<u>Media, Communication Technology, and Protest Waves*</u>

Daniel J. Myers

Department of Sociology

University of Notre Dame

Correspondence should be directed to:

Daniel J. Myers
Department of Sociology
University of Notre Dame
810 Flanner Hall
Notre Dame, IN 46556
Myers.33@nd.edu

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ABSTRACT

When examining the role of networks in social protest, it is difficult to overstate the importance of communication technology. Virtually all theoretical insights about networks and social ties must be understood within a specific technological framework. As communication technology changes over time, the reach and impact of interpersonal and organizational activist networks is modified in ways that can either extend, intensify, dilute, or even eliminate activist influence. In this paper, I will discuss changes in communication technology over time and the implications of these technology changes for explicit and implied protest networks. To illustrate the operation of these information-induced networks, I will examine the spatial and temporal dynamics of collective violence waves that occurred under different technology eras. The first era examined is dominated by print media and word of mouth, the second by television, and the third is an emerging era in which computer-based communication is becoming more important. Each of these three communication technologies implies important differences in the network structures under which potential protestors may be influenced to act. The differences in networks in turn imply different trajectories and life-cycles for protest waves. I will conclude by discussing the implications of these findings for future protest in the context of recent and developing network structures that rely more and more heavily on computer-based communication.

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INTRODUCTION

If protest is going to spread from one individual to another, from one group to another, or from one location to another, information about prior events must travel along these same paths. The paths that connect individuals, groups, and locations form a communication network that allows protest to diffuse.

These communication networks differ in a number of respects and these differences have important ramifications not only for where and when protest will become "contagious,"[1] but also for the overall trajectory of the protest wave. Sometimes communication networks are driven by previously existing acquaintance structures between individuals. In these kinds of networks, protest can be passed from person to person by word of mouth communication. Another communication network that can diffuse protest is the mass media. Although less personal influence is involved, the mass media has a considerably longer reach and in the case of electronic media, provides instantaneous information throughout its network.

The differences in the communication technologies that define communication networks, then, produce different patterns of inter-actor influence and as communication technology changes over time, we should expect to see differing communication networks and different patterns of collective action diffusion. For example, as communication technology approximates

[1] It may be important to state at the outset that when I used the terms diffusion, contagion, and infectiousness, I am not referring to the notions of early crowd theorists (e.g. LeBon [1895] 1960; Freud 1921) who asserted that individuals in a crowd could be "infected," or swept away by the collective body as a kind of unconscious, primitive craze passed from individual to individual. Since these writers forwarded such ideas, there notions of crowd behavior have been thoroughly debunked (see McPhail 1991 for a complete history of crowd psychology). Modern variants of "contagion" notions recognize that diffusion is a rational form of inter-actor influence in which potential actors observe and evaluate the outcomes of others' behaviors and then make a decision for themselves about whether or not to adopt the behavior (Oberschall 1980; 1989). This variant of contagion has long been used in studies of collective behaviors (Strang and Soule 1998) including rioting (Hobsbawn and Rudé 1968; Charlesworth 1979; Bohstedt 1994; Bohstedt and Williams 1988; Oliver 1989; Olzak and Shanahan 1996; Myers 1997a), protest tactics (McAdam 1983; Oberschall 1989; Soule 1997), hijacking, coups, other collective violence (Pitcher, Hamblin, and Miller 1978; Hamblin, Jacobson, and Miller, 1973), the formation of unions (Hedström 1994), and even fads (Aguirre, Quarantelli, and Mendoza, 1988).

instantaneous transfer of information, the temporal lag in the diffusion process should be substantially reduced. Likewise, as information technology allows more and more distant connections between actors and allows easier communication across geographic and political boundaries, the geographic limits of protest diffusion should also be reduced.

The purpose of this paper, therefore, is to examine the implications of changing communication technology by considering three technology regimes and tracing the underlying networks defined by those technologies to better understand the diffusion they facilitate. The first part of the paper will develop some generic notions about communication technology networks using the television station as a communication technology model. The second part of the paper will examine these dynamic networks structures in three specific technology eras: Pre-electronic (depending on word-of-mouth), electronic (depending on the mass media--particularly television), and advanced electronic (depending on computer-assisted communication via the internet).

COMMUNICATION TECHNOLOGY NETWORKS: THE EFFECTS OF MASS MEDIA

As scholars have noted for many years, the mass media is extraordinarily important to protest (Lipsky 1968; Molotch and Lester 1974; Danzger 1975; McCarthy, McPhail, and Smith 1996; Salzman 1998). At least in the modern era, it is seen as essential that activists access and utilize the media if they are going to be successful in their political endeavors. Access to the mass media allows activists the ability to communicate their cause to much larger number of people than they could ever do using only their own resources. While part of the activist's agenda is to spread information about their cause, an even more important goal is to gather new recruits and spur additional action. Even if activists do not specifically set out to recruit imitators (as in, for example, a riot), the mass media can diffuse collective behavior by providing models for action and information about the outcomes of prior actions (Myers 1996; Hamblin, Jacobson, and Miller 1973). The mass media therefore, provides for a network that connects individual and collective actors, which both facilitates and limits the spread of protest and collective violence. Who exactly is connected by the mass media and how become critical questions for understanding the trajectory of a protest wave--both in space and time.

Defining Network Connections: The Range of Distribution

To begin with, the communication networks produced by mass media are of a slightly different ilk than affiliation structures often examined in network studies. Instead of being defined by a series of one-to-one ties, mass media networks are better thought of as a blanket that covers a specific geographic area. This area is defined by the physical distribution of the media. For example, VHF television stations in the 1960s broadcast their signals over a certain range determined by the power of their transmitter and the physical features of the local geography. Each station, then, had a realm of influence defined by its broadcast radius and provided for a network among all actors within that area. Figure 1 illustrates this notion with a single television station located at the point in the center of the graph. The raised area represents the broadcast reach of the station and posits that an influence network exists among all of the actors in the circle.

| Figure 1 Here |

The connections among these actors can represent either one-way or two-way influence. If it is assumed that the media outlet will gather information about what all actors in the distribution area are doing and report this information, then all actors within the distribution area have influence on each other. Another plausible concept of the ties within the media network is that the influence is not reciprocal such that only actions of those in the media center are reported (or reported disproportionately). In this case, the network connections among actors are onedirectional, flowing from the actor that houses or controls the media center out to all others in the media distribution area.[2]

Of course, it is possible to translate this area-based network notion into a typical affiliation network. For example, using the two way influence model, a matrix can be constructed that would indicate the presence of a tie between any pair of actors within the distribution area and the lack of a tie between any actor inside the area and any actor outside. The area-based device, however, will become a more useful tool as the network definition becomes more complex below.

Diffusion and Mass Media Networks: The Probabilities of Imitation

When mass media exerts its influence, it does not follow that every individual within the distribution area will respond. If, for example, a riot occurs in a central city and its television station broadcasts the news of the riot, this does not mean that every town within 60 miles of the television stations will respond with a riot of its own. Not only do all of these towns have individual intrinsic propensities to riot (based on population characteristics and so forth), but the even the most likely to riot will not respond with a riot every time its residents are informed about a riot elsewhere. Instead, the media influence process is better thought of as one in which information transmitted though the media <u>changes the probability</u> that actors within the media distribution area will act or imitate.

Therefore, the definition of a tie between two actors should not be an all or nothing proposition. Instead, when we consider diffusion processes, the tie between actors A and B should be defined as an increase in the probability of action by actor A if B acts (and actor A receives information about the first action). In other words, the tie indicates an <u>imitation index</u> that relates how contagious one actor is to another. In our simple media distribution example in

[2] Myers 2000 provides empirical evidence for both of these kinds of media networks in riot waves.

Figure 1, we can represent this imitation index by the height in three-dimensional space of the raised circle. If a two-way influence model were operating, then there would be an equal, non-zero quantity connecting all actors within the media distribution area and an zero quantity connecting any other pair (as illustrated in Figure 2).

| Figure 2 Here |

Gradations in Influence: Distance-related Decay

The media networks represented in Figures 1 and 2 are, at best, a simplistic version of how mass media actually exerts influence. To begin with, the distinctions between who is in and who is out of the network are unrealistically stark. In reality, if a television station has the power to transmit its signal 60 miles, people who live 61 miles away from the station are not affected substantially differently from those who are 59 miles away. A more appropriate model would allow for the influence of the media source to gradually decline as distance from the media source increased. Even beyond the decline of media consumption, there are other reasons that influence should decrease over as a function of distance given that the behaviors of far-away actors are usually less salient than that of close neighbors. These kinds of distance-related decays influence have found substantial support in a number of studies (see Myers 1997).

