifadas exclusively against their counterpart and not against each other, i.e., wave against wave and intifada against intifada.

In order to analyze if terrorism is uniquely different during the Third and Fourth Waves, a series of tests was conducted to identify the attack characteristics. Preliminary tests were conducted to test overall differences between the two waves. Two difference of
means t-tests were run to analyze the intensity of the attacks and the total number of attacks per region. The null hypothesis and alternative hypothesis for both tests can be written as:

\[ H_0: \mu_1 - \mu_2 = 0 \]
\[ H_a: \mu_1 - \mu_2 \neq 0 \]

, where the null hypothesis states that there is no difference between the means of attack intensity or number of attacks per region. The alternative hypothesis would state that the null hypothesis can be rejected if the difference between sample means is too big, thus concluding that the variables that were tested indicate that terrorist attacks between the Third and Fourth Wave differ.
2.1 Defining Terrorism and Terrorism in Theory

Terrorism is a term that can encompass a wide range of definitions. The attacks on 9/11 set in motion efforts to create an international joint response to combat terrorism, yet the various states that have condemned the phenomenon have not come to an agreement on a universal definition. Many states have chosen different criteria to determine what acts constitute terrorism. The theme of “freedom fighters” is invariably also inserted in the conversation, with scholars and state representatives arguing the point that people have the right to self-determination and to resist foreign occupation (Zeidan 2006; Hodgson and Tadros 2013). The term will be addressed here because a general consensus within the academic gamut and in government agencies (Krueger and Maleckova 2003; Zeidan 2006), for what constitutes terrorism has not been established (Rock 2002; Schbley 2003; Hodgson and Tadros 2013).

A basic or simple explanation may describe it as a violent crime, an act of war, a crime against humanity, etc., that disrupts the social status-quo. The following definitions have been outlined by the U.S. Department of Defense, the United Nations, and the Global Terrorism Database (GTD), but these are only three of many definitions that exist.

- **USDOD**

  o “The calculated use of violence or the threat of violence to inculcate fear; intended to coerce or to intimidate governments or societies in the pursuit of goals that are generally political, religious, or ideological.”
UN Security Council Resolution 1566

- Criminal acts, including against civilians, committed with the intent to cause death or serious bodily injury, or taking of hostages, with the purpose to provoke a state of terror in the general public or in a group of persons or particular persons, intimidate a population or compel a government or an international organization to do or to abstain from doing any act.

GTD (LaFree, Dugan, et al. 2006)

- “The threatened or actual use of illegal force and violence by a non-state actor to attain political, economic, religious, or social goal through fear, coercion, or intimidation.”

Most other definitions echo the ones outlined above, often highlighting the ideology and actions of perpetrators who engage in the act. However, these definitions fail to address that terrorism, at its core, is about controlling physical space (Rock 2002). Moreover, terrorists generally do not view themselves as criminals, but as individuals working towards the establishment of a better society. They see themselves as freedom fighters, liberators, revolutionaries, etc. Those terms and the weight they carry reinforce the notion that the goal of terrorists goes beyond just exerting violence and intimidating a

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1 The definition is an adaptation of the one that the Pinkerton Global Intelligence Services, a private security agency and the original curator of the GTD, used. The PGIS definition of terrorism is as follows: “The threatened or actual use of illegal force and violence to attain a political, economic, religious or social goal through fear, coercion or intimidation” (PGIS 2003; GTD 2015).
government and its people. While those things may be inherent to terrorism, they do not comprise all of its constituents. The underlying desire to dominate physical space has been found to be a goal for various terrorist groups throughout history (Rapoport 1984).

As Rock (2002) notes, what terrorists ultimately hope to achieve is to control geographic space. Achieving control of space allows those in charge to dictate how those within it behave, how land is used and who has access to its resources. Although that end-game is not always apparent to outsiders and at times insiders, i.e., terrorists themselves, the goal seldom changes. Daesh (more commonly known as IS, ISIL or ISIS) is the most recent terrorist group that has managed to partially achieve that goal, although they are not recognized as a legitimate government by any of the world’s nations. However, there is no ambiguity about their desire to establish their own nation state– an Islamic caliphate. As a result, they serve as the archetypical illustration of Rock’s argument.

Additionally, the convoluted history of terrorism has not been devoid of subjectivity (Zeidan 2006). The myriad definitions, the connotations they carry, and the individuals that use them attest to such a claim. The origins of the term also lay credence to that notion². Addressing the superficial facets of fear, intimidation, death, etc., so often embedded in modern definitions of terrorism are counterproductive if they fail to address

² The earliest form of terrorism originated during the French Revolution (from the French word *terrorisme*), although its connotations were different from how we think of terrorism today. The term originally applied to government maltreatment towards its populace.
the end-game of most terrorist groups. In this light, Rock’s (2002) plea for a theory and
definition that addresses the space issue of the terrorist phenomenon is well founded.

2.2 The Four Waves Modern of Terrorism

Throughout history various groups and individuals have employed aggressive
tactics to achieve political goals. As a result, identifying the inception of terrorism and
classifying different styles of terrorism has been a challenging task for academic
researchers. David Rapoport (2004) partly alleviated the situation by postulating four
waves of modern terrorism, each distinctly different in terms of terrorists’ goals,
ideologies, and tactics. However, any periods that are established like those of the Four-
Wave model must be approached with caution as not all groups fall neatly within each
category (Rapoport 2004; Radil and Flint 2015). Nevertheless, the model is a great
contribution to terrorism research because of the guidance it provides to analysts.

Rapoport’s theory is unique because it analyzes terrorism beyond the group-level.
Its distinguishing feature is that it utilizes a “wave” concept to group years into different
periods of terrorism based on distinguishing features. A “wave” as defined by Rapoport
(2004) consists of cycles of activity, with unique energies, that are characterized by their
international ebb and flow in a given period and usually last around one generation. The
international factor is a key feature since characteristics of each cycle can be found prior
to the First Wave, e.g., during the French Revolution. Waves are also characterized by
their unique ability to inspire groups which replace failing ones. Finally, when a wave is
unable to inspire new groups it ceases to exist and a new one takes its place whereupon
terrorists find new ideologies and strategies to carry out attacks. It is important to note
that Rapoport points out that some groups “survive” a receding wave by adapting to the
succeeding one. Other important characteristics of the waves are the types of organization, transient populations, state involvement, sympathetic foreign populations, and supranational organizations.

The “Anarchistic” (first) wave, occurring roughly between 1880 and 1920, marked the advent of modern terror and was driven by perceptions of social injustice emanating from despotic systems. The predominant goal for terrorist groups in that era was to restructure monarchies, in part by assassinating prominent figures. Anarchists reasoned that assassinations would polarize society and trigger a revolution. Their actions eventually gained notoriety in different nation states as Russian anarchists traversed beyond their borders either due to exile, to escape prosecution, or just to spread revolutionary ideas (Bantman 2013).

The actors of the Second Wave (the “Anticolonial”), occurring roughly between 1920 and 1960, were concerned with removing foreign colonial powers after the First and Second World Wars. Divided territories and mandates gave people the incentive to rise up against those who were occupying their lands. Terrorists during that wave were able to take advantage of the colonial situation by sowing dissent, rallying support and ultimately, through their actions, consolidating power that legitimized them, albeit only partially (Rapoport 2004). Thus, while some terrorists did have success, it was not what would be considered total victory. Groups like the Irgun had to compromise with the people they were trying to overthrow. As a result, places like Palestine were carved up and reshaped instead of being completely absorbed into Israel after the British Mandate ended. This wave also marked the period when terrorists opted out of calling themselves
terrorists and began to refer to themselves by the more romantic term “freedom fighters” (Begin 1977). A smart decision on their part which also highlights their adaptability. Third Wave (“New Left”) terrorists were moved by the prolonged Vietnam War. They found rekindled hopes in toppling mammoth armies and powerful states, often with the aid of other states, as they became determined to make a change. This wave also inspired more people from places like Germany, France, the United States, and Japan, who also revitalized a revolutionary banner. They were certain that their actions could help change the oppressed circumstances of people in Third World countries (Rapoport 2004). Groups with different backgrounds and objectives also began to mutually support each other. One of the more prominent groups, the Palestinian Liberation Organization (PLO) emerged to combat Israelis within and outside of Palestinian territories through acts of terrorism. The PLO had plenty of support and resources when it attacked Israel’s heartland but when transnational attacks were carried out they had to seek help from other organizations.

