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Spatial and Temporal Patterns of Terrorist Attacks by ETA 1970 to 2007

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Abstract Rational choice perspectives maintain that seemingly irrational behavior on the part of terrorist organizations may nevertheless reflect strategic planning. In this paper we examine spatial and temporal patterns of terrorist attacks by the Spanish group ETA between 1970 and 2007. Our analysis is guided by a public announcement by ETA in 1978 that the group would shift from emphasizing attacks in the Basque territory to instead launch attacks more widely in the hopes of exhausting the Spanish government and forcing it to abandon the Basque territory. This announcement suggests that prior to the end of 1978 ETA attacks were based mostly on controlling territory in the Basque region that they hoped to rule; and after 1978 the organization decided to instead undertake a prolonged war of attrition. Accordingly, we argue that before the end of 1978 ETA was mostly perpetrating control attacks (attacking only within the Basque territories) and that the diffusion of attacks between provinces was mostly contagious (spreading contiguously). After the 1978 proclamation, we argue that the attack strategy shifted toward attrition (attacking in areas outside of the Basque territories) and that the attacks were more likely to diffuse hierarchically (spreading to more distant locations). As predicted, we find that after ETA moved toward a more attrition based attack strategy, subsequent attacks were significantly more likely to occur outside the Basque region and to target non-adjacent regions (consistent with hierarchical diffusion). We also find that hierarchical diffusion was more common when a longer time elapsed between attacks (a likely consequence of the fact that more distant attacks require more resources and planning) and that attacks against Madrid were unlikely to be followed immediately by more attacks on Madrid or surrounding provinces. After ETA announced a shift in policy, they maintained a highly dispersed attack strategy even during their period of decline. Using information about

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where and when prior attacks occurred could provide useful information for policy makers countering groups like ETA.

Keywords Terrorism · Spatial data analysis · Rational choice · Spain · Control and attrition attacks · Contagious and hierarchical diffusion

Introduction

Over the past several decades, the rational choice perspective has been applied to a wide variety of criminal behavior, including drunk driving (Nagin and Paternoster 1993), burglary (Wright and Decker 1994), robbery (Wright and Decker 1997), shoplifting (Piquero and Tibbetts 1996), income tax evasion (Klepper and Nagin 1989), drug selling (Jacobs 1996), and white-collar crime (Paternoster and Simpson 1996; Simpson et al. 1998). Despite the fact that terrorist attacks often appear irrational, a growing number of studies have demonstrated that rational choice explanations are nevertheless useful for understanding terrorism (e.g., Wilkinson 1986; Hoffman 1998; Pape 2005; Dugan et al. 2005; Kydd and Walter 2006; Enders and Sandler 2006; Clarke and Newman 2006). Crenshaw (1998, p. 7) characterizes terrorist violence as ‘‘an expression of political strategy’’ and claims that it represents ‘‘a willful choice made by an organization for political and strategic reasons.’’ And Sandler and Arce (2003, p. 320) point out that the predictable responses of terrorist groups to changes in sanctions and rewards aimed at constraining their behavior is strong evidence for their rationality.

In this paper we begin with the assumption that terrorist attacks are often rational and explore the possibility that the spatial and longitudinal patterns of attacks may provide important insights into the strategies employed by terrorists. Further, understanding these strategies might be useful not only for advancing our understanding of rational choice perspectives in general, but ultimately for providing more effective methods of countering terrorist violence.

Quantitative analyses of the spatial distribution of crime have greatly expanded with recent research examining whether crimes cluster in specific areas (Roncek 2000; Sherman et al. 1989; Weisburd et al. 1992; Weisburd and Green 1994) and areas and times (Johnson and Bowers 2004; Townsley et al. 2003; Johnson et al. 2007; Ratcliffe and Rengert 2008), whether spatial clusters can be explained by demographic and ecological characteristics of areas (Messner et al. 1999; Morenoff et al. 2001; Roncek and Bell 1981; Roncek and Maier 1991) and the processes by which crimes spread to neighboring or more distant areas (Cohen and Tita 1999; Messner et al. 1999; Morenoff and Sampson 1997; Tolnay et al. 1996). However, with a few recent exceptions (Berrebi and Lakdawalla 2007; Townsley et al. 2008; Johnson and Braithwaite 2009), similar analyses have not been extended to the study of terrorism. We begin this research with the assumption that the strategies employed by terrorists may provide important insights into the spatial and longitudinal patterns of their attacks.

Our research focuses on ETA (Euskadi ta Askatasuna or Basque Homeland and Freedom), a terrorist organization whose principle objective has been to gain independence for a Basque homeland in northern Spain and southern France. ETA provides a strategic case study because its nearly continuous attacks over the past four decades have been closely monitored and reported. This allows us to consider how the strategies of terrorist groups may be related to their geospatial attack patterns over time. Especially critical here is a decision by ETA in the late 1970s to switch its strategy for independence from seeking to win an outright military victory in the Basque region of Spain to instead undertaking a ''war of attrition'' (Sanchez-Cuenca 2007, p. 295) to force the Spanish government to capitulate to its demands.

Based on this strategic shift, we find it useful here to distinguish between *control* attacks, which take place in the territory that the terrorist groups hopes to eventually govern, and *attrition* attacks, which take place in more distant locations and are instead aimed at exhausting the government economically, politically, and ultimately psychologically into agreeing to group demands (de la Calle and Sanchez-Cuenca 2006). The distinction between control and attrition attacks also has important implications for how terrorist attacks diffuse (or desist) over time: based on Cohen and Tita (1999), we define as *contagious*, diffusion that spreads through direct contact between spatial units in the terrorist organization's base of operations; and *hierarchical*, diffusion that spreads to more distant locations outside of the operational base. In this research, we hypothesize that before ETA's 1978 policy shift, they emphasized control attacks. Given that control attacks take place in the terrorist's main base of operations, we expect that the control strategy will be associated with contagious diffusion. We also hypothesize that after the 1978 policy shift, ETA's strategy became more attrition based. And given that attrition attacks take place in more distant locations, we expect that attacks during the second period will be more likely to diffuse hierarchically.

In this research we define terrorism as ''the threatened or actual use of illegal force and violence to attain a political, economic, religious or social goal through fear, coercion or intimidation'' (LaFree and Dugan 2007, p. 184) and use the Global Terrorism Database (GTD) to examine nearly 2,000 terrorist attacks by ETA that took place between 1970 and 2007. We begin by examining empirical support for our basic hypothesis that ETA's declared 1978 change in strategy will manifest through a shift from control attacks and contagious diffusion to attrition attacks and hierarchical diffusion. After finding some evidence that attrition attacks did become more common following the 1978 policy change, we next consider whether a set of temporal and geospatial measures can help us predict whether a particular attack will be in the same province, an adjacent province or a more distant province. We conclude by considering the extent to which findings such as these can inform counter-terrorism policies.

The Spatial – Temporal Concentration of Crime and Terrorism

The idea that violence is highly concentrated across spatial units can be traced back at least as far as Quetelet's (1831/1984) pioneering study of the distribution of crime in France, Belgium and Holland. Similarly, nearly a century later Shaw (1929) observed the tremendous variation in the concentration of violent crime rates across Chicago neighborhoods, with some areas producing a great deal of violent crime and others virtually none. More recently, Sherman et al. (1989) examined emergency calls for the Minneapolis Police Department and found that crime reports were highly concentrated in a few locations, which they referred to as ''hot spots.'' In a follow-up study, Sherman and Weisburd (1995) found that most of the calls for police service came from a relatively small percentage of addresses. Only 4.4% of the addresses and intersections placed 3 or more calls for service for serious crime; and only 0.3% phoned the police 20 or more times. Similar patterns were observed in Indianapolis where Sherman (1995) found that all of the calls for service relating to gun crimes came from just 3% of the addresses in the city (see also Eck et al. 2000).