Adjusting Figure 1 to account for distance related decay, we must change the surface such that the height (indicating the influence of the center city) decreases as we move a way from the city in any direction. The result is the hill-shaped model given in Figure 3. The network model implied by this situation is substantially more complicated than the simple model given in Figure 2. Now the influence between any particular pair of actors can be different than any other pair, and the imitation index (indicating the level of influence) is a function of the distance between the actors. Figure 3 models a one-way influence model flowing from the center city to the other cities. In it, the relative spatial positions of each city are plotted in the upper plane, and the height of three-dimensional surface below indicates the relative influence of the central city on that city.

| Figure 3 Here |

Figure 4 translates the distance decay model. Now, instead of all cities inside the distribution area having the same imitation index and all those outside having zero, all cities (II-V) are influenced by the central city (I) with imitation indexes a > b > c > d.

| Figure 4 Here |

A Dynamic Network: Time-Dependent Changes in Imitation Probabilities

When inter-actor influence is examined in the context of collective action, one of the most important elements has to be the dynamic nature of the influence. As time progresses and events occur, the influence exerted on actors that comes from the behavior of others is constantly changing. The two most important elements driving these dynamics are the occurrence of events, and the decay of influence over time.

When events occur, an influence network is activated. In some sense, a diffusion network does not exist until an event occurs and exactly what network gets activated is determined in part by the characteristics of the event itself (discussed more in the next section). Since the network connections between actors are defined as the increase in probability that each actor will act as a result of an event occurring, then those imitation indexes are zero until an event occurs. This does not mean, however, mean that the actors in a social field have zero probabilities of acting. Instead it means that beyond whatever individual propensities they have to act, there is no contagious supplement to that probability if there has been no prior action. In terms of the three-dimensional plots, this means that before any event occurred, the surface would be flat--there would be no "hill." Once an event occurs, such as a riot in the central city, the distribution of the media reporting that event would define an influence network such as portrayed in Figure 3.

The second dynamic element in a mass media/collective action network is the decay of influence from an event over time. In traditional diffusion models, once an adoption occurs, the amount of contagious influence it emits never changes over time (Mahajan and Peterson 1985; Strang and Tuma 1993). When dealing with protest and collective violence however, this assumption cannot be maintained (Oliver and Myers 1998). As the event becomes distant in time, it loses its salience in the public mind and eventually may even be completely forgotten. As events age, then, the imitation index connecting two actors diminishes: Actor B is more likely to imitate an event that occurred to Actor A two days later than 8 days later. If this process occurs, then whatever imitation indexes are assigned when an event occurs, they should be systematically reduced as time goes by. As in Figure 5, the hill in the three-dimensional surface should diminish incrementally following an event until the imitation indexes eventually return to zero.[3]

| Figure 5 Here |
Note: An animated variants of Figure 5 is also available. Click on or go to:
http://www.nd.edu/~dmyers/lomond/fig5.html

Event- and Actor-Dependent Effects.

The intensity of an imitation effect is governed by more than just time, however. In any diffusion network (but perhaps particularly so when mass media is driving the diffusion process), the contagiousness of an event can in part be traced to its severity and in part to that characteristics of the actor to which it occurred. It has been well documented that more intense protest events receive more media coverage (e.g., Snyder and Kelly 1977; McCarthy, McPhail, and Smith 1996; Oliver and Myers 1999; Myers and Caniglia 2000), and because large events get more coverage, they are considerably more subject to imitation than are small events (Myers 1996). Likewise, larger events are also likely to have a greater geographic reach than small events. Therefore, different event size can result in different height and range of the "hills" in the three-dimension graphs.

[3] Again, it is possible to translate this dynamic surface into a series of network diagrams with imitation indexes connecting each set of actors, but these are not show due to reduce redundancy.

Figure 6 illustrates three different intensity related possibilities. Panel A provides a baseline model of contagion flowing from an event of moderate intensity. Panels B, C, and D each represent contagion patterns that could be associated with a more intense event. In Panel B, the maximum imitation index is the same, but the declining effect of distance is less severe--effectively allow the contagious effect to cover a wider area. In Panel C, the imitation indexes are stronger, but the effect of increased distance is the same. The final panel combines both of these effects.

| Figure 6 Here |

Differences in the infectiousness of an actor may also be traced to characteristics of the actor (instead of characteristics of the event). For example, in the case of riots and protest, it may be the case that larger cities function as cultural hubs and actions that occur there are more salient to smaller cities than the other way around. In these cases, events occurring in large cities will increase the height of the influence surface more than events in smaller cities.[4]

A Dynamic Surface Representing Inter-actor Influence

When all of these influence effects (spatial decay, event occurrence, temporal decay, event characteristics, and actor characteristics) are combined, the result is a dynamic surface indicating the increased probability of all actors imitating the behavior of others.[5] Over time, we have a sort percolating surface in which the probabilities of adoption due to influence from other

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[4] These kinds of differences are called "infectiousness" by Strang and Tuma (1993) but I do not use the terminology in this specialized sense in the current paper.

[5] It is also possible to include each actor's individual propensity to act (see Strang and Tuma 1993; Greve, Strang, and Tuma 1995) as a determinant of the height of the adoption probability surface. For example, if a city's chances of experiencing a riot are controlled in part by its population size, then larger cities would start out with higher levels on the probability surface than would smaller cities. Instead of the baseline being a flat plane, the imitation effects would build on an already curved surface. In these cases, the interpretation of the surface becomes the overall probability of acting at any given time rather than the increase in the probability of acting. Because I am currently focusing on the diffusion effects alone, I will not incorporate this complication into the present analysis.

actors is constantly changing. This dynamic model portrays diffusion as a much more fluid process than traditional network influence models.

I conclude this section by building a number of the above elements into a single model of influence. To make the discussion more concrete, I will treat each of the actors as a city and each event as a riot. The various influence elements modeled are summarized in Table 1. Actor characteristics are represented by assuming that the central city (I) is twice a large as the second largest city (II), and cities III, IV, and IV are half a big as city II (See Figure 4 to identify cities).[6] City I experiences three riots at t = 3, 7, and 10, city II experiences two riots at t = 5 and 11, cities III and V each experience one riot at t = 7 and 13 respectively, and city IV experiences no riots. The severity of each riot is given as a fraction of the most severe riot (riot 2) and ranges from 1.0 (the most severe) to .2 (the least severe).

| Table 1 Here |

The simulation of this hypothetical model is also controlled by two functions that relate the effects of temporal decay and of distance decay. The time decay model allows the maximum amount of influence during the first time period (T = 1) following the event (T = 0). The influence is then decreased each time period by dividing by the number of time periods that have elapsed until seven time have elapsed.[7] After seven time periods have passed, the influence of the event becomes zero. The decay over distance is a monotonically decreasing function that decays little very near the event, then decelerates rapidly over the first few distance units, eventually slowing to an asymptote.[8] Figure 7 graphs the effects of temporal decay and of distance decay.[9]

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[6] Note that these actor characteristics are use to relate differences in the infectiousness of events occurring to that actor rather than to relate differences in the individual propensities to experience an event.

[7] The decay multiplier is given by TD = $1/(t-T_0)$ if $t \leq T_0+7$ and TD = 0 if $t > T_0+7$, where T_0 is the time the event occurs.

[8] The distance decay function used for this simulation is an arbitrary function that mimics the behavior of much more complex distance decay functions that have been found to operate in these environments. The decay function used here is: DD = $\ln\left(1-\sqrt{.1-d^{2.5}}+\sqrt{4-d^{2.5}}\right)$, where d is the distance from any given city to an event.

| Figure 7 Here |

Figure 8 animates all of these influence factors for each city/event and at any point in time we can see the influence of prior events, as conditioned by distance, time decay, severity, and so forth. The simulation combines the effects of individual events and actors such that the joint effects of events whose influence overlaps in time and space are aggregated. On paper, only a few snapshots of the sequence can be displayed, but even in the sequence of six times periods shown in Figure 8, it is clear that inter-actor influence can be a very dynamic process, and so, therefore, are the existence and strength of the network ties through which influence flows. Over time, influence networks develop and fade away, other develop that replace older ones, and the combination of overlapping networks can aggregate into powerful imitation influence. For example, in Panel 2 of Figure 8, the model posits that the most likely place for a riot to break out at *t*12 is somewhere between cities I and II, despite the decays over distance of influence. This effect is the result of the combination of contagious influence flowing from recent riots in both cities I and II.

| Figure 8 Here |
Note: An animated variant of Figure 8 is also available. Click on or go to:
http://www.nd.edu/~dmyers/lomond/fig8.html

In the model represented by Figure 8, we have accomplished a number of things. One is that we have defined a dynamic network in which the strength of ties between the nodes is constantly shifting. In addition, we have combined the influence effects of many different actors into a single value, i.e., the height of the three-dimensional surface at any given point in time. In other words, for each actor (or city, in this case) the height of the surface combines the influence to imitate that it feels from all other actors. When events are fairly isolated in time or in space,

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[9] The time units and distance units are arbitrary. In prior research, I have found effects in certain circumstances that approximate these functions when the time unit is one day and the distance unit is approximately 100 miles.

actors only experience contagious influence from one other actor at a time. But, when events occur closer together, as in panels 2-4 in Figure 8, the contagious influence felt is a combination of influence from more than one source.

TRACING EMPIRICAL PATTERNS

The model developed in Section 2 is conceptually instructive as we try to understand the role of events, networks, and the mass media in producing influence among collective actors, but it is not yet clear how this approach might be used to investigate empirical phenomena. Furthermore, I have not yet discussed what kinds of questions might be illuminated by taking this particular approach to diffusion and networks. In the remainder of the paper, I will take some preliminary steps onto this ground by offering preliminary analyses of two empirical situations in which diffusion through spatial networks has been previously inferred. I will also extrapolate from these findings to consider their implications for future patterns of protest and collective violence diffusion.