Tactics also shifted back to ones that would generate large publicity, similar to those in the First Wave, although assassinations were carried out for different reasons and kidnappings became more rampant. While First Wave groups focused more on assassinating high-profiled targets, groups in the Third Wave opted for hijacking airplanes and taking hostages because of the symbolic and monetary value that they

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3 The PLO has deemed itself to be a legitimate organization since 1970 and has presumably abandoned terrorist tactics. It has been recognized by the United Nations as a representative of the Palestinian people since 1974 and by Israel since 1993.
would garner. During that wave the term “international terrorism” was resuscitated, and with good reason since groups were choosing to attack targets beyond “their” borders. For example, the group Black September, a Palestinian sympathizer organization, kidnapped and killed members of the Israeli Olympic team and one German police officer during the 1972 Munich Olympics. A religious component to the actions of certain groups was also becoming evident and gathered more momentum as the years went by. The decisive blow of this wave was the conclusion of the Soviet/Afghan war. Small groups, in comparison to the Soviet army, with strong religious affiliations managed to stymie a world superpower. Since then, Muslim groups in former Soviet Union territories have bolstered the ranks of terrorist groups in the Middle East.

The current Fourth Wave (the “religious”), roughly post 1990’s, is characteristically identified by the overly present religious dogmatic tones which are used as pretexts and motivation to advance radical ideas. Terrorists in this wave often justify injuring individuals who do not adhere to the same morals and beliefs by invoking religious scripture. Like earlier waves, this one also has its origins in conflict, especially the Soviet invasion of Afghanistan and the Iranian Revolution, which had strong cultural ideologies behind it. Although much of the focus of religious terrorism research has centered on Islamic extremists, the phenomena has been found to be a global one and many major religions have had members participating (Rapoport 1984; Jergensmeyer 2000; LaFree 2010; S. Radil 2015). The most troubling aspect of this wave is that it appears to be the most violent (Jergensmeyer 2000; Rapoport 2004).

One of the most widely used tactics during the current wave has been suicide bombing, and has a direct connection to religion. Religious terrorists, mainly Muslim,
have often expressed that death does not concern them as it is perceived to be a transitional stage in their life. Other things that distinguish terrorism in this wave is a decrease in groups and the durability that active ones have had. The decrease in the number of groups is interesting and may imply that religious terrorist syndicates have large memberships. Rapoport’s point of group durability is equally interesting. The implication of that notion is that religion is acting as a “glue” to hold together a group’s cause. It would explain why al-Qaeda is still functioning, although with less influence, even without Osama bin Laden.

2.3 Terrorism and Crime Analysis

Since terrorism is a subset of crime, the tools and theories which have been used in criminology can also be applied to studies of terrorism. The earliest forms of crime mapping are old and were created without the use of the modern computer. Geographer Borden Dent (2000) has traced the technique back to the early 19th century. In recent years, the advent and proliferation of modern GIS software has increased the interest in crime mapping, although use of GIS software has not been found to be a standard practice by institutions whose goal is to mitigate it (Chamard 2006). Nevertheless, GIS has been proven to be a useful tool for crime analysis and various studies have highlighted its advantages (Canter 1997; Bowers, Johnson and Pease 2004; Ratcliffe 2004).

Although it can be tempting to relegate individuals who commit terrorist acts to the realm of the mentally insane, scholarly research indicates that terrorist acts are undertaken by individuals who are mentally sound and largely in control of their actions (Miller 2006). Many of them display perfectly normal personalities (Turk 2004; Collins...
Rational choice theory has been invoked in terrorism studies (Lakdawalla and Zanjani 2005; Caplan 2006; Berrebi and Lakdawalla 2007), and has led some scholars to believe that acts of terrorism can perhaps be considered to be more rational than other types of crimes. The following are some reasons which have been proposed: (1) many of the targets and/or dates that are chosen by terrorists have strong symbolic meanings behind them (Berrebi and Lakdawalla 2007); terrorists understand that targeting particular places at certain times yield results that go beyond inflicting maximum human damage. (2) Terrorist acts are imbued with strong revolutionary ideals (Rapoport 2004; Turk 2004; Comas, Shrivastava and Martin 2015). The revolutionary trait is certainly apparent in Rapoport’s model and is magnified by Rock’s (2002) argument that terrorism is intrinsically related towards the desire to control physical space. (3) Finally, due to the modern counter-terrorism measures that have been implemented by various states, acts of terrorism are not simple to carry out. Depending on the level of sophistication, attacks require meticulous planning, preparation, and exhibit a great deal of complexity.

Rational-choice theory suggests that terrorists are more likely to allocate their resources towards attacking higher-value targets based on the risk-reward ratio. While this stance is not wrong as it has helped terrorism studies (Lakdawalla and Zanjani 2002, 2005; Caplan 2006; Berrebi and Lakdawalla 2007), another theory to consider is that of bounded rationality. Bounded rationality theory expounds on terrorism analysis by alluding that things like the types of attacks, location, and weapons that terrorists use are directly related to knowledge, personal experience, environmental constraints, and world-views (Medina, Siebeneck and Hepner 2011). The theory suggests that the process is
rational for terrorists who operate within a distorted world view, or one that is not widely accepted.

2.4 GIS, Statistics, and Terrorism

Analyzing incident datasets through Geographic Information Systems (GIS) and statistical analyses has proven to be a good way to explore various types of crime. Scholars have drawn on the Global Terrorism Database to formulate analyses on terrorism. Radil and Flint (2015) found that in India, contrary to the “cosmic war” thesis, the severity of urban terrorism has decreased during the Fourth Wave. Their findings indicate that religiously motivated terrorists in India appear to be no more than geopolitical agents with the same desire to construct and/or reshape geographic space and political boundaries. Hussain (2010) found that terrorism in Pakistan, although considerably bad, has not been at the level that the media would lead us to believe. A more significant result from his study was finding a correlation between terrorist attacks and terrorist arrests. Foster (2008), also using the GTD, found a positive correlation between political events, significant dates, and terrorist attacks. An increase in attacks was found to be markedly noticeable when there was a possibility that attacks would reduce the legitimacy of a particular group or figure.

An increase in attacks on significant days has also been echoed in the works of Siebeneck et al. (2009) and Medina et al. (2011). Both studies found statistically significant changes in terrorist attacks around important days. Other studies which used different datasets have also had fruitful results. Dugan et al. (2005) found that terrorists are not always inclined to attempt aerial hijackings when there is a greater chance of being apprehended. Moreover, they found a diffusion-like effect with hijackings after
those types of attacks occurred. The results indicated that after successful hijackings there was a significant increase in attacks of the same type. Overall, studies show that terrorism databases are a good resource to analyze the phenomenon.

2.5 Does Terrorism Work?

There is a healthy debate about the efficacy of terrorism as a strategy to make policy changes. On a basic level, terrorism frightens the general public and puts governments on high alert. However, terror is only a means to an end. The desire to force policy changes that directly influence the regulations on physical space is a more appropriate variable because it is their final goal and highlights why they choose to engage through hostile actions. Terrorism may help rally supporters and/or help groups gain momentum for their cause which may lead to some form of policy change in the future. The position that terrorism as a strategy does not work has been fervently championed by Abrahams (2006). He asserts that there is little empirical evidence to suggest that policy changes are enacted as a result of the tactics that are employed by terrorists. He suggests rather, that the data and events used to support the notion that terrorism is an effective strategy is often cherry-picked. Policy changes that occur after certain terrorism events may be attributed to mere coincidence and may be a result of other underlying variables that are overlooked (Abrahams, Correspondence: Does Terrorism Ever Work? 2007).

The position taken here is that even though not all groups will ultimately achieve their goals, some terrorists’ actions can have incendiary effects that will rally supporters who may at some point achieve their demands (Rapoport 2004; Gould and Klor 2010; Hodgson and Tadros 2013). Abrahms’ research is undoubtedly noteworthy as it relies on
quantitative analysis rather than on anecdotal and interpretive approaches but there are some things to consider. Abrahms’ study alludes that there can be minimal success on the part of terrorists. Surmising that even minute forms of success are enough to keep terrorists around cannot be backed by any statistical facts but it is not a difficult position to comprehend.
Chapter 3: Data

3.1 The Global Terrorism Database

The dataset used for this study was procured from the National Consortium for the Study of Terrorism and Responses to Terrorism (START). Its Global Terrorism Database (GTD) is the culminated work of different institutions whose goal was to create a comprehensive repository of information and to utilize it to better understand terrorism. Today the dataset is quite extensive, its earliest entries date to 1970, and it includes events from over 200 countries making it an ideal source for this study. Moreover, GTD analysts have continuously worked to update it with the most recent terrorist events, ensuring the robustness of the database. Efforts to create an extensive database on terrorism have been undoubtedly arduous and the institutions responsible for the GTD have done a fine job but by START researchers’ (START 2015) own accounts the database still has limitations that users need to be aware of.