An important corollary finding (e.g., Wiles and Costello 2000; Rossmo 2000; Johnson et al. 2007) suggests that ordinary criminal offenders do not travel far to select their targets. Cromwell et al. (1991), Maguire (1982), and Rengert and Wasilchick (2000) claim that offenders select targets near where they live because they prefer to operate in familiar areas. Pease (1998) points out that once a crime has been committed, it becomes easier to repeat that crime than to identify a new location (see also Johnson et al. 2007, p. 205). In support, Ericsson (1995) found that 76% of the burglars he interviewed had burglarized the same houses between two and five times. Similarly, Everson (2003) found that at least 37% of all criminal offenses against a specific target were committed by the same offender. In a recent analysis of space-time patterns of burglary in ten areas located in five different countries, Johnson et al. (2007, p. 215) conclude that when a burglary occurs at one location, it substantially increases the chances that another burglary will happen in a nearby location and in a short period of time.

Clarke and Newman (2006, p. vii) argue that ''terrorism is a form of crime in all essential respects'' and predict that terrorist attacks will cluster in time and space in the same way as ordinary crimes. In their analysis of counter terrorist strategies, they (p. 139) stress that terrorists, like other criminals, are closely constrained by geography and ''will choose targets that are close to their operational base'' and that (p. 154) ''Proximity to the target is the most important target characteristic to terrorists.'' However, thus far very few empirical studies have examined the geospatial and longitudinal characteristics of attacks by terrorist organizations. An important exception is recent research by Smith (2008) and his colleagues (Smith and Damphousse 2006; Cothren et al. 2008), who studied 59 high profile terrorist attacks originating in the United States and found that 44% of the perpetrators lived within thirty miles of the target they attacked. Terrorists that were not U.S. citizens were especially likely to attack targets close to their homes. Smith (2008) speculates (p. 2) that terrorists that are not citizens may stay close to home because of their immigration status, lack of transportation, lack of knowledge of the urban landscape or a desire to avoid attention.

In the research that follows, we examine the spatial-geographic concentration and diffusion of terrorist attacks by ETA over a nearly 40-year period and consider the strategic implications of their targeting choices. A unique feature of the attacks by the nationalist group ETA is that there is evidence that the organization went through a major change in their strategy for selecting targets in the late 1970s—a situation that is likely uncommon for ordinary crimes that lack a well articulated organizational structure.

Control Versus Attrition Attacks

According to DeNardo (1985), all terrorist groups must struggle between a strategy that emphasizes building a base of popular support and a strategy aimed at securing wider recognition through immediate violent action. McCormick (2003, pp. 495–496) points out that these two strategies impose different constraints, which he calls ''security'' and ''influence.'' Terrorist groups are constrained by the fact that they must maintain a minimum level of internal security to keep from being arrested or killed. This requirement suggests protecting an operational base. But at the same time, groups are also constrained by the fact that to be perceived as effective, they must continue to carry out shocking and highly visible attacks. This requirement puts a greater value on staging strikes outside the operational base. As Jenkins (1975, p. 4) famously observed, terrorism is in large part theatre and when terrorists begin to disappear from the media, it threatens their ability to mobilize new members, to increase the size of their organization, and to sustain a cohesive movement.

Nationalist terrorist organizations, those that seek independence or national liberation (Reinares 2005; Sanchez-Cuenca 2007), are among the most common of modern terrorist groups. Aside from ETA, other well-known nationalist groups include the Irish Republican Army (IRA) in Northern Ireland, the Liberation Front of Quebec in Canada, Hizbullah in Lebanon, the Liberation Tigers of Tamil Eelam (LTTE) in Sri Lanka, and the Fuerzas Armadas de Liberacion Nacional (FALN) in the United States. As with terrorist organizations in general, nationalist terrorist organizations must worry about both their security and their ability to influence the government and its citizens. After de la Calle and Sanchez-Cuenca (2006), we describe these two competing strategies for nationalist terrorist groups as *control* and *attrition*. On the one hand, nationalist organizations need to control the population of the territories they hope to eventually rule as a means of preserving their security and underscoring their resolve to be a governing force. As such, they may punish those who collaborate with the enemy or fail to abide by the rules being developed by the organization. On the other hand, nationalist groups want to stage violent attacks against the opposing State in order to wear it down and garner broader support for their independence. As sub-state entities, terrorist organizations generally have limited power to engage the State in a direct military fashion. Consequently, their alternative strategy is to inflict sufficient pain on the State to coerce its retreat. As de la Calle and Sanchez-Cuenca (2006, p. 5) point out, attrition attacks by terrorist organizations are more about psychological than physical hardship.

We regard control and attrition attacks as useful concepts but would not expect any terrorist organization to make absolute distinctions between them in staging their attacks, or certainly in announcing their attack plans. Our more limited goal here is to determine whether a decision by the leadership of a terrorist organization to move toward a more attrition-based strategy, as suggested by the 1978 pronouncement, produces a measurable shift in the geospatial patterns of their future attacks to areas outside their control base.

Contagious Versus Hierarchical Diffusion

The distinction between control and attrition attacks suggests a similar distinction in the processes by which diffusion occurs. To examine diffusion, we build on research of Cohen and Tita (1999) whose study of the spread of youth violence distinguishes between *contagious diffusion* that spreads through direct contact between spatial units, and *hierarchical diffusion* that spreads without direct contact. We apply similar logic to develop two competing processes by which ETA may have widened its spatial reach over time: During its early control phase before 1978 was it more likely to spread contagiously, starting with provinces that were contiguous to its established attack areas and during its later attrition phase (after 1978) was it more likely to spread hierarchically, skipping to more distant provinces?

While control and attrition may relate to the broad strategies of terrorist organizations, contagious and hierarchical diffusion can tell us more about how terrorist attacks increase (or decline) over time. We argue that control attacks are more likely to diffuse following a contagious pattern because both concentrate on attacks close to the base of operations. Conversely, when organizations diffuse their attack patterns hierarchically, we argue that their motivation is more likely attrition-based because the targeting is occurring over a broad area, far beyond the confines of the space the group hopes to eventually govern. For these reasons, we associate control attacks with contagious diffusion and attrition attacks with hierarchical diffusion throughout the remainder of the paper.

ETA's Shift to an Attrition Based Strategy

ETA is the only major remaining nationalist terrorist organization in Western Europe among those that emerged during the wave of political violence of the late 1960s and early 1970s. Although it was founded in 1959 during the dictatorship of Francisco Franco (Clark 1980; Reinares 2004; Sanchez-Cuenca 2007) and was originally a splinter group of the youth organization of the Basque Nationalist Party (PNV), it did not claim its first fatality until 1968. Its operational base is in the Basque Autonomous Community (BAC), which was established by the Spanish Government after the death of Franco in 1975 and consists of three provinces in the North of Spain (Alava, Guipuzcoa, and Vizcaya). The BAC has a combined population of 2.1 million people with more than half of the population residing in Vizcaya. Compared to Spain as a whole, the BAC is a wealthy region, with a GDP much higher than the Spanish average. Its economic strength likely accounts for the fact that it continues to attract immigrants. The BAC has considerable political autonomy within Spain, including its own separate Basque Parliament and government, police force (the Ertzaintza), educational and health system, and even a public television channel.