In developing the model in the previous section, I used the example rioting (the action) across city (the units of analysis). I also depended heavily on the distribution of television signals in showing how the network diffusion model operated. The model, however, is not limited to just these kinds of circumstances. It is just as plausible to examine other kinds of collective action (such as non-violent demonstrations), other collective units of analysis (such as organizations or schools), and other kinds of communication technology (such as word of mouth). Historically speaking, there have obviously been transitions from one kind of communication technology to others and these transitions may have produced marked changes in diffusion patterns and thus in the trajectories of protest waves. Furthermore, more than one kind of technology (or unit of analysis, or action) may be operating at the same time and these different technologies, units and actions may have important effects on each other's diffusion processes.

To avoid an overly complex analysis, however, I will limit what follows to a very few diffusion-related characteristics of the dominant communication technology in three specific historical periods. Generally speaking, my aim will be to show how the "hills" in the imitation influence surface would be different across these three period, as a function of the dominant communication technology of those times. The first period I will call pre-electronic. In this period, communication technology was human. There were no televisions, radios, telephones, or telegraphs and the speed that information could travel was no faster than it could be physically delivered. In the fastest cases, a stage coach or a rider on a horse was the maximum speed. The particular case I will examine during this period is the set of riots known as "Captain Swing" which occurred in Britain during the fall of 1830.

The second technology period is the electronic mass media age. During this period, local televisions and radio stations operated and most were linked to a national network. Telephones also allowed long-distance and even international "real-time" communication. Television was clearly the dominant technology in the United States though. Ownership was very high (in excess of 95% of households had a television set, Rogers 1986) and even those who did not own televisions usually had access through friends and local establishments. The case I will examine during this period is the racial riots that occurred in the middle to late 1960s in the U.S.

The third technology period is the internet age. Since the advent of the internet and in particular the explosion of the World Wide Web, the computer has become a major source of information, particularly (but not only) in technologically advanced countries. Although computers have not replaced the television and telephone as media and interpersonal communication technologies, they are taking an strong position along side these technologies and offer important advantages to activists that are changing the way influence networks are structured and how diffusion flows through them. Because computer technology operates alongside and in conjunction with other communication technologies, it is difficult to isolate the effects of computers on diffusion. In addition, internet based communication is still very new and it will still be some time before its permanent effects on communication and influence patterns can adequately be assessed. Therefore, I will offer only a speculative treatment of diffusion via computer networks based on an extrapolation of the trends revealed through the examination of the first two periods and the specialized character of computerized communication (Diani 1999; Myers 1994; Hill and Hughes 1998).

Captain Swing Riots

In the Autumn of 1830, a series of protests by agricultural workers broke out in the south of England. Although these protests have been commonly thought of as machine-breaking riots because of the widespread destruction of threshing machines, activities were more broad-ranging and included attacks on overseer of the poor, attacks on workhouses, extortion of money, and barn burnings. Accompanying much of the protest activities were threatening letters to the landowners and other targets of protest activities. More often then not, these letters were signed by the mythical icon of the movement "Captain Swing," hence the name commonly used to identify this set of events (Hobsbawm and Rudé 1968; Charlesworth 1979; Tilly 1995).

In the several accounts of these events, including the authoritative version given by Hobsbawm and Rudé (1968), the spread of the riots across the countryside is an important focus. The issue of diffusion and imitation in this set of events remains somewhat contentious however. While it is quite apparent that there is a distinctive geographic pattern of events (see esp. Charlesworth 1979), it is not clear exactly what the source of this pattern was. Several diffusion patterns have been suggested by different observers. One is dependent on the flow of politically important information along highways extending away from London. Another suggests that a more "capillary" diffusion occurred in which events flowed from rural areas and converged toward the center. Yet another model posits that diffusion was tied to market towns--people would travel on markets days to these regional centers, learn about unrest elsewhere, and carry unrest back to their home towns. Hobsbawn and Rudé eventually rejected these diffusion notions as being relatively weak contributors to the pattern of rioting. They reasoned instead that the events were spontaneous, local reactions to economic and structural conditions and were not connected to the diffusion of larger political ideologies and tactics.

Charlesworth's (1979; 1978) reanalysis of the data suggests otherwise. By carefully tracing each event over space and time with a geographer's eye, Charlesworth shows convincingly that protest did travel along major lines of communication. How much of the pattern was due to diffusion of information and political ideology and how much of it was due to the coincidental distribution of radicals is left as an open question.

No matter what exactly the pattern of diffusion and the source of it, the communication technology behind the spread of rioting was distinctly human. Individuals physically carried information from town to town in the form of newspapers and pamphlets and mentally as they met with groups of men in other towns to discuss recent political events and their coordinated responses. As such, information traveled as quickly as the stage coach could or as slowly as men who actually walked from one village to the next.

In terms of diffusion, then, the protests and riots that spread during the fall of 1830 must have must have moved relatively slowly. Not only did word of prior protest have to spread up and down stage coach routes, but once word arrived, reactions were often delayed as information was processed and discussed, and organizing occurred for the next action. Thus, in terms of distance related decay, we should expect a relatively slow process. Series of delays from travel and organizing would introduce additional time between events, but not necessarily reduce the salience of past events. Of course, eventually, news would become "stale" and have less of an impact, but the diffusion process would exhaust itself at a relatively slow pace.

The distance related effects of such a communication network would necessarily be limited. Given the relative short range that information could travel each day, the contagious range for each event would be severely restricted. Over longer periods of time, secondary effects might reach far away, but the primary effect of any riot would be limited to the distance that information could travel in a few days. Thus, the pattern of diffusion dependent on the communication technology of this period is expected to show a strong distance related effect (the strongest diffusion near the location of a prior riot and a quick decline of contagion as distance grew) and a weaker effect of time within the geographic range of influence.

Urban Riots in the 1960s

In the mid-1960s, a wave of urban rioting broke out in the U.S. that resulted in an unprecedented amount of property damage, injury, arrest, death, and mobilization of repressive forces (National Advisory Commission 1968; McAdam 1982; Bergesen 1982; McPhail 1994; Gale 1996). The magnitude of the rioting shocked the American public and scholarly community alike and turned much attention to determining the causes of the rioting. In addition to the various economic and social causes thought to be at the root of the riots (Governor's Commission 1965; National Advisory Commission 1968; Spilerman 1970; 1971; 1976; Carter 1983; 1986; Jiobu 1971; Leiske 1978; Feagin and Hahn 1973; McElroy and Singall 1973), many observers considered imitation to be a primary force in determining the patterns, timing, and intensity of the rioting. The Kerner Commission (National Advisory Commission 1968) study of the "long, hot summer" of 1967 specifically called out contagion as a source of rioting and noted that many of the disorders could be classified into geographic and temporal clusters, suggesting that much rioting was the result of sympathetic outbreaks in communities near recent riots.

In analyses that have followed the Kerner Commission, diffusion/contagion has not been a major focus. Although some studies at least considered the notion that diffusion processes were operating, the tools used to discern such patterns were extremely limited and strong conclusions could not be drawn (Spilerman 1970; Stark et al., 1974; Midlarsky 1978; Pitcher, Hamblin, and Miller 1978). Later, Myers (1996; 1997; 2000) revived the question of contagious influence in the riots, and using event history techniques, found powerful diffusion effects. In all of these analyses, the authors (and others; Crump 1966; National Advisory Commission 1968) noted the importance of television as an information source about rioting and as the conduit through which rioting spread.

Communication through television has several important characteristics that have important implication for how information and influence flow. First, television broadcasts spread information much more quickly and over much greater distances than earlier modes of communication. Helicopters from Los Angeles television station KTLA were broadcasting scenes of the 1965 Watts riot while it was happening (Crump 1966). This kind of instantaneous transfer of information about what was happening and where has often been implicated as a force that fanned the flames of riots (Stark et al. 1974; Waddington 1992). Because television stations were connected by the national television networks, news and pictures of the riots were quickly transmitted over thousands of miles. It was not necessary to wait for days or weeks for news about unrest in other parts of the country-one could expect updates on at least a daily basis.

Second, television broadcasts are an one-way communication mechanism. The broadcasts are sent and received, but those who receive them do not engage in any kind of dialogue with the sender. The communication mechanism does not allow for any kind of response by the receiver nor is there any kind of negotiation about the content or meaning of the information transmitted.

Third, television has the ability to make the events it reports more real to the watchers by showing footage of actual rioting, damages, the behavior of the police, and so forth. These images can work to both agitate those who view them to action or to suppress further action by showing the negative outcomes of rioting.

These three elements combined have important implications for inter-actor influence in terms of the networks the media constructs and the way it uses these networks to diffuse collective action. First, because of the speed of information transfer, diffusion processes should occur more quickly than when physical travel time is required. In addition to spreading behavior more quickly, the forces that terminate a wave of action (i.e., repression or exhaustion) should also diffuse more quickly--both in response to the quicker spread of protest, and through their own diffusion processes (Myers 1997b). The combined result should be wave of activity that are considerably shorter and more intense than those found in early protest waves.