GTD data collection has been undertaken by the following institutions: the Pinkerton Global Intelligence Service (PGIS), the Center for Terrorism and Intelligence Studies (CETIS), the Institute for the Study of Violent Groups (ISVG), and START staff (currently ongoing). Although data collection methods and inclusion criteria have been consistent throughout most of the process, occasional modifications have been made to the structure of the GTD. For example, incident data collected from 1970 to 1997 was included by reference to one set of standards (see Chapter 2, section 2.1) (LaFree, Dugan, et al. 2006; LaFree 2010) and after 1997 a revised standard was used to determine inclusion in the database. However a general consensus on how scholars define terrorism has never been established, so it is unlikely that all incidents have been included.
Incidents recorded after 1997 had to meet two of the following three criteria in order to be included in the GTD (START 2015):

1. The violent act was aimed at attaining a political, economic, religious, or social goal;

2. The violent act included evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) other than the immediate victims; and

3. The violent act was outside the precepts of International Humanitarian Law.

START staff have gone through database records so that early entries adhere to the criteria which are presently used. As a result, some incidents initially in the GTD have since been removed. Another thing to note is that data collection methods have improved greatly over time and weeding out unrelated incidents is now a more refined process. The evolution of the inclusion criteria suggests that some incidents that should have been in the dataset’s early years may not have been included.

Additionally, because data collection methods of the GTD have always relied on public records, news articles and the like, there exists a strong possibility that personal bias and misinformation have tarnished entries (LaFree, Dugan, et al. 2006). Lastly, errors by the curators of the GTD have also occurred and were encountered in the form of spelling errors and other minor inconsistencies during the early stages of this analysis. For example, some entries had similar yet slightly different attributes under the same variable, e.g., Gazy City, City of Gaza and Gaza. These inconsistencies were only an issue with variant spellings, and when the names of two locations were very similar and difficult to distinguish. All inconsistencies and errors were corrected before data analyses began. Entries with uncorrectable errors were excluded from this study.
3.1.1 Terrorism Dataset Preparation

In order to perform data analysis it was necessary to first closely inspect the database, identify inconsistencies and condition entries so the data had maximum internal consistency and was compatible with GIS software. The GTD includes some incidents that may not be easily characterized as “terrorism.” Fortunately, GTD staff regularly chose to error on the side of inclusion, noting borderline cases, leaving researchers with the option of removing any incidents that may not adhere to more narrow criteria of his or her choosing. For the purposes of this study, most incidents were judged to be actual terrorism. A few did not make it into this study – justification for removing some of the incidents is expounded below. Data conditioning was also necessary to prepare the entries in the GTD for use in ArcMap GIS and other statistical analysis software.

The first data conditioning consideration resulted in the exclusion of incidents that did not occur within Israel, the Gaza Strip or the West Bank, which reduced the dataset to 3,767 total attacks. Although a number of attacks on Israeli and Palestinian interests occurred outside of the study boundaries, this analysis was focused on how the two nations have experienced terrorism in their heartlands. Due to the tenuous relationship between the Israeli and Palestinian populace, it was important to include as many incidents as possible in order to improve the performance of the analytic techniques. Other incidents that were removed although they occurred within the study area are identified as “other crime type”, “lack of intentionality”, and “state actors” in the GTD. This step resulted in a dataset with 3,704 potential incidents for analysis.

In order to utilize the remaining incidents, it was important to ensure that they had latitude and longitude coordinates. Unfortunately, further inspection revealed that only
2,165 incidents had coordinates and 1,539 did not. To rectify this problem the “city” variable, which contains the name for the city, village, or town in which the attack occurred was inspected. Since incidents in the GTD are assigned the coordinates for the city level, the same approach was taken for this analysis. It should be noted that the city variable also contains refugee camps and other small-scale communal settlements; coordinates for those entries were kept intact. In addition to assigning coordinates to as many incidents as possible, it was also important that attacks occurring in the same location have the exact same geospatial reference. Consequently, all entries were analyzed through the city variable to ensure geographic consistency.

Google’s search engine, the Islamic Finder website, Family Search website, Wikimapia website, and the Geonames website all provided geographic coordinates for locations without them. Each resource used the WGS 1984 geographic coordinate system. The Family Search and the Islamic Finder websites were particularly useful as they provide a list of variant spellings that are used for a particular city. Without the aid of such systems it would have been impossible to verify certain locations. Nearly 110 data points (3% of the total) proved impossible to geo-locate and were removed from consideration. Still, 1,429 incidents, out of 1,539, were successfully corrected and geo-located. The resulting figure of terrorist attacks after this process totaled 3,594, however two more incidents were later removed when the data was geocoded in ArcMap and it was found that they occurred in Lebanon and Syria.

3.2 Population Data

To test the relationship between population and number of attacks, demographics for the study area were acquired at the Israeli region and Palestinian governorate level.
Both Israeli and Palestinian data was taken from their Central Bureau of Statistics department webpage. Because both nations conduct their census at different times, this study tested the population/number of attack relationship with the 1995/2008 Israeli censuses and the 1997/2007 Palestinian censuses. A more ideal demographic dataset would have included a broader range of dates, but data was unavailable. Earlier data for Israel proved elusive, and is unavailable for Palestine because 1997 was the first year they conducted a census.

3.2.1 Population Data Preparation

Census data was manually extracted from each nation’s official webpage and copied into Excel spreadsheets. To conduct tests about the relationship that population has to the number of attacks, the codes for Israel’s regions were cross-referenced with the codes that were created in the administrative regions feature class; the alteration of the Israeli feature class is detailed in the following section. All regions with the exception of Modi’in and Ramla had proper correspondence in the feature class. Thus, the data was joined at that administrative level; the regions of Modi’in and Ramla were joined to the Ramla sub-district since they both comprise it. Doing this was necessary because neither region has population data for the 1995 census; rather they have a collective sum under the Ramla sub-district. Palestinian census data was joined at the governorate level. The governorate names were checked against the names in the Palestinian feature class to ensure a successful join. Both stand-alone tables were joined in a one-to-one relationship. The region codes, for the Israeli dataset, and the governorate names, for the Palestinian dataset, served as unique keys.
3.3 Shapefiles

Shapefiles of administrative region maps at a smaller level than the State were acquired from the GADM spatial database (version 2.8) found at www.gadm.org.

3.3.1 Shapefile Feature Class Preparation

In addition to projecting the shapefiles to the proper coordinate system (Israeli Transverse Mercator Grid), the Israeli administrative regions shapefile was altered. As it was acquired from GADM, the smallest administrative unit was at the district level, too large for the scope of this study. To conduct a more localized analysis the shapefile was modified to the regions level (Figure 1). The reference map used to create the boundaries was taken from the Israeli Central Bureau of Statistics website. The image was georeferenced to an acceptable state and then the editing feature in ArcMap was used to split the polygons. After the regions were created, a new field was added and the region codes were manually entered.
Figure 1 Israeli administrative regions shapefile acquired from GADM (left) and the modified version to include the regions (right). The Ramla and Modi’in regions are depicted in the inset map; incidents occurring in both regions were analyzed as one entity.
Chapter 4: Methodology

ESRI’s ArcMap 10.3 software was used to identify the spatial and temporal distribution of terrorist attacks. Its spatial analyst tools are ideal to analyze terrorism incidents. Spatial clusters and unique characteristics of the dataset were made evident by using a series of techniques in the software. All spatial statistic tools were run with Zone of Indifference as the conceptualization of spatial relationship between features. That option was chosen because the assumption is that terrorism does not cease to have an influence at a fixed distance.

To separate the dataset into two periods, Rapoport’s (2004) wave-model was referenced. “Third Wave” (1970 to 1990) and the “Fourth Wave” (1991 to 2014) periods were created. To compare the two Intifadas another set of periods was created with attacks occurring between 1987-1993 and 2000-2005. In order to analyze the spatial and temporal patterns of terrorist attacks, a series of tests were conducted to identify trends in the study area.