While the BAC is the administrative unit recognized by the Spanish government, many nationalists consider a much larger region to be the ''Basque Country'' (Euskal Herria). In addition to the three provinces of the BAC, some claim Navarra and the three Basque provinces in the South of France (the French Basque Country, or Iparralde). According to Sanchez-Cuenca (2009, p. 3), Basque nationalism is strongest in Vizcaya, Guipuzcoa and the north of Navarra. The push for a Basque state is much less popular in the French region of Iparralde, in the South of Navarra and in Alava. In this paper we regard the three provinces of the BAC as ETA's operational base.

Since its founding, ETA has survived major regime changes, has carried out negotiations with nearly every democratic government in Spain since Franco, has initiated several ceasefires, and has gone through a long-term cycle of growth and decline. But despite major changes over time, ETA has steadfastly remained a nationalist organization, intent on establishing a Basque homeland. However, as its struggle for an independent state wore on, its membership increasingly began to realize that encouraging the masses to rise up in opposition and thereby destroy the Spanish State was unrealistic. This feeling was likely emphasized by the death of Dictator Francisco Franco in 1975: If revolution had not broken out under a harsh dictator like Franco, how could it be expected in the much more tolerant democratic regime that followed? Thus, after 1978, ETA had largely shifted its strategy from one aimed at controlling the Basque region and encouraging the rest of the country to rise up in support of the movement, to a strategy based much more closely on pure attrition. This position is clearly enunciated in a 1978 ETA policy pronouncement (Letamendia 1994, p. 114):

> The function of the armed struggle is not to destroy the enemy, for that is utopian, but it is indeed to force him, through a prolonged psychological and physical attrition, to abandon our territory due to exhaustion and isolation.

In a 1988 interview an ETA spokesperson (Unzueta 1988, p. 51) captures the attrition mentality succinctly: ''We know that ETA cannot destroy the Spanish State…But the Spanish State cannot destroy us either.'' Sanchez-Cuenca (2007, p. 295) argues that this attrition strategy remained in effect for the next two decades, through the end of the period studied here.

Rational choice perspectives suggest that the decision-making of terrorist organizations is largely strategic. A major strategic choice for terrorist groups in general, and nationalist groups in particular, is the extent to which they focus their attacks on targets in their operational base versus attacking in more distant locations. We approach this choice by looking both at location of attacks and diffusion of attacks. To examine location, we distinguish control attacks, aimed at consolidating coveted political territory, as those attacks that take place within the original base of control or the BAC; and attrition attacks, aimed at wearing down the State, as those attacks targeting provinces outside the BAC. To examine diffusion, we distinguish contagious attacks, which occur in the same province or an adjacent province, from hierarchical attacks, which occur in non-adjacent provinces. Our major hypothesis is that following ETA's policy shift in 1978, attrition-based attacks and hierarchical diffusion will become significantly more common.

Data and Methods

Data

Our analysis is based on 1,993 terrorist attacks attributed to ETA from 1970 to 2007 drawn from the Global Terrorism Database (GTD) compiled by LaFree and Dugan (2007, 2009a, b).[1] Because the GTD is described in detail elsewhere, we offer only a brief explanation here. The GTD was collected by trained researchers who recorded terrorism incidents from wire services (including Reuters and the Foreign Broadcast Information Service), U.S. and foreign government reports, and U.S. and foreign newspapers (including the *New York Times*, the *British Financial Times*, the *Christian Science Monitor*, the *Washington Post*, the *Washington Times*, and the *Wall Street Journal*), and more recently, the Internet. A similar basic coding scheme has been used during the entire 38 years of data collection.[2] A major advantage of the GTD compared to other open source databases is that from its inception, it tracked the kind of domestic terrorist attacks that have characterized ETA.

Our analysis begins in 1970, just 2 years after ETA claimed its first fatality,[3] and concludes in 2007 when ETA attacks had fallen to their lowest level in nearly four decades. Most of the attacks attributed to ETA in the GTD did not identify a specific military wing of ETA. In the analysis we include all cases that either named ETA directly, or attributed attacks to the various military wings of ETA (ETApm, ETAm, Iraultza, Grupo Vasco Iraultza, Iraultza Aske).[4] We also include all cases attributed to ETA in other parts of the world. This includes 15 cases from the Basque region of Southern France and 31 cases from Western Europe (France, Italy, Germany, Belgium, and the Netherlands) and

[1] Data from 1993 were lost by PGIS in an office move and we have never been able to successfully restore them. We, therefore, treat 1993 as missing.

[2] The current analyses are based on GTD data downloaded on May 1, 2009.

[3] Sanchez-Cuenca (2009, p. 613) reports only three ETA-related casualties between 1968 and 1970, the year when our analysis begins.

[4] On the eve of Franco's death in 1975, ETA split into two organizations, the political-military ETA (ETApm) and the military ETA (ETAm). ETApm, the larger and more powerful of the two, favored political participation and in 1981, renounced the use of terrorism and began full participation in electoral politics. Most of the attacks and fatalities attributed to ETA in our data base were actually carried out by ETAm.

Mexico.[5] We exclude from the analysis 594 terrorist attacks that occurred in Spain during this period in which the GTD did not attribute responsibility to any specific group.[6]

Using geographic information provided by the GTD, we were able to assign the Nomenclature des Unites Territoriales Statistiques (NUTS) region III administrative subdivision codes to 1,891 (95%) of the ETA attacks.[7] The NUTS Boundaries data show subnational administrative areas within the European Community (EC). Every EC member state has different levels of administrative subdivisions, designated as NUTS-I, NUTS-II, and NUTS-III (Commission of the European Communities, Eurostat). Excluding three islands, Spain has 47 NUTS-III regions, with an average area of 3,800 square miles. While these regions are fairly large, they represent historically meaningful boundaries, or provinces. The provinces are also an attractive starting point for research as they serve as data collection units for administrative data that we later use to model trends.

Methods

To test our prediction about the shift from control to attrition based attacks following the strategic shift in 1978 we classify each attack over time in terms of whether it occurred in one of the three provinces that make up the Basque Autonomous Community (BAC) or whether it occurred in a more distant province. And to test our prediction about the shift from contagious to hierarchical diffusion, we calculate Local Indicators of Spatial Autocorrelation (LISA) statistics. These analyses allow us to determine the extent to which ETA spread by either contagious or hierarchical diffusion and how these patterns changed over time. Finally, we use multinomial logistic and logistic regression analyses with incident location as a dependent variable to determine whether ETA's announced policy change in 1978 and the location of previous attacks can help us predict the location of subsequent attacks.

The Geospatial Distribution of ETA Attacks

Based on statements made by the ETA leadership, we divide ETA attacks into two periods: (1) an emphasis on encouraging a nation-wide mass revolt against the Spanish government from 1970 to 1978, and (2) an emphasis on a war of attrition from 1979 to 2007.[8] Next we

[5] Including the ETA cases, GTD recorded a total of 2,958 terrorist attacks against Spain during the study period. Other major groups responsible for these attacks included the First of October Antifascist Resistance Group (or GRAPO; 207 attacks; 7.0%); Terra Lliure (or TL; 61 attacks; 2.0%); and the Revolutionary Anti-Fascist Patriotic Front (or FRAP; 47 attacks; 1.6%).

[6] The proportion of attributed terrorist attacks in Spain from the GTD is relatively high compared to the data base as a whole. Of the 3,235 attacks in the GTD from 1970 to 2007, no terrorist group is attributed in only 594 (18.4%) of the cases.