While the temporal reach of diffusion may be more limited in the electronic mass media age, the distance over which inter-actor influence occurs will be greatly expanded. Quite simply, the communication network created by networked television stations is much larger than could ever be created by word-of-mouth networks. And because the influence of prior events has a tendency to decay over time, the influence felt far from an event will be stronger not only because the network carries the information to that location, but also because it gets the information there more quickly--before temporal decay processes have had much time to operate.

While both the timeliness and the reach of television broadcasts both serve to accelerate the rate of action, the impersonal nature of television may serve to reduce the impact on individual adopters. Personal, face-to-face networks exert much more influence on individual's behavior than information coming through the mass media. While the information spread by the mass media may be more standardized than that coming through personal contact, it also may be more suspect because it is not possible to clarify details that may be pertinent to the listener, the motivations of the communicator may be unclear, and mass media reports are not usually accompanied by exhortations to act. Thus, while the mass media increases the overall impact of prior events by greatly expanding the network, it reduces the impact of each individual link.

The results of these characteristics of electronic mass media in terms of the influence patterns developed in this paper are mainly that diffusion should be less localized, expand and contract more quickly, but involve fewer of the target population (those who receive the information and could choose to act) than diffusion processes occurring in earlier times.

Results: Swing versus the 1960s

The patterns of events in both the Swing data and the 1960s riots are consistent with expectation for distance decay and for temporal decay. To track both kinds of influence decay, I estimated a temporal decay function and a distance decay function for each set of data.[10] The temporal decay function was derived from the count of riots each day following each riot in the data. The results of this procedure are given in Figure 9, where the relative probability of an event occurring one day after any riot, two days after any riot, and so forth is plotted. (More details on how these functions were estimated in given in Appendix A.) In both sequences of riots, there is a temporal decay effect: Additional riots are most likely to occur soon after any riot and the likelihood generally decreases as time goes on. This pattern, however, is much more extreme for the 1960s riots than it is for the Swing riots. The slope is much steeper for the more modern riots. In the seven day period, the relative probability has decreased by 83% for the 1960's riots while only a 22% reduction occurs in the Swing sequence. In the 1960s, then, contagious influence was highly marked immediately following the riot and then dropped away quickly. In the Swing riots, the influence of riots was much more constant over time--the riots has less of a contagious effect immediately, but continued exerting influence over much longer period of time.

| Figure 9 Here |

The distance-related decay patterns are also consistent with the above discussion. To estimate the distance decay function for each data set, I compared the distribution of distances between all city pairs to the distribution of distances between each riot and all riots that occurred within one week after it (again, see the Appendix for details on this procedure). The resulting distance decay functions are given in Figure 10. The first panel shows the effect of distance decay in the 1960s riots over the approximate relevant range of distance. The trend is

[10] The enumeration of Captain Swing events comes from Horn and Tilly (1988) and of the 1960s riots from Carter (1983).

monotonically decreasing and the slope becomes somewhat less steep as the distance from the source riot becomes larger. This trend simply means that riot are more "contagious" to cities nearby than they are to ones far away.

| Figure 10 Here |

The pattern for the Swing riots is quite substantially different (Panel 2 of Figure 10). To begin with, the overall trend of the decay pattern is negative, as was the case for the 1960s riots, but this pattern is reversed at locations very close to the riot. In the 0-50 mile range, there is actually an increase in riots as distance increases. One possible explanations is that when a riot occurs, repression is mobilized in areas relatively close by, thereby repressing the rate of rioting in those areas (Myers 1997b discusses this possibility in more detail).

Two other trends in the data are more important for present purposes, however. First, the decay effect is much more extreme in the Swing data than in the 1960s riots. At its peak, the Swing riot are most contagious about 50 miles from a source riot. At this point, the rate of riot occurrence is about four times what would have occurred if there were no distance related effects. The high point for the 1960s data is only about 1.3 times expectations. (The 1960s distance decay function is plotted over Panel 2 for comparison). Second, the Swing distance decay effect dissipates over a much shorter distance than the 1960s riots. 200 miles away from a riot, the contagious effect has all but vanished for Swing riots, but the 1960s riots still have a contagious effect at 300 miles, 1000 miles and more.

The results of these analyses are simple to summarize. Primitive, slow moving communication technology causes diffusion effects to be more concentrated locally and to slow the diffusion wave such that the contagious effects are displayed over longer periods of time. More advanced communication technology allows information, and therefore influence, to be spread over much greater distance at greater speed. This in turn reduces the effects of distance decay and causes shorter, more intense waves of activity. In essence, advanced communication technology produces larger influence networks but sustains their existence for considerably shorter period of time. If we translated our findings in this section back into the framework use in the first half of the paper, we would find that the Captain Swing riots produced three-dimensional hills that were taller, covered less area at the base, and collapsed more slowly than the hills produced by the 1960s riots.

IMPLICATIONS FOR THE DIFFUSION OF PROTEST AND COLLECTIVE VIOLENCE IN THE INTERNET AGE.

Although there have been any number of innovations in communication technology in recent years, it is easy to argue that the explosion of the internet and the World Wide Web are the most important and far reaching. Not only has the internet restructured how business is conducted within and between companies, with consumers, and even within families, but it has also changed the political landscape as well. Just like so many others, political activists have not been reluctant to embrace the internet and the web. Literally thousands of activist web sites now exist touting causes all over the political spectrum and advocating and coordinating tactics ranging from letter writing campaigns to violence.

Activists are drawn to the internet because it offers important advantages over traditional means of communicating a cause and coordinating action. For many, spreading the word is far cheaper via email and the web than communicating by direct mail, phone, or even face-to-face. The reach of the message is also much greater than activists can achieved with traditional messages. Sending information thousands of miles across international boundaries cost no more than sending it to people living in the same town. Computer-assisted communication also offers activists increased accuracy when reporting their plans, activities, goals, and ideology to constituents. Not only can messages be easily replicated exactly, but movements producing their own information avoid the inevitable distortion produced by mass media filters. Activists also have access to the ideas, experience, and support of other, like-minded activists with whom they might never have had contact without the internet (see Myers 1994; Diani 1999; Hill and Hughes 1998; for a more in depth discussion of these issues).

For present purposes, these differences in communication technology imply different kinds of networks among activists and the differences in these networks imply changing patterns in the spread, both geographically and temporally, of protest. In one sense, it seems likely that the trends observed as we moved from the pre-electronic age to the electronic mass media age will be extended into the internet age. In terms of the spatial reach of communication and influence, the internet provides a direct extension of prior trends. Before the electronic mass media, information about protest might travel, at most, a few hundred miles (depending of course on the severity of the incident). The level of technology in the 1960s broadcast such events thousands of miles (again, conditioned on the severity and therefore, the newsworthiness of the event, see Snyder and Kelly 1977; Mueller 1997; Myers and Caniglia 2000). Now, using the world wide web, events receive world-wide coverage.

The implication of this ever-widening network for the diffusion of protest extends the comparison given in Figure 10. When the computer is used, information is not only carried over a greater region, the decay of influence is less marked over distance as well. In other words, as we move into the future, the slope of the distance decay function will continue to grow flatter and flatter. This does not mean, of course, that distance related decay will completely disappear. As long as people populate the earth in cultural clusters, distance decay will result--even when information is completely homogeneously distributed, people will find some events more culturally salient than others (due to location, language, and political boundaries), and these events will be more contagious to those people. As long as culture is not independent from geography, distance related effects will be a part of the story of diffusion.

Temporal factors also extend previous trends. Communication using the computer is at least as fast as the television--even faster in many cases because computer users can retrieve information at any time--they do not have to wait for the news to come on. In addition, because the computer has such a long reach, it can get information to very far away places much more quickly. The result, of course, is an extension of the trends represented in Figure 9: Action will tend to accelerate ever more quickly and also burn itself out more quickly.

These predictions must be tempered, however, because computer communication is not exactly the same as other kinds of communication technology. For example, the computer e-mail message can become very impersonal, especially if the recipient is one of a list of hundreds or even thousands who have received the message. It is hard to imagine that this kind of communication could be remotely as influential as a phone call or face-to-face conversation. E-mail communication has become replete with junk-mail as well. The ease of communicating via e-mail leads inevitably to a situation of information overload in which many messages that arrive are tossed away with little or no consideration by the recipient. Because electronic information is so easily copied, the system is also highly susceptible to fraud. Messages calling for action and providing inaccurate and even completely fabricated information are continually passed on via e-mail networks. Serious action calls can then be lost in a sea of mistrust arising from experience with hoaxes. Furthermore, web-based information systems require the user to retrieve the content. This is also true of the electronic mass media, but many people will find it substantially more difficult to boot-up, log on, and find the information than to push the button on their remote control. Thus, although messages and information are much easier to supply via the internet, how and how often they are received by potential activists may offset many of these gains.

Finally, to understand the trajectory of communication technology networks and diffusion, it is important to consider alternative technologies alongside computers. Is the role of television and radio changing in response to the internet? How did the move to cable television change information networks? How do cellular phones, messaging systems, chat rooms, and so on play into these issues? How do these technologies build on, compete with, and complement each other? Also, how do these changes in technology affect different types of collective action (for example, a protest the requires a great deal of planning and coordination versus a riot)?