Spatial autocorrelation techniques were used to determine if attacks exhibit spatial dependence, or clustering of like features. The tool used to identify clusters of features with similar values was the Getis-Ord Gi*. Additionally, the Anselin Local Moran’s I tool was used to identify outliers, i.e., features surrounded by features with dissimilar values. To identify where the concentrations of attacks occurred, the kernel density tool was utilized. All tools were run two times. The first test analyzed weighted point values and the second test analyzed the intensity of the attacks.
4.1 Calculating Attack Intensity

To measure the severity of attacks, an algorithm that weighted attack intensity by the human damage caused, was created (Siebeneck, et al. 2009). Analyzing exclusively the total number of incidents a city sustained was not ideal for this analysis because the results would have failed to address the lethality of attacks. This approach was taken because other studies have found that cities where many attacks occur do not always sustain the most casualties (Siebeneck, et al. 2009; Medina, Siebeneck and Hepner 2011).

To measure the magnitude of attacks, a modified attack intensity index, developed by Siebeneck et al. (2009), was used. It is written as:

$$AI = \frac{(F + I + H) - (TF + TI)}{T}$$

Where:

- $F =$ the total number of fatalities per incident,
- $I =$ the total number of injuries per incident,
- $H =$ the number of hostages per incident,
- $TF =$ the total number of terrorist deaths per incident,
- $TI =$ the total number of injured terrorists per incident, and
- $T =$ total number of incidents for a specific time period.

The AI index considers injuries and hostages as potential fatalities (Medina, Siebeneck and Hepner 2011). In this study, injuries and hostage incidents are considered to be severely debilitating to victims and society’s resources, in addition to the belief that they can be considered as potential fatalities. For comparison purposes, the AI index was calculated for all of the incidents in the study before the periods were created. This procedure was repeated to compare the Intifadas against each other. Finally, the values of
the AI were standardized into a range between 0 and 100. Once the dataset was conditioned, it was mapped using GIS software.

4.2 Finding Threshold Distance Bands for Spatial Analysis

Although running density analysis tools with default settings provides insights on the data, a more refined approach is to establish proper search radius values for the input feature layers (ESRI 2016). To find the right scale of analysis, two tools were utilized: first, the Average Nearest Neighbor tool, and second, the Incremental Spatial Autocorrelation tool.

4.2.1 Average Nearest Neighbor

The Average Nearest Neighbor tool was utilized to find the observed mean distance between all points for all periods. The tool works by measuring the distance between each incident’s centroid and its nearest neighbor’s centroid and then averages the distances (ESRI 2016). If the observed mean distance yields a value less than that of a hypothetical random distribution, the data is considered to be clustered. Conversely, if the observed value is greater, the data is considered to be dispersed. The Average Nearest Neighbor ratio is calculated by dividing the observed distance by the expected distance (a hypothetical random distribution with the same number of features). The Formula is written as:

\[ \text{ANN} = \frac{\bar{D}_O}{\bar{D}_E} \]

Where:
• \( \overline{DO} \) = the mean distance of each observed feature and their nearest neighbor, and
• \( \overline{DE} \) = the mean distance of each feature given a random distribution.

This test was conducted with the shapefile output of the Collect Events tool in order to also weight results by location. Running the tool with non-weighted point data would have yielded unusable mean distance values as many of the attacks occurred in the same locations. To achieve optimal results, the total area for the study region was used as a parameter.

4.2.2 Incremental Spatial Autocorrelation

To identify at which distances the data exhibited statistically significant spatial clustering, the Incremental Spatial Autocorrelation tool was run for all period shapefiles. The logic behind this tool is that clusters of incident data peak at certain distances because of underlying spatial factors. As the distance between the underlying factor and incidents increases, clusters become less pronounced. To run this tool, the mean distance values from the Average Nearest Neighbor results were used as the beginning distance values. Had this tool been run with default settings, the results would have yielded significant peak values at very large distances as a result of locational outliers. This occurs because the default settings ensure that each incident has at least one neighbor. To err on the side of caution, different incremental distances were used, but 1,000 or 2,000 meters yielded the best results.

The tool works by running a series of Global Moran’s I tests for various incremental distances and measures their spatial clustering intensity (ESRI 2016). The results are a set of z-scores, which reflect the distances where high intensities of spatial
clustering occur as a result of underlying spatial processes. Usually the first statistically significant peak is considered to be an appropriate scale of analysis for the study. However, not all results identify statistically significant peaks in the data. This is often due to various spatial process at work and is typically common with large datasets.

Results for this test seldom yielded significant peaks. The assumption is that various spatial processes affect terrorist attacks in Israel and Palestine. However, the tool still proved to be useful as the output graphs depicted some clustering, albeit mostly with low z-scores. To conduct a local analysis on the dataset, the second peaks were chosen as the optimal distance threshold values (Table 1).

<table>
<thead>
<tr>
<th>Incremental Spatial Autocorrelation</th>
<th>Peak</th>
<th>z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave 3, weighted points</td>
<td>16,000</td>
<td>-0.237409</td>
</tr>
<tr>
<td>Wave 3, attack intensity</td>
<td>13,000</td>
<td>6.940517</td>
</tr>
<tr>
<td>Wave 4, weighted points</td>
<td>16,000</td>
<td>1.091268</td>
</tr>
<tr>
<td>Wave 4, attack intensity</td>
<td>14,000</td>
<td>20.681536</td>
</tr>
<tr>
<td>F. Intifada, weighted points</td>
<td>15,000</td>
<td>-0.150829</td>
</tr>
<tr>
<td>F. Intifada, attack intensity</td>
<td>16,000</td>
<td>-0.499104</td>
</tr>
<tr>
<td>S. Intifada, weighted points</td>
<td>19,000</td>
<td>0.172763</td>
</tr>
<tr>
<td>S. Intifada, attack intensity</td>
<td>14,000</td>
<td>13.949835</td>
</tr>
</tbody>
</table>

4.3 Kernel Density Estimation

To identify areas that sustained a high number of attacks or attacks with a high intensity, the kernel density tool was used. The tool generalizes the data over the study area and creates a “risk surface” layer. The assumption is that even though not every single point of the study area’s surface experiences a terrorist attack, there are some areas that are more prone to attacks than others. The probability of highest risk is considered to
be at the point where an incident takes place. As the distance between the point of occurrence and proximal location increases, the incident loses its influence. Multiple incidents at a single point heighten risk, as do multiple incidents in close proximity. The value of the tool is that it allows for some estimation of risk even in places that have not experienced any attacks, but are proximal to areas that have been victimized.

4.4 Getis-Ord Gi*

The Getis-Ord Hot Spot Analysis tool was used to identify hot and cold spot clusters based on a given set of weighted features. The tool evaluates each feature and its neighboring features and checks for spatial autocorrelation (ESRI 2016). Each feature and its neighbors’ local sum is calculated and proportionally compared to the weighted sum of all the features in the dataset. If the resulting value of the observed sum is considerably different from the expected sum, a high or low z-score indicating statistical significance is given. If a feature is found to have a high or low value and is not surrounded by other like features, the tool does not consider the pattern to be statistically significant.

The Getis-Ord Gi* analysis was conducted on all period shapefiles and was run twice for most. This approach was necessary due to the significantly higher number of attacks that some cities sustained (Table 2), in comparison to the rest of the cities. Had the test been conducted without excluding outliers, the risk of not finding clusters would have increased. When the tool was run to analyze attack intensity, the first test included all the incidents and the second excluded incidents with a value of zero, i.e., incidents where no casualties were reported.
Table 2. Table shows the cities that are outliers.

<table>
<thead>
<tr>
<th></th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave 3</td>
<td>Jerusalem</td>
</tr>
<tr>
<td>Wave 4</td>
<td>Gaza</td>
</tr>
<tr>
<td>F. Intifada</td>
<td>None</td>
</tr>
<tr>
<td>S. Intifada</td>
<td>Jerusalem</td>
</tr>
</tbody>
</table>

4.5 Cluster and Outlier Analysis (Anselin Local Moran’s I)

This tool was used to identify statistically significant spatial outliers which are identified by calculating the Moran’s I value, p-value, and z-value for each feature (ESRI 2016). Another reason for running this tool is because research has shown that results from the Cluster and Outlier Analysis differ from the results of the Getis-Ord Gi* tool (Siebeneck, et al. 2009; Taylor 2013). The decision to utilize both tools was good as they ended up complimenting each other.

4.6 Spatial Join

To show the spatial distribution of terrorist attacks by Israeli region or Palestinian governorate, a series of spatial joins were conducted. This method joins the attributes of one layer to another based on spatial location. In addition to joining the number of incidents that occurred within a given polygon, the method was also used to calculate their mean AI.