[7] The match rate exceeds the minimum threshold of 85% suggested by Ratcliffe (2004). We were unable to geocode the remaining attacks either because the GTD data did not include city-level information or because the city listed in the database was matched to multiple locations.

[8] In supplementary analysis, we also tested for structural changes in the time series of ETA attacks by using Andrews' (1993) and Bai and Perron's (1998, 2003) methods for identifying structural breaks in time series (data outputs available upon request). The analysis used quarterly counts of ETA attacks from 1970 to 2007. The goal of the analysis was to test the null hypothesis that the level of ETA attacks remained constant over the study period, and a rejection of the null hypothesis would indicate potential break points in the series. Before conducting the structural change test, diagnostic checks were conducted on the series for stationarity and autocorrelation. The analysis identified an autoregressive model with 4 lags and a constant term as the best fitting model for the series, in which the residuals were white noise. Thus, using this autoregressive

examine attack patterns over time and space to determine whether they are consistent with our hypotheses. We first compare the trend in the overall frequency of attacks to the spatial dispersion and concentration of attacks for each year. Dispersion is measured as the percent of areas that are active for each year. Concentration is measured by the average number of attacks in active provinces (Cohen and Tita 1999). By plotting these measures over time, we are able to determine whether the two periods have distinct trends in spatial dispersion and concentration. Next, the spatial patterns by province are plotted for the entire period and then for the periods before and after ETA's major policy shift (i.e., 1970–1978 and 1979–2007). Combined, these visual comparisons should reveal whether ETA's attack patterns support our predictions about the spatial distributions of control and attrition attacks before and after 1978.

Identifying Diffusion Pathways

In order to identify the diffusion pathways of ETA attacks, we adopt the strategy that Cohen and Tita (1999) used to examine pathways of diffusion for homicide across cities. By linking LISA statistics to different mechanisms of diffusion, we can test whether certain types of spatial transitions are more prevalent than others. In particular, we are interested in determining the extent to which ETA attacks spread through contagious province level contact or more distant, hierarchical diffusion. We define provinces as neighbors using queen contiguity; that is, two provinces are considered adjacent if they share a common boundary or meet at a corner. We treat the 15 cases from the Basque region of southern France in the same way as the other mainland Spanish cases. We include the 31 ETA attacks against other countries as ''non-adjacent'' attacks in the descriptive statistics, but because they do not share boundaries with Spain we exclude these cases from the LISA analysis.

Briefly, LISA statistics provide a formal representation of the relationships between values at a local unit and its neighbors. Compared to simple measures of global autocorrelation, they offer a more precise means of displaying spatial relationships. Thus while global spatial autocorrelation statistics such as the Moran's *I* summarize spatial dependencies in the overall data, LISA statistics provide a measure of the extent to which the arrangement of values around a specific location deviates from spatial randomness (Anselin et al. 2000, pp. 233–234) and allow for the identification of clusters of high and low values. The LISA statistic (*L*) for unit *i* is defined as:

$$L_i = Z_i; \sum_j W_{ij} Z_j$$

where Z_i and Z_j are deviations from the mean and *j* refers to all adjoining units.

Using LISA statistics, local spatial associations are described by a pair of values (XY) for the variable of interest. The pair of values consists of the standardized value of the variable in the current (X) or local spatial unit and the standardized value of the same variable in neighboring (Y) units. Furthermore, each value is either high (H) or low

Footnote 8 continued
model, we projected the break points with the *R* package *strucchange* function *breakpoints* using the standard trimming value of 15% at each end of the series (Zeileis et al. 2002). Based on this analysis, we detected only one break in the third quarter of 1979, which is consistent with the fact that this is the high point of ETA attacks over the nearly four decades spanned by the data (for similar methods, see McDowall and Loftin 2005). We note in passing that a break point in the series based purely on a statistical test closely resembles the break point we expected, based on ETA's stated policy shift.

(L) relative to the mean and these values are used to locate spatial units within a two-dimensional Euclidean space producing four quadrants (HL, HH, LH, LL, starting at the upper left quadrant moving clockwise). A spatial unit that has high local values (X·) and high neighboring values (·Y) falls in the upper right (HH) quadrant, indicating a spatial cluster of high activity. Similarly, a spatial unit with low activity and low neighboring activity falls in the lower left (LL) quadrant, indicating a spatial cluster of low activity. The levels of activity in local units may differ from the levels in neighboring units, giving rise to LH (low local values, high neighbor values) and HL (high local values, low neighbor values) clusters. Because LISA statistics shift the focus from strictly local values and incorporate measures of activity in surrounding areas, they can be used to map local clusters.

While LISA statistics are often used to display spatial relationships in cross-sectional data, Cohen and Tita (1999) extend this method to examine dynamics of spatial diffusion of crimes across geographic areas over time. Like Cohen and Tita, we are interested in determining whether the source of change within a local unit can be attributed to diffusion from a neighboring unit or a non-adjacent unit. We do this by comparing the values of LISA statistics at year *t* with those at year *t* ? 1. Because we are determining the source of attacks that diffuse *to* the local unit, any transitions where the value of the current unit has remained unchanged are considered stationary, even if the neighboring values have changed.

Consider the example of a spatial unit that is designated LL (low local value, low neighbor value) at year *t*. At year *t* ? 1, this unit may remain stationary at LL or LH or increase to HL or HH. These increases cannot be a result of diffusion from adjacent areas because neighboring values at year *t* were low. Furthermore, these transitions may be isolated or global depending on whether changes occur also in the neighboring units or if they are restricted to only the local unit. Transitions from LL to HL are isolated increases if changes occur only in the local unit with no similar increases in the neighboring areas. We consider the transition from LL to HH as a global increase if levels of activity in both local and neighboring units increase.

Similarly, a spatial unit designated LH at year *t* may remain stationary at LL or LH or increase to HL or HH at year *t* ? 1. These increases suggest that the changes in the local value are associated with diffusion from adjacent areas because their values were high at year *t*. The transition from LH to HL suggests that high levels of activity have moved from the neighboring locations to the local unit. By contrast, transitions from LH to HH suggest that attacks have expanded because the original location maintains high levels of activity. Together, movements away from LL and LH demonstrate that increases may reflect diffusion from both adjacent and non-adjacent units.

Decreases—or the withdrawal of activity—may also be due to diffusion from adjacent and non-adjacent units. Transitions from HH to LL or LH cannot be attributed to adjacent areas because the neighboring units had high values in the preceding year. Continuing with this logic, transitions from HL to LL or LH are decreases that can reasonably be attributed to adjacent areas because the adjacent areas were low in the preceding year.

In short, all transitions of local units can be categorized as adjacent (contagious diffusion) or non-adjacent (hierarchical diffusion) depending on whether changes could have come from adjacent areas. Table 1 provides a summary of how to interpret these changes.[9] Each cell in the table designates whether the transition is stationary, from an adjacent unit, or from a non-adjacent unit. Cells that represent transitions that result in increases in the

[9] This table is adapted from tables A1 and A2 in Cohen and Tita (1999).