Finally, we must consider how unequal access to communication technology will help and hinder different kinds of movements. The poor and the less educated will have greater trouble accessing and making use of new communication technologies than those with more privileged status (King 2000), thereby exacerbating not only the gap between the rich and the poor in society, but also between the resource rich and poor within the body of social movements.

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Table 1: Hypothetical City and Event Characteristics

City	City Size	Riot	Time of Riot	Riot Severity
I	1.0	1	t = 3	.7
		2	t = 7	1.0
		3	t = 10	.2
II	.5	4	t = 5	.4
		5	t = 11	.8
III	.25	6	t = 7	.6
IV	.25	---	---	---
V	.25	7	t = 13	.5

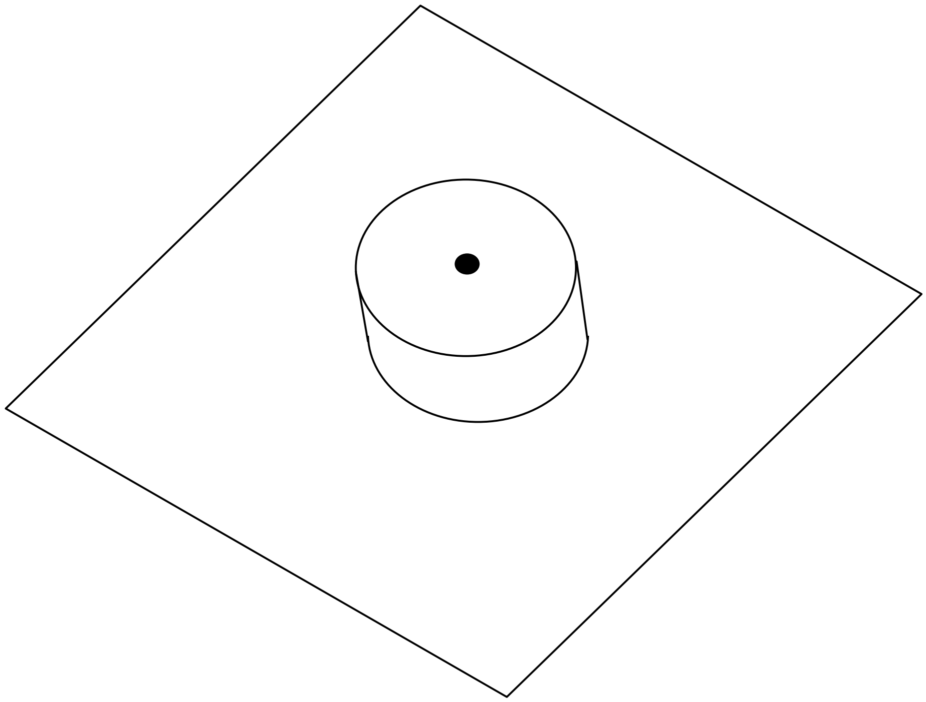


Figure 1: Media Influence Network Defined by Distribution

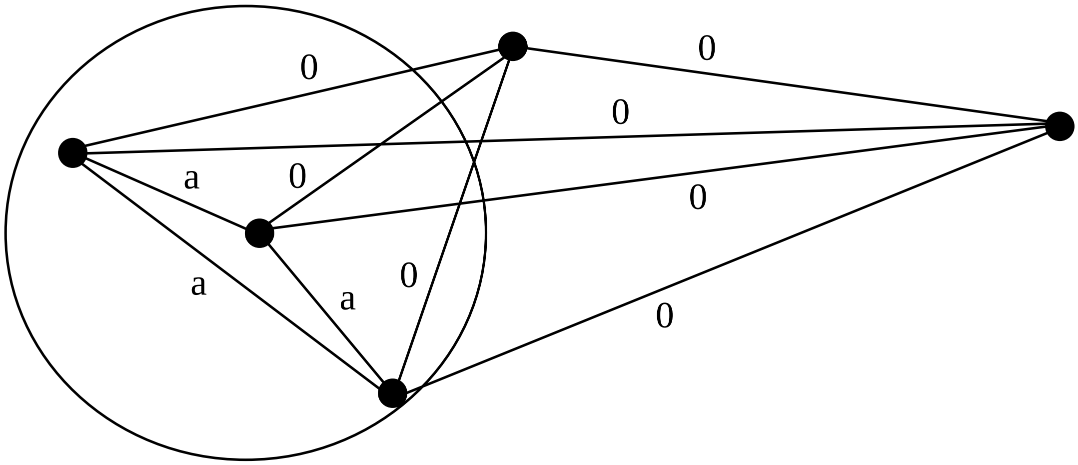


Figure 2: Imitation Index Ties Inside and Outside Media Distribution Area

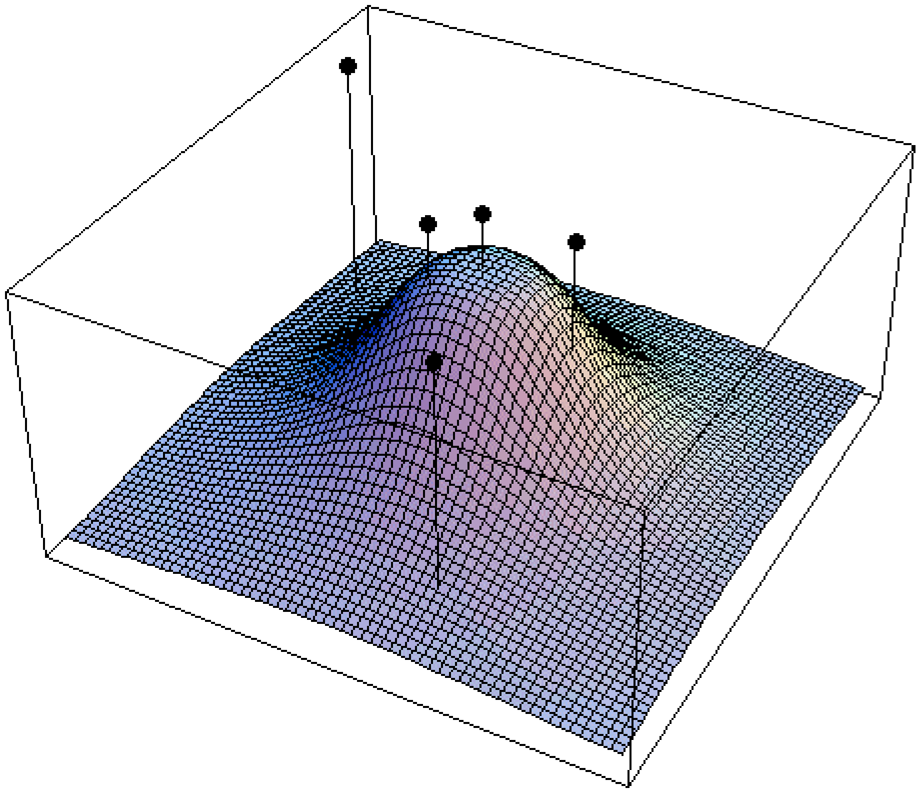


Figure 3: Decay of Influence over Distance

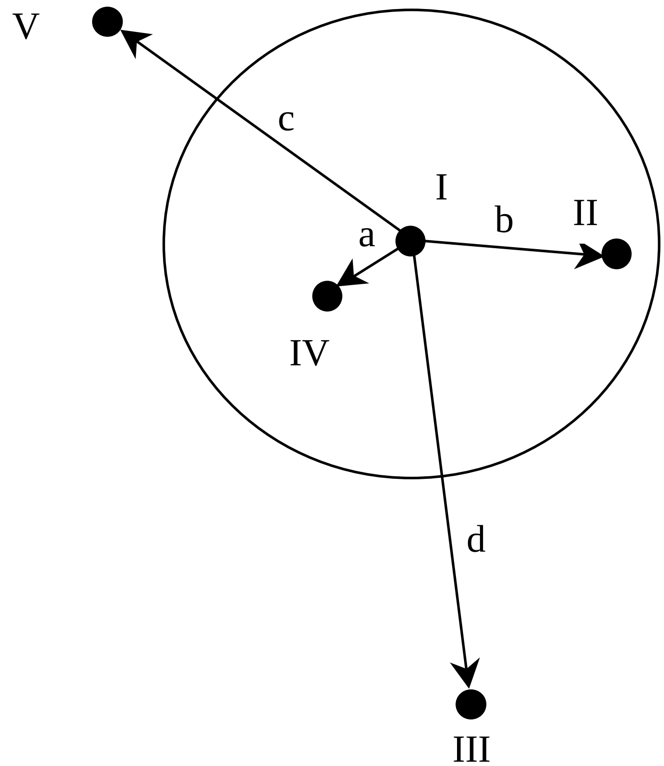


Figure 4: Distance Decay in Imitation Index

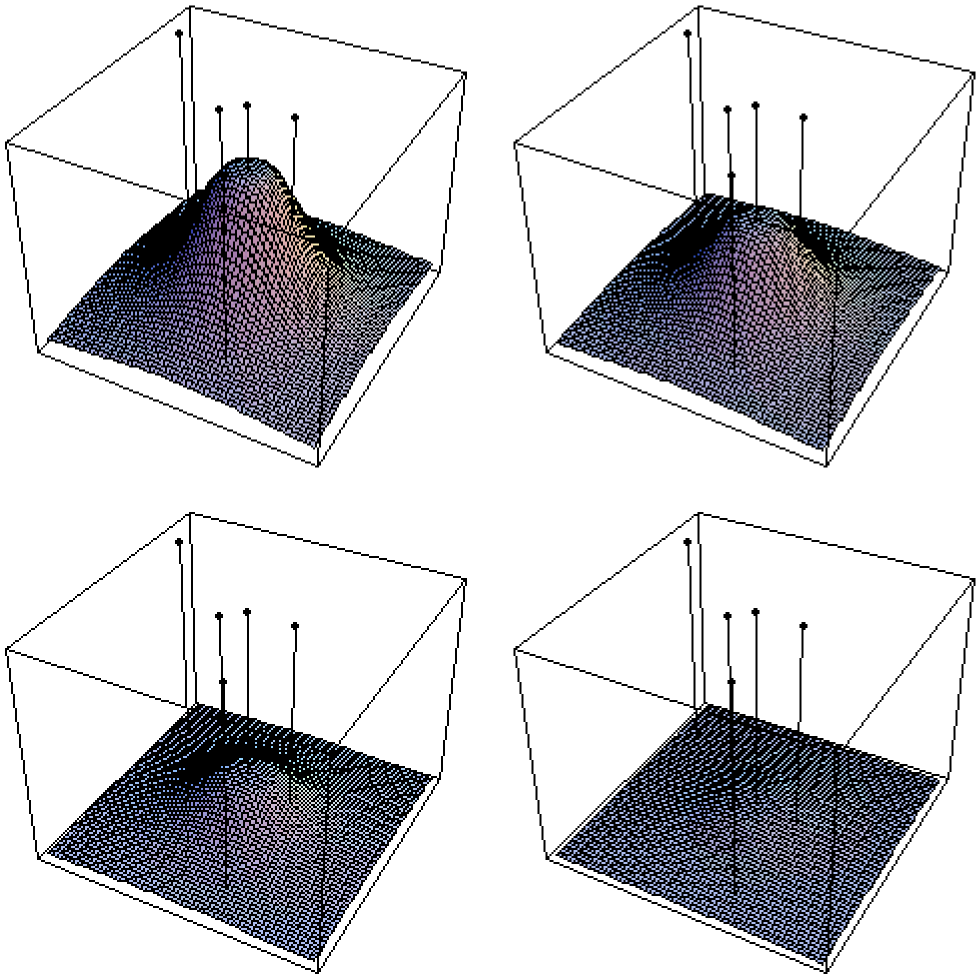


Figure 5: Decay of Influence over time (t = 1, 4, 7, 9)

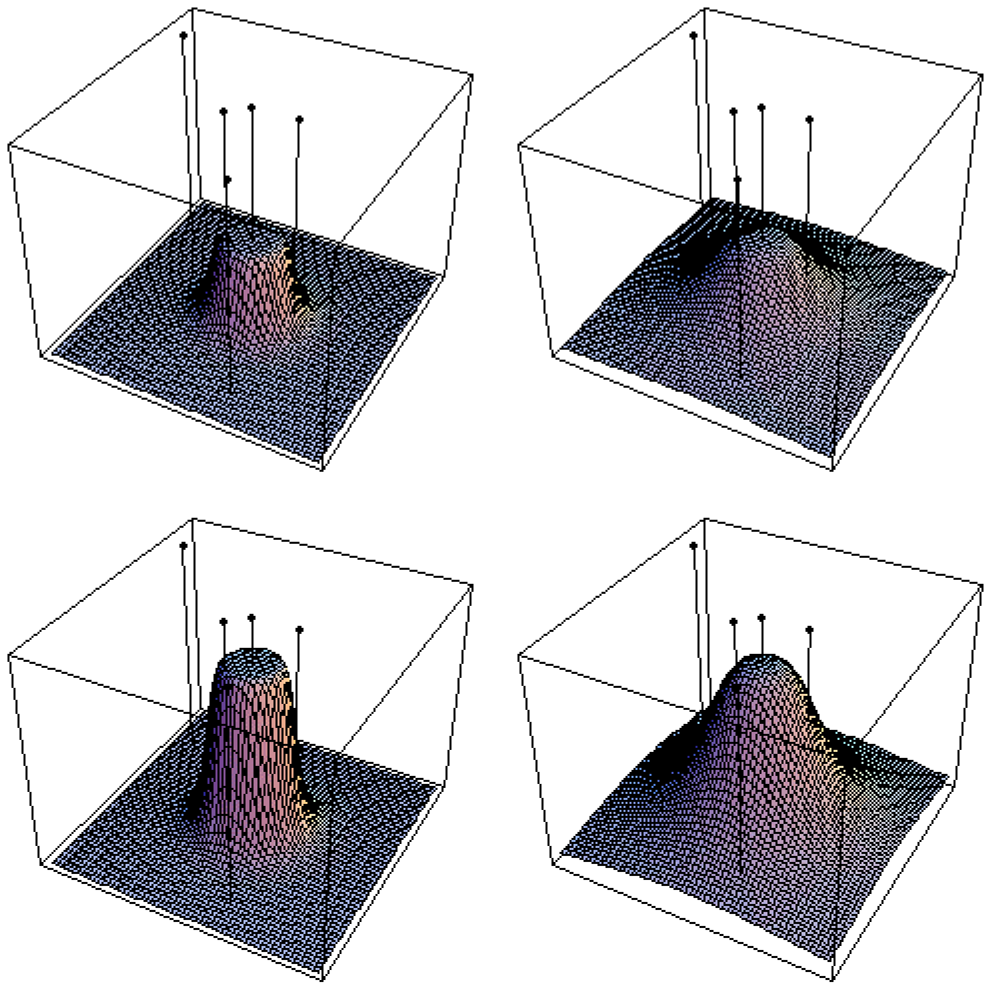
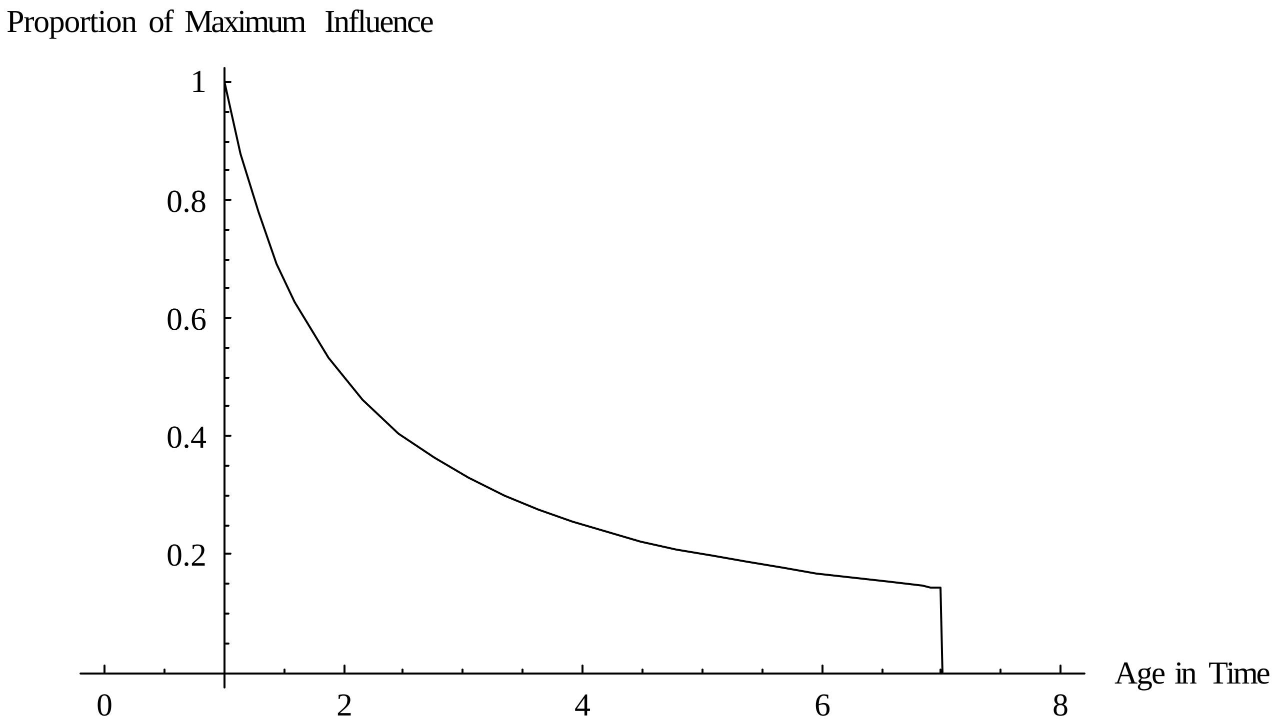
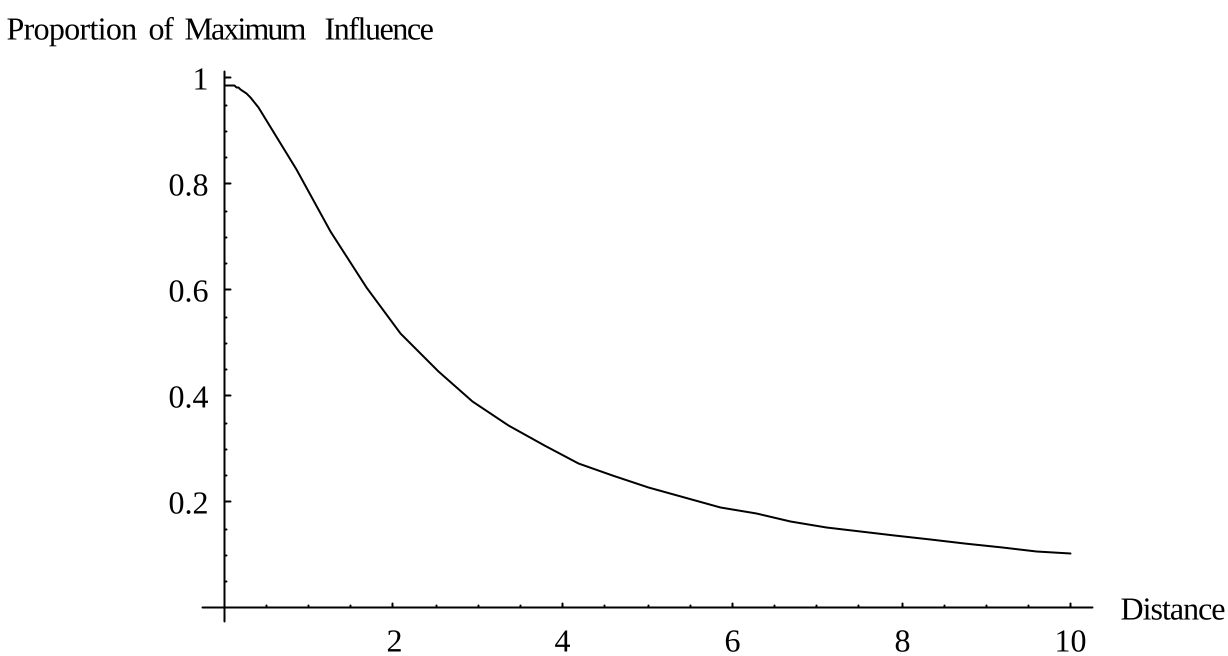