4.7 Descriptive and Inferential Statistics

To supplement the GIS analysis, descriptive and inferential statistics were conducted. These methods were helpful in identifying the characteristics of terrorist attacks. Pearson’s r correlations tests were run to test the relationship between population/attacks and population density/attack intensity. The population dataset that
was used is from the Israeli 1995/2008 censuses, and the Palestinian 1997/2007 censuses; only incidents occurring on or before those years were included in each analysis.

Descriptive statistics were used to find the frequency of attacks by target type (Table 3), attack type, and location. To test the significance of the descriptive statistics, chi-square tests were conducted.

Table 3  Target type classification.

<table>
<thead>
<tr>
<th>Military</th>
<th>Police</th>
<th>Other Government</th>
<th>Civilian</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military</td>
<td>Police</td>
<td>Government (Diplomatic)</td>
<td>Airports &amp; Aircraft</td>
<td>Terrorists/Non-State Militia</td>
</tr>
<tr>
<td>Government (General)</td>
<td>Business</td>
<td>Private Citizens &amp; Property</td>
<td>Journalists &amp; Media</td>
<td>NGO</td>
</tr>
<tr>
<td>Educational Institution</td>
<td>Transportation</td>
<td>Educational Institution</td>
<td>Religious Figures/Institutions</td>
<td>Private Citizens &amp; Property</td>
</tr>
<tr>
<td>Transporta</td>
<td>Telecommunication</td>
<td>Violent Political Party</td>
<td>Tourists</td>
<td>Food or Water Supply</td>
</tr>
</tbody>
</table>


Chapter 5: Results and Conclusions

The research questions for this thesis were conceived as a result of the Four-Wave model (Rapoport 2004) and notions that religious terrorism has been far more deadly than other types of terrorism (Jergensmeyer 2000). The results of these analyses indicate that attack characteristics, in terms of intensity, methods, and chosen target type are significantly different during the Third and Fourth Waves. However, the targets and methods chosen by terrorists during both periods sometimes contradicted the Four-Wave model. The results for the analyses on the Intifadas also showed a significant change in attack intensity, even though most attacks occurred in the same locations during both eras. Overall, the results imply that terrorist attacks in Israel and Palestine have largely been concentrated in the same locations, but their frequency and intensity has increased during the Fourth Wave.

5.1 Research Question 1: Results and Analysis

Were terrorist attacks significantly different in frequency and intensity during the Third and Fourth waves?

Scholars have proposed that attacks during the Fourth Wave have been more severe than in other periods (Jergensmeyer 2000; Rapoport 2004). Radil and Flint (2015) postulate that if that holds true, terrorist attacks should occur at higher frequencies where large populations congregate. It is a logical conclusion considering one goal of religious terrorism is to reach broad audiences (Jergensmeyer 2000). Therefore there should be a correlation between the frequency of attacks and the population of attack sites. Pearson’s \( r \) results showed a statistical significance between population and number of attacks (Test 1: \( r = .482, p < 0.001 \); Test 2: \( r = .453, p < 0.001 \)). The results support claims that attacks
occur more frequently in areas that have larger populations. However, there were less
certain correlations between population and mean attack intensity; and density and
attacks/mean attack intensity. They were not statistically significant at alpha 0.05 or 0.10
using the Pearson’s r test (Table 4). It is important to note that these tests used region and
governorate data to conduct the analysis.

<table>
<thead>
<tr>
<th>Test 1</th>
<th>Pop, attacks</th>
<th>$p$</th>
<th>Pop, mean Al</th>
<th>$p$</th>
<th>Density, attacks</th>
<th>$p$</th>
<th>Density, mean Al</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = .482</td>
<td>0.00</td>
<td>-0.02</td>
<td>0.86</td>
<td>r = .198</td>
<td>0.113</td>
<td>r = -.042</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Test 2</td>
<td>r = .453</td>
<td>0.00</td>
<td>0.11</td>
<td>0.38</td>
<td>0.094</td>
<td>r = -.011</td>
<td>0.93</td>
<td></td>
</tr>
</tbody>
</table>

There was a significant difference in the number of attacks in each wave as well.
The difference of means t-test analysis suggests that the average number of attacks per
region or governorate was significantly less during the Third than in the Fourth Wave
(Table 5). The spatial arrangement of attacks also showed considerable difference.
Attacks were clustered during each period, but it appears that during the Fourth Wave,
terrorists focused their energies on fewer targets. According to the Average Nearest
Neighbor tool, each era had an index value less than 1.0, indicating clustering (see Table
6). The results of both tests appear to support the argument that terrorism during the
Third and Fourth Waves was different in terms of their relative spatial distribution.

Initial analyses indicated that attacks during the Third and Fourth Waves were not
all that different in terms of their intensity, i.e., attacks where a high number of fatalities
and casualties (non-fatalities) were reported. The results for the test for attack intensity
were not statistically significant at alpha 0.05, thus the null hypothesis could not be
rejected. A second test was conducted on intensity that did not consider regions or
governorates. The results showed a statistical significance ($p < 0.001$) between the means
of attack intensity. Overall, the results for frequency analysis support the notion that terrorism during the Third and Fourth Waves exhibit different characteristics. Although the results of the first intensity test imply that attacks have largely remained the same at the region or governorate level, the second intensity test which did not consider regional boundaries indicated differently (Table 5). However even when regions and governorates were excluded and the results were statistically significant, the means were not strikingly dissimilar. The results suggest that terrorist have been more successful during the Fourth Wave.

![Table 5 Difference of means t-test results.](image)

<table>
<thead>
<tr>
<th>Attack Frequency Analysis</th>
<th>Wave 3</th>
<th>Wave 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>17.01538462</td>
<td>38.23076923</td>
</tr>
<tr>
<td>Variance</td>
<td>1779.202885</td>
<td>4316.274038</td>
</tr>
<tr>
<td>Observations</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>t Stat</td>
<td>-2.190805094</td>
<td></td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0.030595088</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.98196749</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attack Intensity Analysis</th>
<th>Wave 3</th>
<th>Wave 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.159309462</td>
<td>2.089563646</td>
</tr>
<tr>
<td>Variance</td>
<td>18.2177279</td>
<td>5.067177544</td>
</tr>
<tr>
<td>Observations</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>t Stat</td>
<td>-1.554250699</td>
<td></td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0.123381421</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.984723186</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Attack Intensity Analysis</th>
<th>Wave 3</th>
<th>Wave 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.086763819</td>
<td>2.211282263</td>
</tr>
<tr>
<td>Variance</td>
<td>23.37995664</td>
<td>38.43090404</td>
</tr>
<tr>
<td>Observations</td>
<td>1106</td>
<td>2486</td>
</tr>
<tr>
<td>t Stat</td>
<td>-5.878101998</td>
<td></td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>4.66469E-09</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.960850878</td>
<td></td>
</tr>
</tbody>
</table>
**Table 6** Average Nearest Neighbor Summary. OMD = Observed mean distance; EMD = Expected mean distance.

<table>
<thead>
<tr>
<th></th>
<th>OMD</th>
<th>EMD</th>
<th>Index</th>
<th>z-score</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wave 3</strong></td>
<td>5096.2289</td>
<td>6100.7692</td>
<td>0.835342</td>
<td>-4.353418**</td>
<td>0.000013</td>
</tr>
<tr>
<td><strong>Wave 4</strong></td>
<td>3530.8815</td>
<td>4215.7154</td>
<td>0.837552</td>
<td>-6.215482**</td>
<td>0</td>
</tr>
<tr>
<td>F. Intifada</td>
<td>5617.0406</td>
<td>6116.8028</td>
<td>0.918297</td>
<td>-2.154501*</td>
<td>0.031201</td>
</tr>
<tr>
<td>S. Intifada</td>
<td>5289.7807</td>
<td>6447.6763</td>
<td>0.820417</td>
<td>-4.492573**</td>
<td>0.000007</td>
</tr>
</tbody>
</table>

*Significant with α = .05, ** Significant with α = .01

### 5.2 Research Question 2: Results and Analysis

*Did terrorists attack different targets during the Third and Fourth Wave / First and Second Intifada?*

Rapoport’s theorized (2004) that attacks exhibit unique characteristics during different periods, in part because terrorists have different agendas. He refers to the Third Wave of terrorism as the “Anti-colonial.” Radil and Flint (2015) postulate that if the Four-Wave model is accurate, attacks during the Fourth Wave should decrease in historically disputed places. Results show that there was a difference in attacks by area between the Third and Fourth Waves. Attacks in the West Bank, perhaps the most contested region, was attacked the most during the Third Wave. However targets were predominantly civilians, not government entities as would be expected from groups that were primarily focused in toppling state powers. Nevertheless, descriptive statistic results show that government targets were attacked more often during the Third Wave, by about 10% (Table 9). Attacking largely civilian targets during all periods may be as a result of the tensions between both populations and unique to the study area.