Table 1 Summary of diffusion pathways

Local-Neighbor Pair at Year t	Local-Neighbor Pair at Year t+1			
	LL	**HL**	**LH**	**HH**
LL	N_{11} Stationary	**N_{12} Non-Adjacent (Hierarchical Increase)**	N_{13} Stationary	**N_{14} Non-Adjacent (Hierarchical Increase)**
HL	**N_{21} Adjacent (Contagious Decrease)**	N_{22} Stationary	**N_{23} Adjacent (Contagious Decrease)**	N_{24} Stationary
LH	N_{31} Stationary	**N_{32} Adjacent (Contagious Increase)**	N_{33} Stationary	**N_{34} Adjacent (Contagious Increase)**
HH	**N_{41} Non-Adjacent (Hierarchical Decrease)**	N_{42} Stationary	**N_{43} Non-Adjacent (Hierarchical Decrease)**	N_{44} Stationary

Stationary: $(N_{11} ? N_{13} ? N_{22} ? N_{24} ? N_{31} ? N_{33} ? N_{42} ? N_{44})/N$
Change: $(N_{12} ? N_{14} ? N_{21} ? N_{23} ? N_{32} ? N_{34} ? N_{41} ? N_{43})/N$
Increases: $(N_{12} ? N_{14} ? N_{32} ? N_{34})/(N_{12} ? N_{14} ? N_{21} ? N_{23} ? N_{32} ? N_{34} ? N_{41} ? N_{43})$
Decreases: $(N_{21} ? N_{23} ? N_{41} ? N_{43})/(N_{12} ? N_{14} ? N_{21} ? N_{23} ? N_{32} ? N_{34} ? N_{41} ? N_{43})$
Non-Adjacent Increases: $(N_{12} ? N_{14})/(N_{12} ? N_{14} ? N_{32} ? N_{34})$
Adjacent Increases: $(N_{32} ? N_{34})/(N_{12} ? N_{14} ? N_{32} ? N_{34})$
Non-Adjacent Decreases: $(N_{41} ? N_{43})/(N_{21} ? N_{23} ? N_{41} ? N_{43})$
Adjacent Decreases: $(N_{21} ? N_{23})/(N_{21} ? N_{23} ? N_{41} ? N_{43})$

levels of activity in the local unit are shaded black while those representing decreases are shaded grey. To test for diffusion pathways, we calculate LISA statistics for the number of ETA attacks per 100,000 population in each province for each year to year transition. We examine diffusion pathways separately for the period before and after ETA's shift toward attrition as a major strategic goal. If our hypothesis is correct, we would expect the LISA statistics to indicate that prior to ETA's policy shift, diffusion was mostly contagious; and after the shift it became more hierarchical.

Predicting the Next Attack

Given the distinctions we are making between control and attrition attacks and contagious and hierarchical diffusion, we next ask whether information about the timing and location of past attacks can help us predict whether new attacks are likely to target the same province, an adjacent province or a more distant province. To address this issue, we sorted all ETA attacks by the date of the incident (year-month-day) and created an incident location variable coded ''1'' if incident *i* ? 1 occurred in the same province as did incident *i*, ''2'' if incident *i* ? 1 occurred in an adjacent province, and ''0'' if incident *i* ? 1 occurred in a non-adjacent province.

To predict the location of the next attack based on the location of the previous attack, we next treated the incident location as a dependent variable (distinguishing same, adjacent and non-adjacent provinces) and created a series of independent variables, including the time period when incident *i* occurred (periods 1 and 2; period 1 is the reference category), the length of time that elapsed between the two incidents (in days), and the geographic location of incident *i*. We used a series of dummy variables to indicate whether the incident occurred in the BAC (including Alava, Guipuzcoa, and Vizcaya), Navarra, Madrid, Barcelona, or Malaga (other provinces are the reference category).

Results

The Spatial Distribution of ETA Attacks, 1970–2007

Figure 1 presents trends in terrorist attacks attributed to ETA during the study period. In addition, we show attack dispersion (times ten), and attack concentration (times ten) over time for the study period. Recall that the percent of areas that are active in each year provides a measure of spatial dispersion, whereas the average number of attacks in active provinces provides a measure of the concentration of attacks (Cohen and Tita 1999). Figure 1 shows that attacks increased precipitously in the mid-1970s, reaching a series high point of 201 in 1979—the year after ETA signaled a major shift toward an attrition-focused strategy. After 1979, total attacks fell off considerably, but nevertheless, remained at very high levels throughout the 1980s. Following 1990, trends in annual attacks substantially declined with only 3 attacks attributed to ETA in 1999. There were a total of 8 attacks attributed to ETA in 2007—about the same number as were reported in 1974 (9 attacks).

According to Fig. 1, trends in dispersion and concentration closely followed trends in total attacks during the first period (the correlation between attacks and concentration = 0.97; the correlation between attacks and dispersion = 0.88), indicating that increases in attacks were due to both increased spread of terrorist activity to new areas and

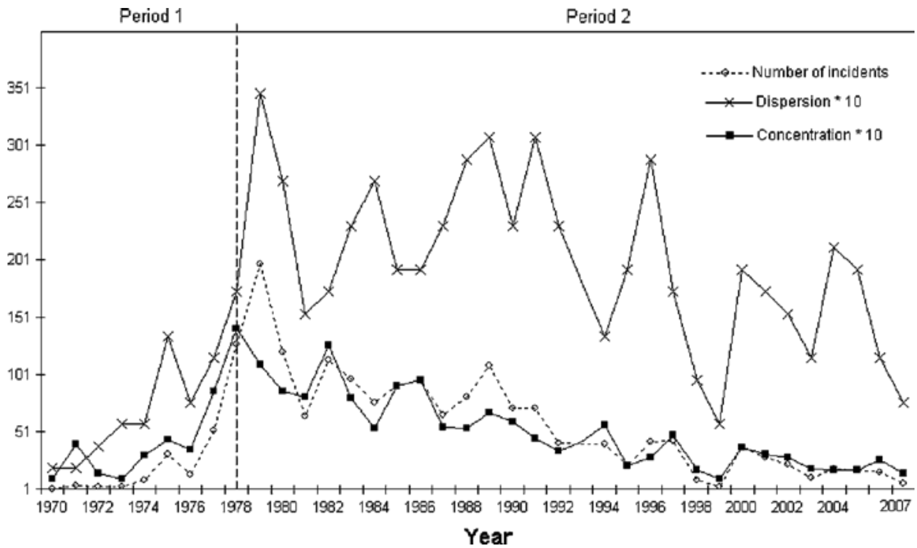

Fig. 1 Frequency, concentration and dispersion of ETA attacks, 1970–2007

intensified concentration in the already active locations. The peak year for dispersion (percent of areas that are active each year) was 1979—the first year after the 1978 historic strategy shift—while concentration (average number of attacks in active provinces) peaked in 1978. If we look more generally at time periods one and two, we see that during the second period total attacks and the concentration of attacks declined substantially, while the dispersion of attacks remained relatively high. In other words, once ETA moved toward a strategy based on attacking broadly (consistent with attrition), it never fully retreated from this strategy, even when its total number of attacks substantially declined.

In Fig. 2 we show the spatial distribution of ETA attacks in Spain and the five French departments (equivalent to provinces) that border Spain. To standardize the comparisons, we divide total counts for each province by its size. The light grey boundaries between spatial units depict provinces or NUTS-III units, and the dark gray boundaries depict larger administrative regions that are named in the figure, each comprising several provinces. The three BAC provinces are marked by black bolded boundaries. What is perhaps most striking about Fig. 2 is how widely dispersed ETA attacks have been. From 1970 to 2007 the GTD records at least one ETA attack in all administrative regions and for 41 of the 47 mainland provinces of Spain (87.2%). In terms of raw counts (not shown in the map), four provinces (Guipuzcoa, Vizcaya, Navarra, and Madrid) had more than 100 ETA attacks and six had more than 50 attacks (the previous four plus Alava and Barcelona).