Figure 6: Effects of Event Intensity on Inter-actor Influence



Temporal Decay



Distance Decay

Figure 7: Temporal and Distance Decay Functions

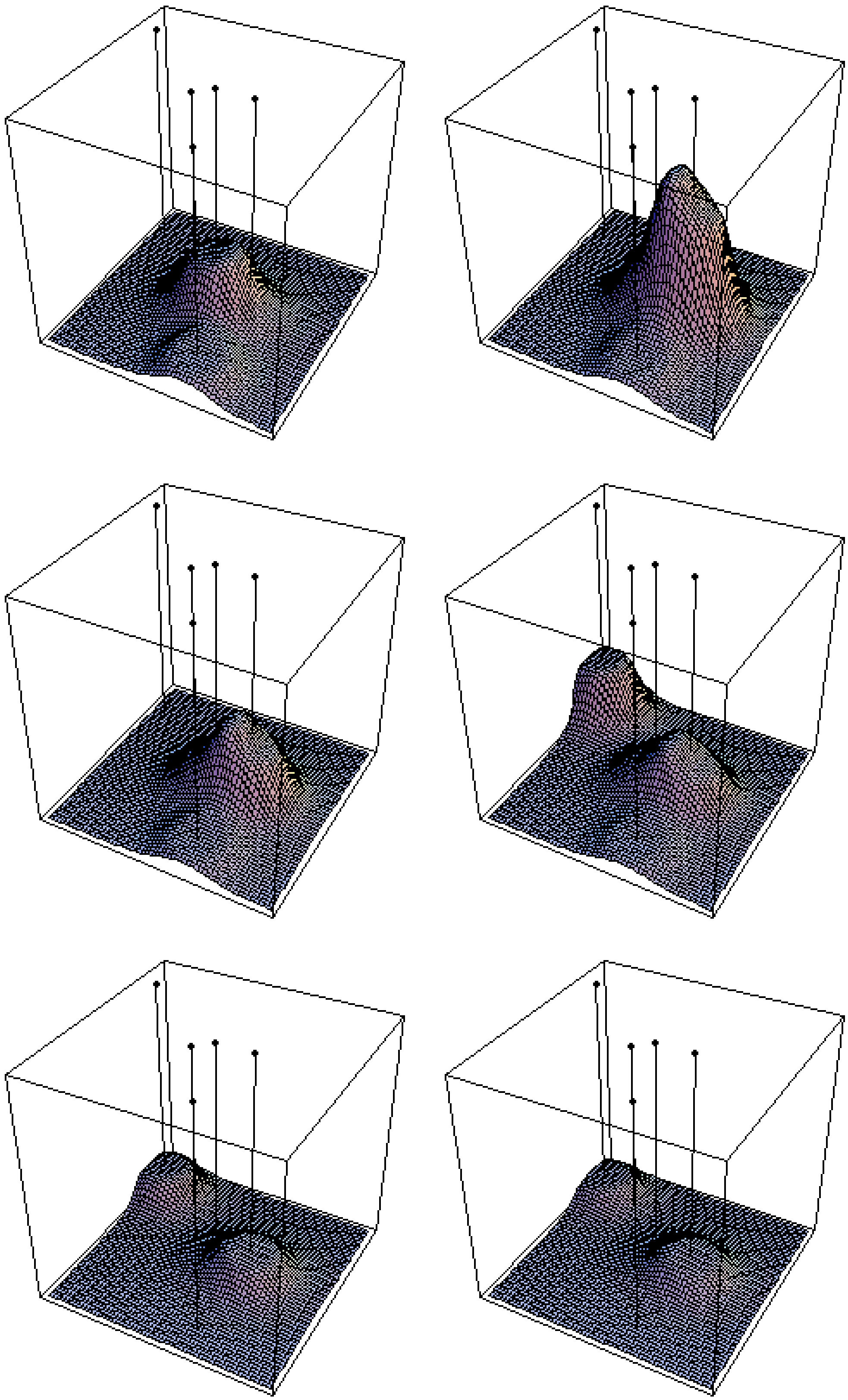


Figure 8: Changes in Imitation Influence Surface over Time (t11-t16)