During the Fourth Wave, or the “religious” wave, attacks increased in Israel. If a prime goal of terrorists was to attract large audiences, Israel would certainly be where
most attacks would be expected to occur. Civilians were also primary targets during the Fourth Wave, however attacks on “other government” targets decreased. Descriptive statistic results support the idea that terrorists shifted some of their focus to different targets during the Fourth Wave (Table 9). However, a decrease in attacks against diplomats does not coincide with the wave-model as Rapoport (2002) has stated that Fourth-Wave groups have increased their attacks against military and government targets. Suicide attacks which the model identifies as a key feature of the Fourth Wave have occurred more often (Table 8). The results appear to reinforce some features of the model, but not all of them.

The results for both Intifadas were different. Attacks during the Second Intifada increased in Israel, but decreased in the Gaza Strip and the West Bank. There were significantly more fatalities than casualties (non-fatalities) as a result of the attacks. The Intifadas reinforce certain features of the Four-wave model more than the results of the waves. A significant decrease in assassinations and an increase in bombings and explosions indicate that terrorists utilized Fourth-Wave methods during the second Intifada (Rapoport 2004). Most other methods, with the exception of armed assaults which increased during the Second Intifada, were consistent.

5.2.1 Statistic Results for Both Waves

There were a total of 3,592 incidents used in this study. There were 1,106 attacks during the Third Wave and 2,486 during the Fourth Wave. Terrorists struck in the West Bank (42.23%) and Israel (37.92%) most often. The Gaza Strip was a less frequent target (19.85%). The West Bank was far less attractive as a target (-16.31%) during the Fourth Wave (Table 7). However, Israel (9.58%) and the Gaza Strip (6.73%) were more
dangerous during the Fourth Wave. As expected, attacks in both waves produced far more casualties (non-fatalities) than fatalities (Table 8), and suicide attacks were carried out more frequently during the Fourth Wave.

Table 7  Frequency of attacks by location for both waves.

<table>
<thead>
<tr>
<th>Location</th>
<th>Wave 3</th>
<th></th>
<th>Wave 4</th>
<th></th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Percent</td>
<td>n</td>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>Gaza Strip</td>
<td>168</td>
<td>15.18987342</td>
<td>545</td>
<td>21.9227675</td>
<td>6.73289408</td>
</tr>
<tr>
<td>Israel</td>
<td>346</td>
<td>31.28390597</td>
<td>1016</td>
<td>40.86886565</td>
<td>9.58495968</td>
</tr>
<tr>
<td>West Bank</td>
<td>592</td>
<td>53.52622061</td>
<td>925</td>
<td>37.20836685</td>
<td>-16.31785376</td>
</tr>
<tr>
<td>Total</td>
<td>1106</td>
<td>100.000000</td>
<td>2486</td>
<td>100.000000</td>
<td>0</td>
</tr>
</tbody>
</table>

The majority of targets during both waves were civilians: 55.24% for the Third Wave and 57.04% for the Fourth Wave (Table 9). The percent change for military and police targets was minimal. The largest percent change between waves was for the category “other government” – see Table 3 for reference. Targets included in the category of “other” also saw an increase (5.10%) from the Third Wave to the Fourth. To test the significance of the results, a chi-square test was conducted. The difference are large and statistically significant (Critical chi-square = 12.78, \( p = .012 \)). Armed assault and assassination methods employed by terrorists had the most drastic change between waves. Armed assault attacks increased by 10.74% and assassinations decreased by
12.20% in the Fourth Wave (Table 10). Surprisingly, most of the other methods used by terrorists were found to be reasonably consistent in both periods.

Table 9 Frequency of attacks by target type for both waves.

<table>
<thead>
<tr>
<th>Target Type</th>
<th>Wave 3</th>
<th>Wave 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Percent</td>
</tr>
<tr>
<td>Military</td>
<td>182</td>
<td>16.4556962</td>
</tr>
<tr>
<td>Police</td>
<td>47</td>
<td>4.24954792</td>
</tr>
<tr>
<td>Other Government</td>
<td>249</td>
<td>22.51356239</td>
</tr>
<tr>
<td>Civilian</td>
<td>611</td>
<td>55.24412297</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
<td>1.537070524</td>
</tr>
<tr>
<td>Total</td>
<td>1106</td>
<td>100.0000000</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 12.78755685 \]

\[ \text{probability} = 0.012361858 \]

Table 10 Frequency of attacks by attack type for both waves.

<table>
<thead>
<tr>
<th>Attack Type</th>
<th>Wave 3</th>
<th>Wave 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Percent</td>
</tr>
<tr>
<td>Armed Assault</td>
<td>149</td>
<td>13.47197107</td>
</tr>
<tr>
<td>Bombing/Explosion</td>
<td>617</td>
<td>55.78661844</td>
</tr>
<tr>
<td>Facility/Infrastructure Attack</td>
<td>54</td>
<td>4.882459313</td>
</tr>
<tr>
<td>Hijacking</td>
<td>1</td>
<td>0.090415913</td>
</tr>
<tr>
<td>Hostage Taking (Barricade Incident)</td>
<td>5</td>
<td>0.452079566</td>
</tr>
<tr>
<td>Hostage Taking (Kidnapping)</td>
<td>22</td>
<td>1.98915009</td>
</tr>
<tr>
<td>Unarmed Assault</td>
<td>7</td>
<td>0.632911392</td>
</tr>
<tr>
<td>Unknown</td>
<td>8</td>
<td>0.72327306</td>
</tr>
<tr>
<td>Total</td>
<td>1106</td>
<td>100.0000000</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 22.65885991 \]

\[ \text{probability} = 0.003830984 \]

5.2.2 Statistic Results for Both Intifadas

The results of these analyses also indicate that there was a difference in attack intensity between the two Intifadas. GIS models show that there were more attacks with a high intensity during the Second Intifada, than the first. However their spatial distribution was not very different; many of the same locations were attacked. The area which sustained the most attacks during both intifadas was the West Bank, but descriptive statistics show that the overall frequency of attacks decreased by 7% from the First to the Second Intifada (Table 11). The percent of attacks in the Gaza Strip also decreased from
the First to the Second Intifada by 6%. There were only 4 more attacks in Israel during the Second Intifada, but its share of all attacks increased by 13%. Descriptive statistics for casualties, fatalities, and suicide attacks reveal a pattern similar to the data from the two waves (Table 12). More casualties (non-fatalities), than fatalities, were reported for both Intifadas, but suicide attacks were significantly higher during the Second Intifada.

Table 11 Frequency of attacks by location for both intifadas.

<table>
<thead>
<tr>
<th>Location</th>
<th>F. Int</th>
<th>S. Int</th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaza Strip</td>
<td>282</td>
<td>129</td>
<td>-6.165623071</td>
</tr>
<tr>
<td>Israel</td>
<td>181</td>
<td>185</td>
<td>13.81691507</td>
</tr>
<tr>
<td>West Bank</td>
<td>523</td>
<td>261</td>
<td>-7.651292001</td>
</tr>
<tr>
<td>Total</td>
<td>986</td>
<td>575</td>
<td></td>
</tr>
</tbody>
</table>

Table 12 Descriptive statistics for both intifadas.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>mean</th>
<th>SD</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. Int Casualties</td>
<td>2028</td>
<td>2.056</td>
<td>7.61</td>
<td>0</td>
<td>148</td>
</tr>
<tr>
<td>S. Int Casualties</td>
<td>4928</td>
<td>8.57</td>
<td>19.05</td>
<td>-1</td>
<td>179</td>
</tr>
<tr>
<td>F. Int Fatalities</td>
<td>607</td>
<td>0.61</td>
<td>1.95</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>S. Int Fatalities</td>
<td>863</td>
<td>1.5</td>
<td>3.24</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>F. Int Suicide</td>
<td>7</td>
<td>0.007</td>
<td>0.08</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>S. Int Suicide</td>
<td>138</td>
<td>0.24</td>
<td>0.42</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

The percent change for target types from the First to the Second Intifada was most pronounced in military (-6%) and civilian (+8%) targets (Table 13), but these changes are not statistically significant. The biggest change is evident in the methods of attack (Table 14). Assassinations were common during the First Intifada, but decreased by about 40% during the second. Replacing assassinations were bombings and explosions. Armed assaults also increased by 12% during the Second Intifada.
Table 13  Frequency of attacks by target type for both intifadas.