We hypothesized above that following a major announced strategy shift in 1978, ETA would begin emphasizing attrition attacks outside the BAC heartland. To examine this possibility, we compared the period before the policy change (1970–1978) to the period after (1979–2007). The two parts of Fig. 3 show province level distributions of ETA

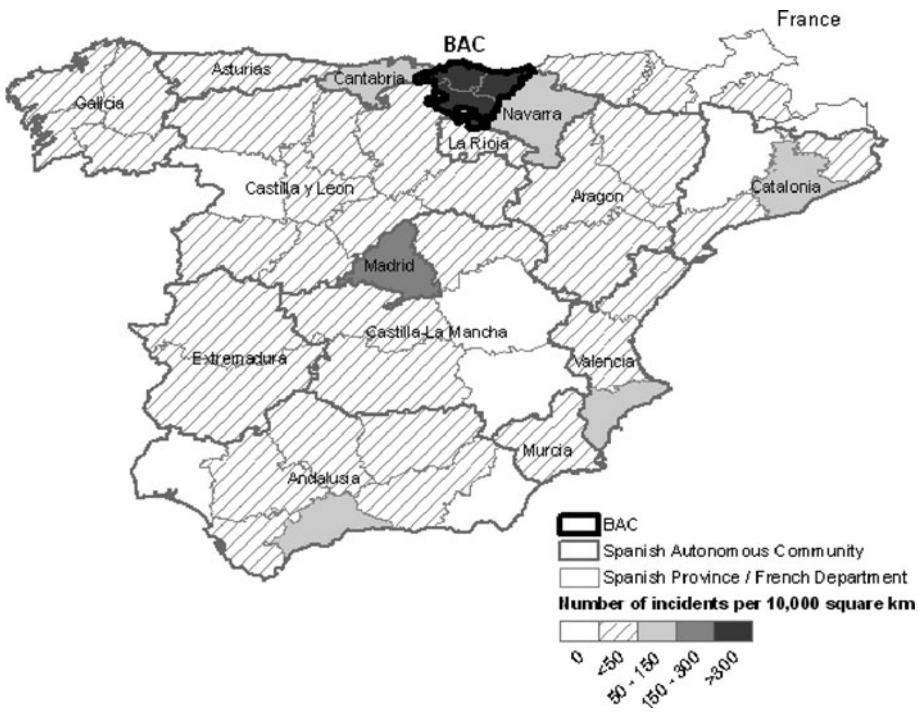

Fig. 2 Terrorism attacks attributed to ETA, 1970–2007

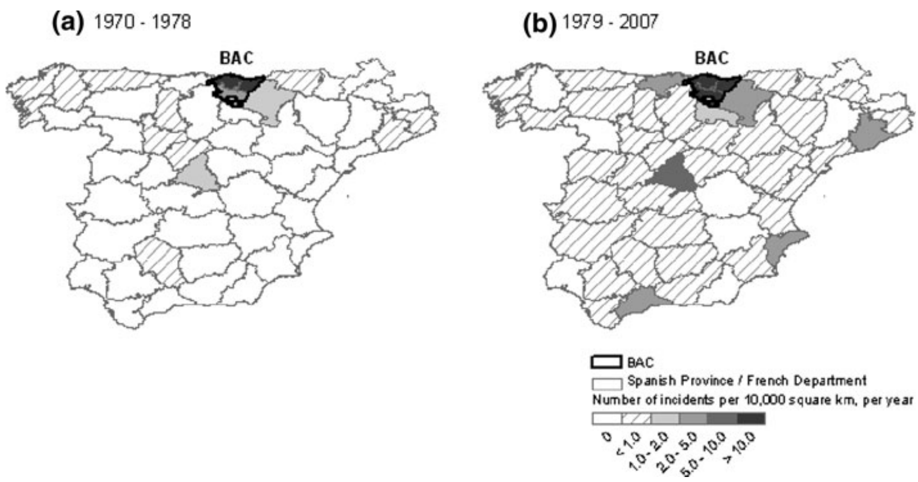

Fig. 3 Province level distribution of ETA attacks for the two major attack periods, 1970–2007

attacks over time for the spatial density of attacks for Spain and southern France. Because the two periods differ in the length of time covered and in their size, for comparative purposes we divide the total number of attacks for each province by the land area and the number of years in each period. Figure 3a covers the years 1970–1978 and shows that during this first period, ETA attacks were heavily concentrated in Guipuzcoa and Vizcaya, two of the three provinces in the BAC. And compared to the rest of the country, attacks were also concentrated in Alava (the third BAC province), Navarra (which borders the BAC), and Madrid. With a single exception (Cordoba), no province in the southern half of Spain experienced an ETA attack during the period 1970–1978.

Figure 3b, which starts in 1979 and ends in 2007 (1993 missing), shows a dramatic increase in the diffusion of attacks. While the epicenter of ETA attacks was still the same two provinces of the BAC, the third BAC province, Alava, had a large increase in the density of attacks (from 2.6 to 10.5 per 10,000 square km per year). In this period ETA staged attacks in 40 Spanish provinces and three departments in southern France. Perhaps the most striking shift during this period is the appearance of attacks in 13 provinces in the southern half of Spain, including attacks in the far southern region of Andalusia. In unreported analysis, we also examined patterns of dispersion by excluding 1979 (the year with the highest number of attacks) and by focusing on different sub-periods from shorter time spans. The results remained the same without the attacks in 1979, meaning that the results were not unduly influenced by the data in that particular year. Interestingly, in the second period even when the total number of attacks was considerably lower, ETA attacks were spatially dispersed. For example, from 1999 to 2007, a time span of 8 years like the first period, ETA staged a total of 161 attacks in 24 of the 47 provinces in Spain (the corresponding numbers for the first period were 224 attacks in 16 provinces). These results suggest that after ETA moved from a strategy based on control to one based on attrition, it never turned back—even when it substantially reduced its total terrorist activity.

Table 2 shows the pattern of attacks across provinces for the two time periods, including the province in which each attack occurred and whether the next attack took place in the same province, an adjacent province, or a non-adjacent province. Perhaps the most striking finding in Table 2 is that a very large proportion of total ETA attacks are in fact close to its operational base. Thus, a total of 33.1% of attacks are in the BAC province of Guipuzcoa and 63.8% are in one of the three BAC provinces. Apart from attacks in the BAC, Madrid and Navarra each account for 7.5% of attacks followed by Barcelona (2.6%) and Malaga (2.3%).

We argued above that attrition attacks would more likely diffuse hierarchically, and would become more common for ETA after the organization switched its emphasis to a war of attrition in 1979. Table 2 supports this expectation. Thus, the percentage of attrition attacks (those occurring in non-adjacent provinces) in the BAC more than doubled between periods one and two—from 10.0 to 22.2%. The same pattern is also repeated for each of the three provinces that constitute the BAC, with the percentage of attacks on non-adjacent provinces moving from 7.3 to 19.4% in Guipuzcoa, from 14.3 to 26.1% in Vizcaya, and from zero to 21.1% in Alava. Although there was individual variation in the percentage of attrition attacks in the provinces outside of the BAC region, in general, attrition attacks in the non-BAC provinces remained remarkably stable at a high level across the two periods (61.4 vs. 60.5%).

Additionally, it is instructive to compare the distributions of the non-BAC attacks for the two periods. In period 1, non-BAC attacks accounted for 18.0% of total attacks, whereas in period 2, the percentage of non-BAC attacks increased to 39.0%. Of all non-BAC attacks, 93.6% took place in period 2. By contrast, although the majority of the BAC attacks also occurred in the second period, the percentage was considerably lower (83.3%; *p* ₩.001).

Diffusion Pathways

Using counts of yearly transitions of LISA statistics, we next computed and compared the proportion of: (1) all transitions that result in changes in province levels of activity, (2) all transitions where province levels of activity remain unchanged (i.e., stationary), (3) increases (low to high) and decreases (high to low), (4) increases that arise from adjacent areas and those from non-adjacent areas, and (5) decreases that arise from adjacent and non-adjacent areas. Table 3 presents these proportions for all ETA terrorist attacks during the two periods identified above.

In general, provinces showed little yearly change in their levels of terrorist activity. However, the large percent of stationary transitions is driven by those provinces that experienced no terrorist attacks during each period (96.1 and 84.5% of stationary transitions had no attacks in periods 1 and 2, respectively).[10] Thus, the more interesting statistic is the percent that actually do change in each period. As expected, there were nearly twice as many provinces experiencing change during ETA's second phase (12.4%) than during its first phase (6.7%). When we focus only on those transitions where there were changes, we find that increases were considerably more common than decreases during the early

[10] There were a total of 416 transitions in period 1 of which 388 transitions were stationary. The 416 transitions are based on a total of 52 provinces (47 in Spain and 5 in France) where each province has 8 year-to-year transitions (1970–1971, 1971–1972, so on). In each year, for each province, we calculated a LISA statistic. Then, we compare the LISA statistic in year t to the LISA statistic in year *t* ? 1 and classify the change as either stationary or change using the rules specified in Table 1. Using this information, we counted the number of provinces that had zero attacks in each year and its transition was classified as stationary. This results in a total of 373 transitions. So the percentage reported in the text is 373/388 = 96.1%. We used the same procedure for period 2 and found that out of the 1,230 stationary transitions, there were 1,039 transitions involving a count of 0 attacks in a given year. So the percentage is 1,039/1,230 = 84.5%.

Table 2 Total percent of ETA attacks that were in the same, adjacent, or nonadjacent provinces for two time periods

Province	*N* (%)	Period 1				Period 2			
		N	Same province %	Adjacent province %	Non-adjacent province %	*N*	Same province %	Adjacent province %	Non-adjacent province %
BAC: Guipuzcoa	625 (33.1)	110	50.9	41.8	7.3	515	46.2	34.4	19.4
BAC: Vizcaya	483 (25.6)	84	39.3	46.4	14.3	399	38.3	35.6	26.1
BAC: Alava	97 (5.1)	7	–	100.0	–	90	18.9	60.0	21.1
Navarra	142 (7.5)	18	33.3	27.8	38.9	124	22.6	37.9	39.5
Madrid	141 (7.5)	10	40.0	–	60.0	131	22.9	–	77.1
Barcelona	50 (2.6)	1	–	–	100.0	49	34.7	–	65.3
Malaga	44 (2.3)	0	–	–	–	44	38.6	–	61.4
Others	308 (16.3)	15	6.7	6.7	86.7	293	28.3	10.6	61.1
Total for BAC	1,205 (63.8)	201	44.3	45.8	10.0	1,004	40.6	37.2	22.2
Total for Non-BAC	685 (36.2)	44	25.0	13.6	61.4	641	27.3	12.2	60.5
Grand Total	1,890*	245	40.8	40.0	19.2	1,645	35.4	27.4	37.1

N is reduced by one because the information is missing for the attack occurring after the last attack in the data

Table 3 Summary of spatial transitions at province level

	N of transitions	Stationary *N* (%)	Change *N* (%)	Changes		Increases		Decreases	
				Increase *N* (%)	Decrease *N* (%)	Adjacent *N* (%)	Non-adjacent *N* (%)	Adjacent *N* (%)	Non-adjacent *N* (%)
Period 1 (1970–1978)	416	388 (93.3)***	28 (6.7)***	16 (57.1)	12 (42.9)	9 (56.3)	7 (43.7)	7 (58.3)	5 (41.7)
Period 2 (1979–2007)	1,404	1,230 (87.6) ***	174 (12.4) ***	86 (49.4)	88 (50.6)	31 (36.0)**	55 (64.0)**	51 (58.0)	37 (42.0)
Total (1970–2007)	1,820	1,621 (89.1)***	199 (10.9)***	103 (51.8)	96 (48.2)	40 (38.8)*	63 (61.2)*	56 (58.3)	40 (41.7)

Data were missing for 1993; values with asterisks denote that the probability of observing these percentages is less than 5% if the true value is 50% (analogous to a significance level of less than 0.05; * *p* ₩ .05; ** *p* ₩ .01; *** *p* ₩ .001; see note 11 for a description of how significance was calculated) period (although the difference was not statistically significant), and decreases and increases were equally likely during the most recent period.[11]

The next two columns of Table 3 contrast increases in terrorism due to diffusion from either adjacent or non-adjacent provinces. We argued above that because of a shift in strategy, contagious diffusion will be more common for ETA during its early phase, but the strategic value of hierarchical diffusion will make it more common during its later phase. In support of this hypothesis, Table 3 shows that during ETA's early period, diffusion to adjacent provinces was more common (56.3%) than diffusion to non-adjacent provinces (43.7%), although these differences were not statistically significant. However, during its more recent period, these percentages are reversed so that diffusion to non-adjacent provinces (64.0%) is significantly more common than diffusion to adjacent provinces (36.0%). Thus, after ETA adopted a stronger focus on attrition its attack patterns dispersed. In other words, ETA spread more through contagious diffusion during its early years and more through hierarchical diffusion during its later years.[12]

The last two columns in Table 3 show the LISA proportions for adjacent and non-adjacent decreases in terrorist attacks for the two periods and for the total. In contrast to the diffusion of increased attacks, we find no significant difference between decreases in adjacent and non-adjacent provinces, although the raw numbers suggest that diffusion is more frequently related to lower rates of attacks in adjacent units.

To summarize, the diffusion of ETA attacks were distinctive across the two periods identified. During the first period ETA's adjacent attacks outnumbered non-adjacent attacks although the differences were not statistically significant. However, after their announced strategy shift in 1978, the increases in ETA's attacks were significantly more likely to occur in non-adjacent provinces. These results are consistent with the argument that when ETA was guided by a control strategy the diffusion process was more likely to be contagious; and when they shifted their policy toward an attrition strategy, there were significant increases in hierarchical diffusion.

Predicting the Next Attack

Based on the patterns observed in the data we next examined whether the change in strategy in 1978 and the timing and location of past attacks by ETA can provide any guidance to where ETA will attack next. In Table 4 we present the results of a multinomial logistic model that estimates the effects of the independent variables on the location of incident *i* ? 1. We also estimated a logistic model that combines attacks that happen in the same province and attacks that happen in an adjacent province into one category. The key

[11] We determined statistical significance by first using binomial distributions—B (n, 0.5)—to calculate the exact probabilities of obtaining the observed sample. For example, in period 1, there were 12 decreases: 7 from adjacent units and 5 from non-adjacent units. Thus, using B (12, 0.5) and assuming that the probability of decrease from adjacent units is equal to the probability of decrease from non-adjacent units, we get $p = 0.16$ (decreases from adjacent units = 7)—which is within the range of chance variation. To verify our conclusions, we also used significance tests for a single proportion. The null hypothesis is $H_0: p = 0.5$. The z statistics are calculated as $Z = \frac{\hat{p} - 0.5}{\sqrt{(0.5 \times 0.5)/n}}$. This method produced the same results as the first method and all of the statistically significant cells have a *Z*-value larger than 1.96.