<table>
<thead>
<tr>
<th>Target Type</th>
<th>F. Intifada</th>
<th>S. Intifada</th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military</td>
<td>241</td>
<td>104</td>
<td>-6.355234148</td>
</tr>
<tr>
<td>Police</td>
<td>57</td>
<td>4</td>
<td>-1.780933063</td>
</tr>
<tr>
<td>Other Government</td>
<td>140</td>
<td>76</td>
<td>-0.981391657</td>
</tr>
<tr>
<td>Civilian</td>
<td>538</td>
<td>359</td>
<td>7.870888085</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>13</td>
<td>1.246670782</td>
</tr>
<tr>
<td>Total</td>
<td>986</td>
<td>575</td>
<td></td>
</tr>
</tbody>
</table>

χ² 4.778523517

probability 0.310786334

Table 14  Frequency of attacks by attack type for both intifadas.

<table>
<thead>
<tr>
<th>Attack type</th>
<th>F. Intifada</th>
<th>S. Intifada</th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armed Assault</td>
<td>213</td>
<td>197</td>
<td>12.32584154</td>
</tr>
<tr>
<td>Assassination</td>
<td>409</td>
<td>10</td>
<td>-39.39319887</td>
</tr>
<tr>
<td>Bombing/Explosion</td>
<td>193</td>
<td>348</td>
<td>40.19205617</td>
</tr>
<tr>
<td>Facility/Infrastructure Attack</td>
<td>53</td>
<td>8</td>
<td>-3.956770152</td>
</tr>
<tr>
<td>Hijacking</td>
<td>2</td>
<td>0.342465753</td>
<td></td>
</tr>
<tr>
<td>Hostage Taking (Barricade Incident)</td>
<td>4</td>
<td>12</td>
<td>1.65278447</td>
</tr>
<tr>
<td>Hostage Taking (Kidnapping)</td>
<td>33</td>
<td>1</td>
<td>-3.145350038</td>
</tr>
<tr>
<td>Unarmed Assault</td>
<td>56</td>
<td>4</td>
<td>-4.943209197</td>
</tr>
<tr>
<td>Unknown</td>
<td>32</td>
<td>2</td>
<td>-2.873614649</td>
</tr>
<tr>
<td>Total</td>
<td>995</td>
<td>584</td>
<td></td>
</tr>
</tbody>
</table>

χ² 1068.259265

probability 2.7395E-225

5.3 Research Question 3: Results and Analysis

Can GIS methodologies be used to create predictive models that highlight different aspects of terrorist attacks?

The spatial patterns and intensity of terrorist attacks were successfully identified for all periods. GIS results yielded interesting patterns in the frequency and intensity of attacks. The most important implication of the results is that cities, which were attacked repeatedly, did not always sustain the most casualties. Additionally, using multiple tools proved to be a sound analytic strategy because some methods proved more capable than others of revealing trends in the data.
5.3.1 Collect Events Results

Results of these analyses indicate that most cities are not attacked repeatedly; only few cities appear to be high priority targets for terrorists. The results showed that 187 of 191 cities attacked during the Third Wave (1970 - 1990) had fewer than 50 terrorism incidents. Only four cities, Gaza, Nablus, Jerusalem, and Tel Aviv sustained over 50 attacks and of those four, only Gaza and Jerusalem sustained more than 100 (Figure 2). Terrorists attacked Gaza 106 times and Jerusalem 290 times. Nablus was attacked 69 times and Tel Aviv 87 times. During the Fourth Wave (1991-2014), 391 cities out of 400 were attacked fewer than 50 times. Of the nine which sustained the most attacks, five were attacked fewer than 100 times. Three cities (Hebron, Jerusalem, and Sderot) were attacked between 100 and 200 times, and Gaza was attacked the most, 255 times. Only eight cities were attacked between 25 and 50 times, the rest were attacked fewer than 10 times.

During the Palestinian Intifadas all cities sustained fewer than 100 attacks. During the First Intifada, 180 out of 183 cities registered fewer than 20 attacks (Figure 3). The three cities which were attacked more than 20 times were Bethlehem (22), Jenin (26), and Ramallah (31). During the Second Intifada a similar pattern emerged. Most cities (97%), 165 out of 170 cities were attacked fewer than 20 times. Four were attacked between 20 and 30 times – Gaza (22), Hebron (26), Sderot (24), and Tel Aviv (25). Jerusalem was attacked 62 times.
5.3.2 Getis-Ord $G_i^*$ Results

Results show different statistically significant cluster patterns for attack distribution and attack intensity between both waves, indicating a change in terrorist tactics between both periods. Using all weighted points, tests on Third Wave attacks revealed clustering around the cities of Gaza and Jerusalem (Figure 4). When Jerusalem was removed from the analysis, the area around Gaza became more pronounced and the area around Tel Aviv was identified as a hotspot (Figure 5). When their intensity was analyzed (all incidents included), only northern Israel had statistically significant clusters (Figure 6). The test that excluded Incidents without human casualties showed hotspots around Jerusalem (Figure 7). Cold spots also appeared in the Gaza Strip and near Nablus.

Gaza City and Moshav Karmel were significant hotspots during the Fourth Wave (Figure 6). Removing Gaza City from consideration allowed cities in the southern region of the West Bank and some cities in Israel, adjacent to the Gaza Strip, to appear as
secondary hotspots (Figure 7). The analyses using intensity showed similar results, including the identification of coldspots in most of the Gaza Strip and in the northern areas of the West Bank.

Figure 4  Getis-Ord Gi* results for the weighted points layers.

Figure 5  Getis-Ord Gi* results excluding the city with the most attacks; Wave 3 = Jerusalem, Wave 4 = Gaza.
Analyses on the Intifadas also show a difference in the distribution of clusters between both eras. The models show that intense attacks were more clustered and geographically spread out during the Second Intifada, indicating a change in tactics between the two events. GIS models identified statistically significant clusters around the cities Raba and Mazraa el Sharkiya during the First Intifada (Figure 8). There was no reason to run the tool a second time for the First Intifada because there were no outliers. Analysis on the intensity of attacks (all incidents included), showed the southern region of the West Bank as exhibiting statistically significant high clusters (Figure 10). Running the tool without incidents with an intensity value of zero revealed similar results. In addition to the cities identified as hotspots in the results of the first test, the cities of Beit Ummar, Gush Etzion, Jaba, Jaffa, and Sa’ir were also identified as hotspots (Figure 11).

During the Second Intifada the northern region of the Gaza Strip stood out as a terrorist hotspot, and Jerusalem was a secondary area of activity (Figure 8).
Jerusalem from the analysis, the Gaza Strip appears more plainly as a hotspot (Figure 9).

The tests that analyzed the intensity of attacks displayed similar patterns (Figures 10 and 11). Low intensity attacks were more common in most of the Gaza Strip and north of Jerusalem. Hotspots for especially violent attacks appeared along Israel’s northern coast and Jerusalem most often.

Figure 8 Getis-Ord Gi* results for the weighted points layers.  
Figure 9 Getis-Ord Gi* results excluding the city with the most attacks; F. Intifada = None, S. Intifada = Jerusalem.
5.3.3 Local Moran’s I Results

Local Moran’s I results reinforce that few cities are attacked often. The cities identified as outliers (features surrounded by features with dissimilar values) during both waves were almost identical. The more interesting pattern from these results is evident in the attack intensity analyses because they indicate that attacks which are lethal do not always cluster. A large number of high outliers (high-intensity attacks surrounded by low-intensity attacks) were identified in the Gaza Strip during the Fourth Wave. Results for both wave tests were similar when outliers were included and excluded. The cities of Jerusalem and Nablus appeared as high outliers (Figure 12). Removing Jerusalem from the analysis identified Hebron and Gaza as high outliers (Figure 13). When their intensity was analyzed (all incidents included), Lod, Jerusalem and Tel Aviv appeared as high
outliers (Figure 14). Only Lod was shown to be a high outlier when incidents with a value of zero were removed (Figure 15).

Results for the Fourth Wave analysis identified Hebron, Jerusalem, and Nablus as high outliers (Figure 12). Removing Gaza from the equation also showed Tel Aviv as a high outlier (Figure 13). The test which analyzed their intensity yielded similar results when all the incidents were included and when incidents with an intensity of zero were excluded (Figures 14 and 15). Most high outliers appeared in the Gaza Strip and in the West Bank.