[12] Of the 16 increases in attacks originating in period 1, 4 adjacent increases and 0 non-adjacent increases can be attributed to one of the provinces in the BAC (4/15 = 25%). For the 86 increases in attacks in period 2, 4 adjacent increases and 0 non-adjacent increases can be attributed to the BAC (4/86 = 4.7%). Thus, in support of our arguments, increases in attacks in non-BAC provinces were more likely to occur in the second than in the first period.

Table 4 Regression estimates for incident location ($N = 1,890$)

Independent variables	Model 1 (multinomial logistic model)		Model 2 (logistic model)
	Same province versus non-adjacent province	Adjacent province versus non-adjacent province	Same/adjacent province versus non-adjacent province
Time period			
Period 1 (1970–1978; reference category)			
Period 2 (1979–2007)	−.63 (.20)**	−.67 (.21)**	−.66 (.19)**
Time gap between incidents			
Time Gap (in days)	−.04 (.01)***	−.01 (.00)**	−.02 (.00)***
Geographic regions			
BAC	1.63 (.13)***	3.08 (.21)***	1.92 (.14)***
Navarra	.34 (.24)	2.25 (.27)***	.87 (.21)***
Madrid	–	–	−.60 (.23)**
Barcelona	–	–	−.08 (.32)
Malaga	.43 (.33)	−.80 (1.04)	.17 (.33)
Other (reference category)			
Intercept	−.12 (.22)	−1.76 (.28)***	.17 (.22)
−2 log likelihood	3,607.50	2,040.02	
Likelihood ratio v^2	528.80***	402.97***	

We excluded the variables ''Madrid'' and ''Barcelona'' from the multinomial logistic model because the estimated coefficients have extremely large standard errors. * *p* ₩ .05; ** *p* ₩ .01; *** *p* ₩ .001

findings are as follows. First, compared to attacks occurring in period 1, attacks that occurred in period 2 were less likely to be followed by attacks in the same or an adjacent province. Second, the risk of another attack in the same or an adjacent province decreased as the time since the last attack grew. Third, ETA attacks in the BAC or the neighboring Navarra province had a higher risk of being followed by another attack in the same or an adjacent area than by attacks occurring in other places. And finally, attacks in Madrid were less likely to be followed by attacks in Madrid or the provinces bordering Madrid.

Discussion and Conclusions

In this analysis we examined all terrorist attacks attributed to the group ETA from 1970 to 2007. Based on what we know of ETA's strategies over time, we divide their period of activity between those years where they sought to achieve a military victory in the Basque region of Spain (1970–1978) and the years where they were instead implementing a strategy of attrition (1979–2007). We characterize ETA's strategic goal during the first period as being based on control, aimed at consolidating and protecting their base of operations, and therefore targeting attacks mostly in their home provinces. We characterize the strategic goal during the second period as being based on attrition, aimed at wearing down the Spanish government, and therefore extending attacks to other provinces in Spain. We expect that each attack strategy corresponds to different diffusion processes, with control attacks being associated with contagious diffusion (concentrating attacks in contiguous areas) and attrition attacks being associated with hierarchical diffusion (expanding attacks to more distant, non-contiguous areas). Because ETA explicitly announced a policy shift toward attrition attacks in late 1978, analyzing its attack patterns provides a reasonable case study of how the diffusion of terrorist attacks for a specific group is related to an announced change in its strategy.

Our expectations were largely supported. During period one (1970–1978), ETA attacks were heavily concentrated in the Basque Autonomous Community, but during period two (1979–2007) they became more widely dispersed, with all but six of Spain's 47 mainland provinces attacked at least once. Interestingly, after ETA expanded its attacks beyond the Basque region, it maintained a nation-wide attack campaign through the end of the period examined, even when its total attacks substantially declined. Thus, while ETA's attacks during the second period moved significantly from adjacent to non-adjacent attacks in provinces that experienced increased attacks, there was no significant move back to adjacent provinces in provinces that experienced declines. At the same time, we should be careful not to overstate the magnitude of the transition between control and attrition attacks. While total attacks outside the BAC nearly quintupled between the first and second period (from 110 to 515), nevertheless most ETA attacks remained local: even during the second period 61.0% of ETA attacks were within the BAC.

We used Local Indicators of Spatial Autocorrelation (LISA) statistics to test our argument that the first attack period was more likely to diffuse contagiously and the second attack period was more likely to diffuse hierarchically. In general, we found that nearly 90% of the time Spanish provinces experienced no changes in annual levels of terrorist attacks (mostly because they never experienced any attacks in a specific year). However, changes in attack patterns were about twice as likely during ETA's period of attrition than during its period of control. And as predicted, we found that diffusion occurred less in non-adjacent provinces during ETA's control period (although the difference was not statistically significant), but was significantly more likely to occur in non-adjacent provinces during ETA's attrition period. Thus, before the 1978 announced policy shift 43.7% of the diffusion of attacks were hierarchical (i.e., to non-adjacent provinces), and afterwards, 64.0% were hierarchical.

Our regression analysis of attacks in the same, adjacent and non-adjacent provinces shows that ETA was significantly more likely to attack in non-adjacent provinces during the attrition period (period 2). We also found that when the time between attacks increased, new attacks were more likely to target non-adjacent provinces, a finding that is consistent with the conclusion that attacks in more distant locations require more resources and planning. While attacks in the BAC and Navarra were likely to be followed by more attacks in the same or contiguous provinces, attacks in Madrid were significantly less likely to be followed by more attacks in Madrid or the provinces bordering it.

Pointing out the major limitations of this research can also help us suggest directions for future research. First, we rely on large spatial and temporal units and future research should replicate these analyses at smaller units of space and time and determine whether the results are similar. But indeed, this limitation represents a challenge to most quantitative analyses of terrorist groups. Terrorism, like other types of unusual criminal violence, does not occur frequently enough in most locations to support the types of micro-level analyses that are possible when studying more common events. Moreover, it is often difficult or impossible to find relevant independent variables at the community level. Second, it is not clear whether these results are generalizable to countries other than Spain or to terrorist organizations other than ETA. As research on the spatial aspects of terrorist activity grows, it will be informative to make comparisons across countries and groups. However, our expectation is that all nationalist based terrorist organizations face some similar strategic options. Finally, we examine only locations of terrorist attacks and treat all attacks as equal. Future research might take into account different aspects of attacks (such as fatalities or property damage) when studying diffusion.

With these caveats in mind, our results suggest that after a major announced shift in strategy, ETA expanded its operations from the Basque country to other parts of Spain. The results generally support rational choice perspectives suggesting that much decision making on the part of terrorist groups is strategic. While control may have been common throughout the life cycle of ETA and ETA attacks continued to diffuse contagiously, after ETA announced a shift in strategy toward attrition, diffusion became significantly more hierarchical. In fact, ETA continued to perpetrate attacks throughout Spain even as its total number of attacks considerably declined near the end of the series. While most provinces in Spain experienced no ETA attacks in a given year, and therefore showed little change in attack patterns over time, when there were changes, the percentage of these changes that were hierarchical significantly increased following the new emphasis on attrition. While our results are exploratory, they do provide some reason to hope that analyses of the spatial and temporal patterns of terrorism might not only inform our theoretical models, but also help to guide policies aimed at countering terrorist violence.

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