![Wave 3](image12.png) ![Wave 4](image13.png)

Figure 12  Anselin Local Moran's I results for the weighted points layers.  Figure 13  Anselin Local Moran's I results excluding the city with the most attacks; Wave 3 = Jerusalem, Wave 4 = Gaza.
Intifada models show that attacks clustered around the Gaza Strip and spatial outliers were identified mostly in the West Bank during the Second Intifada. The results for the First Intifada indicated that Bethlehem, Haifa, and Ramallah sustained a high number of attacks in comparison to neighboring cities (Figure 16). Results for the intensity test identified Afula, Hebron, Jerusalem, Qalqilya and Tel Aviv as high outliers (Figure 18). Removing low-intensity attacks showed Gaza and Rafah as high outliers (Figure 19).

For the Second Intifada, the test which included Jerusalem identified Hebron, Jerusalem, Nablus, Tel Aviv, and Tulkarm as high outliers (Figure 16). When Jerusalem was removed, the same cities showed up as outliers, in addition to Jenin and Ramallah (Figure 17). The results for the intensity analyses identified some low outliers. There was little variation with the test that included all the incidents and the test that excluded incidents with an intensity of zero (Figures 18 and 19).
5.3.4 Spatial Join Results

Results for the waves and Intifadas tests revealed that attack intensity has increased during the Fourth Wave and Second Intifada, giving credence to the notion that
terrorism has become more intense in the current era. The models also indicate that attacks increased and had a broader spatial distribution during the Fourth Wave, but attacks during both Intifadas appear to have occurred in similar locations. During the Third Wave, most Israeli and Palestinian regions registered fewer than 24 attacks (Figure 20). Although some of those regions sustained the most intense attacks (Figure 21). In the Fourth Wave, most regions with devastating attacks appeared in the northern coast of Israel. First and Second Intifada maps showed little difference in attack frequency, but indicated that intensity increased during the Second Intifada (Figures 22 and 23).

**Figure 20** Spatial join maps depicting the volume of attacks per region or governorate for both waves.  

**Figure 21** Spatial Join maps depicting the average attack intensity per region or governorate for both waves.
5.3.5 Kernel Density Results

The results for these analyses further imply that high-intensity attacks do not always occur in places that are attacked often. Additionally, while the distribution of attacks appears to be relatively similar during both waves and both Intifadas, results show that attacks were more intense during the Fourth Wave and Second Intifada. The test on the Third Wave revealed hotspots around the cities of Gaza, Jerusalem, Nablus, and Tel Aviv (Figure 24). However, when the Kernel Density map was created with intensity values a different pattern emerged. While most of the same locations appear as hotspots, the results show that attacks with a high intensity occurred primarily in Jerusalem. The implication is that cities which were attacked often did not sustain the most intense attacks. Additionally, the hotspots in northern Israel indicate that terrorist attacks were intense in that area but happened less frequent (Figure 25). Fourth Wave results show hotspots in many of the same locations but they are more pronounced. It hints that more attacks were carried out during the Fourth Wave. The intensity map indicates that attacks
against Tel Aviv caused a lot of human damage, even though it was not attacked as often. Hotspots in northern Israel also indicate that attacks were less frequent, but intense.

Hotspots for both Intifadas can be seen in many of the same areas (Figure 26), but the intensity maps were different. Areas around Gaza, Jerusalem, and the northern coast of Israel stick out as the most intense hotspots (Figure 27). It is interesting to note that not all of the hotspots generated by mapping weighted points appears as hotspots in the results for the intensity test. The pattern reinforces that cities which are attacked repeatedly do not always sustain the most intense attacks.

Figure 24  Kernel density risk maps depicting weighted point values for both waves.  
Figure 25  Kernel density risk maps depicting attack intensity for both waves.
5.4 Conclusions

The analyses for this thesis revolved around finding characteristic differences between different periods. Namely, during the Third and Fourth Waves. The objectives were to analyze the distribution, frequency, and intensity of attacks. Two main conclusions emerged from the results. First, attacks in Israel and Palestine were concentrated in many of the same locations during both waves. Most occurred around Gaza, Jerusalem, and Tel Aviv. Second, tests that measured intensity showed that cities which are attacked often are not the only areas susceptible to highly lethal attacks.

Rapoport hinted that religion may not be driving terrorist attacks in Israel and Palestine. As a result, active groups in those areas may relate more to the Third Wave (New Left) terrorists, rather than the Fourth (Religious). The objective of establishing a secular state from the Palestinian side is likely still at the forefront of terrorists’ objectives. However it appears that methods which became popular in the Fourth Wave,
namely suicide explosions, have been put to use in great numbers within the study area. A culture of reverence towards the individuals who commit the act has even manifested (Whitehead and Aburafha 2008). However, when all bombing and explosion methods were considered, results show that there has been a decrease in that tactic during the Fourth Wave. Additionally, assassinations which were a key method of attacks during the Third Wave have not seen continued use in the Fourth. And while civilians have been the most sought targets during both waves, other targets which would support notions of period differences were identified in the results. Namely that targeting government officials has decreased during the Fourth Wave.

It is difficult to conclude which location, i.e., the Gaza Strip, the West Bank, or Israel, has been the most disputed area. Israelis have repeatedly expressed that they will not cede their land to any nation. That sentiment directly affects the prospects of establishing of a sovereign Palestinian State. Radil and Flint (2015) found that in India, most of the same locations have been attacked during the Third and Fourth Wave. If the wave model is correct, they postulate that a change in attack distribution should have been apparent in their analysis. They infer that attacks should not occur as often in areas which have been traditionally disputed. This thesis found that attacks have decreased in the West Bank and increased in Israel and the Gaza Strip during the Fourth Wave.

The increase in attacks on Israel makes sense from the Fourth Wave perspective but the increase in the Gaza Strip does not. It seems logical that terrorists would attack Israel more often in order to reach a wider audience, but the attacks in the Gaza Strip would seem counter to that strategy. One conclusion that may be drawn is that the study
area is limited in number of ideal targets. Israel is not like China or the U.S., with many
dozens of large cities that would make ideal targets for terrorists.

Another presumed feature of contemporary terrorism is that attacks have become
more lethal. Unfortunately, the results for this analysis corroborate that statement; all GIS
results support that idea. However, it is difficult to conclude that religion is the direct
cause of more lethal attacks. Tensions between both nations’ populace continue to grow
and are mainly tied to nationalistic differences and land issues – mentions of a Third
Intifada (“Palestinian uprising”) have already begun to make headlines in various news
reports. The first two Intifadas arose to challenge the Israeli occupation of the Palestinian
territories. If or when a Third Intifada manifests it will likely be for the same reason.

The analyses on the Intifadas also indicate that, in some aspects, terrorists
behaved differently during both periods. As it was the case during both waves, the
analyses of Intifada data showed that intense attacks did not only occur in cities that were
attacked repeatedly. Moreover, attacks against Israel increased in the Second Intifada,
while attacks against the Gaza Strip and the West Bank decreased. Even though
bombings and explosive methods were used often during both waves, overall they
decreased during the Fourth Wave. The surprising thing about both analyses (Waves and
Intifadas) was that hijackings and taking hostages seldom occurred, relative to other
attack methods.

The models generated from the GIS analyses proved to be highly informative.
Predicting the next terrorist target is likely an impossible feat without the cooperation of
multiple agencies and detailed information on potential actors. However, GIS models can
serve as a guide to infer where terrorist may be looking to strike next. Additionally, keeping in mind that attacks of high intensity are not restricted to “popular” targets is an important implication. GIS models that display low attack frequency/high intensity targets may provide agencies needed information to allot more resources to counter terrorism in those areas.

Although not everything the wave-model outlines fit the study area, referencing it was a good approach to analyze a longitudinal terrorism dataset. Moreover, the GTD proved to be very useful, regardless of its limitations. Future studies on terrorism would do well to reference both things. The GTD can still be used to further analyze terrorism involving Israel and Palestine. One thing this research did not delve into was attacks that have been carried out against Israelis or Palestinians outside of their heartland. If the wave model is an indication of globalized terrorism, incidents involving either or both populations should be apparent. Particularly during the Third Wave. Finding demographic data at a smaller level than regions or governorates would also be more ideal in future research. Even though not all regression tests were fruitless, some did not provide significant results, (e.g., population density/attack intensity). The GIS models indicate that attacks were more intense during certain periods but the tests did not consider a population variable. Thus, the Four-Wave model and other theories which indicate that attacks are very different in the current era cannot be completely validated. Research in other areas also has to be conducted as the results presented here only pertain to Israel and Palestine.
References