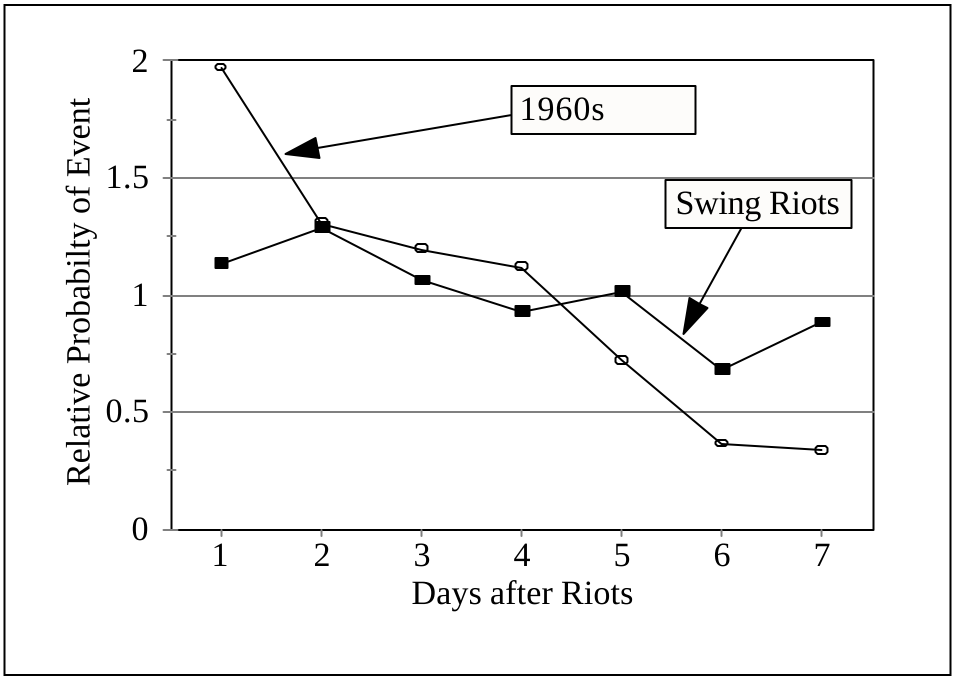


Figure 9: Temporal Decay of 1960s Riots and Swing Riots

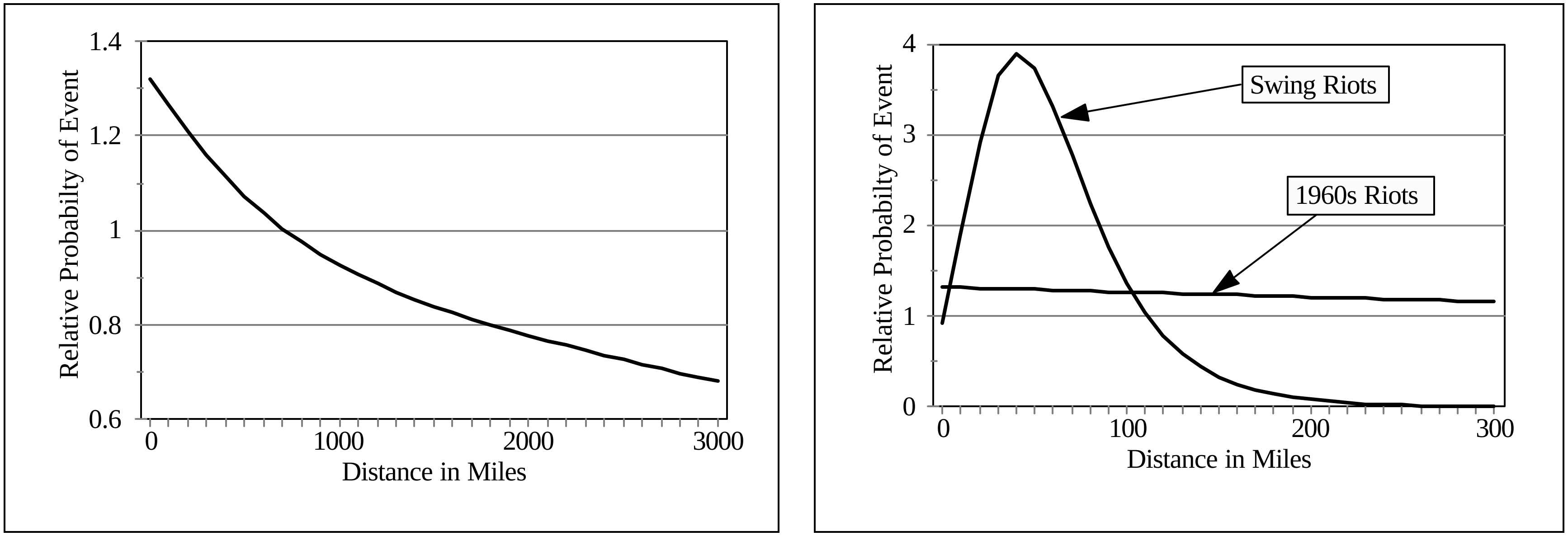


Figure 10: Distance Decay of 1960s Riots and Swing Riots

APPENDIX: DETAILS ON THE ESTIMATION OF DECAY FUNCTIONS

A.1 Temporal Decay

The temporal decay functions presented above were estimated by the following method. First, for each riot, I identified all riots that occurred in the subsequent 1 week period. (Other time periods other than 1 week were examined, but did not produce substantially different results for present purposes.) Then, for each of the subsequent riots, the number of days elapsed since the supposed source riot was recorded. If riots occurred randomly in time, then the number of riots each day following any riot should be roughly similar across the seven day period If riots are subject to diffusion with temporal decay, then the there should be more riots on the earliest days and less on the later days (within each one-week follow-up period).

The probability of a riot occurring on any of the subsequent days was calculated as the total number of riots on each of the seven follow-up days, divided by the total number of riots occurring during the seven day period. Each day was also assigned an expected probability of rioting, which in this case was simply 1/7 or .143. The decay function then was simply the ratio of the probability of riot occurrence divided by the expected probability. These values convey the relative probability of an event occurring compared to what would be expected given a uniform distribution of rioting across days. For example, the probability in the 1960s of having a riot one day after another riot had occurred was almost 2 times what should have been expected if riots were distributed uniformly.

A.2 Distance Decay

Distance-related decay presents a somewhat more complicated situation because cities cannot be geographically configured to produce a uniform distance distribution. Because cities near the borders must have a greater average distance from other cities than cities near the center of the geographic unit, the distribution of cities must be taken into consideration when attempting to assess distance-related decay of influence.

As above, all riots occurring in the one week following each riot were identified and their distances from the source riot were calculated. These riot-pair distances form a distribution such as represented by the white bars in Figure A.1. Subsequent rioting appear to be fairly high near source riots, but is even higher about 600 miles away after which it declines to a relatively low level. But because the city-pair distances are not uniformly distributed, this pattern may be misleading. When the city-pair distance distribution is considered, (the gray bars in Figure A.1), a different pattern may emerge since the riot-pair distance distribution must be, in part, a function of the distribution of city-pair distances.

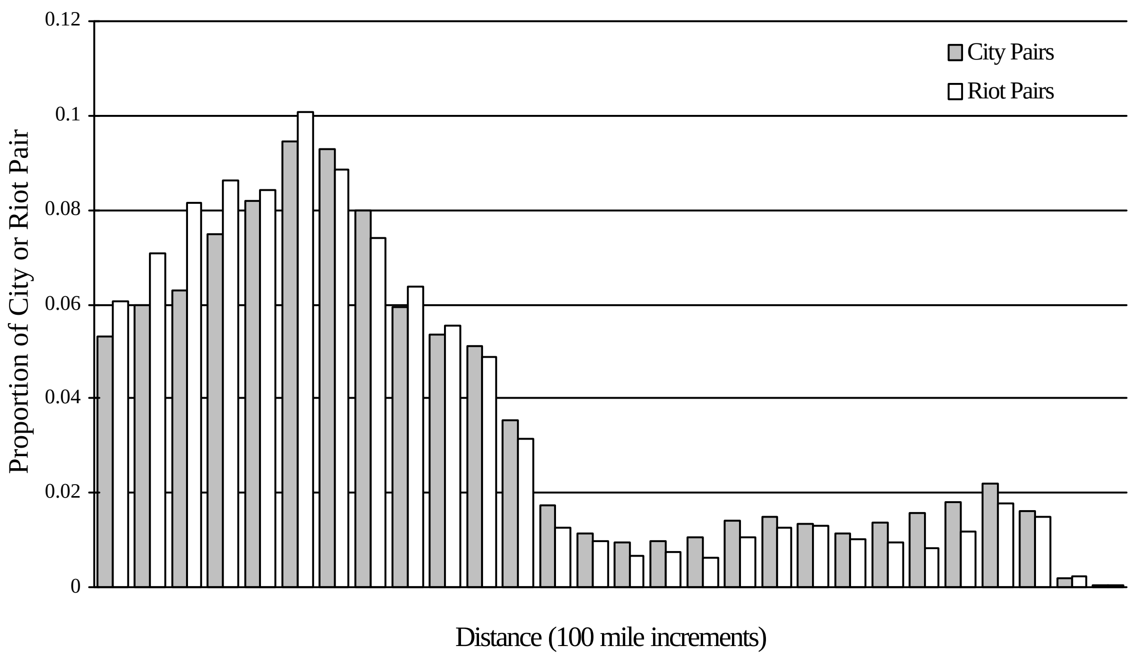


Figure A.1: Distribution of riot and city pair distances.

To appropriately identify the distance decay function then, it is necessary to correct the distribution of riot pair distances for the distribution of city pair distances. To do so, I first estimated the cumulative distribution function for each distribution of distances (one riot-pair and one city-pair for Swing and for the 1960s). In each case, the general shape of the probability distribution function (as in Figure A.1) suggests that the cumulative distribution function approximates a Gompertz function. Therefore, I fit the Gompertz function

$$y = a + b \exp\left[-\exp\left(-g\,(x-d)\right)\right] \tag{A.1}$$

to each of the data sets (city-pairs and riot-pairs) using non-linear least-squares. The estimated parameters are detailed in Table A.1. The derivative of the two functions defined by these estimated parameters (the probability density functions) represents the distribution of distances for each set of pairs and are the continuous variants of distributions like those in Figure A.1. These distributions are given by substituting the appropriate parameters in the equation:

$$\frac{dy}{dx} = bg\,\exp\left[gd - \exp\left(g\,(d-x)\right) - dx\right]. \tag{A.2}$$

Table A.1: Gompertz Model Parameters Estimates

	Racial Riots in the 1960s		Captain Swing Riots	
	Distances between City Pairs	Distances between Riot Pairs	Distances between City Pairs	Distances between Riot Pairs
a	-.0137 (.00033)	-.0221 (.0082)	-.158 (.0023)	.0622 (.00075)
b	.957 (.00041)	.980 (.0010)	1.23 (.0031)	.935 (.0014)
g	.00252 (1.6×10^{-6})	.00265 (3.8×10^{-6})	.00715 (2.0×10^{-5})	.0316 (9.6×10^{-5})
d	494 (.28)	442 (.64)	113 (.42)	45.1 (.062)
R^2	.997	.999	.999	.990

SEs in parentheses.

Comparing the two functions simply requires calculating the ratio of the riot distance *pdf* to the city distance *pdf* to determine the relative probability of a riot occurring at each distance. The resulting function is

$$I = .998\, e^{\left[\frac{-3.2}{e^{.00265x}} + \frac{3.48}{e^{.00252x}} - .000128x\right]} \tag{A.3}$$

for the 1960s riots, and

$$I = 6.22\, e^{\left[\frac{-4.15}{e^{.0316x}} + \frac{2.23}{e^{.00715x}} - .0244x\right]} \tag{A.4}$$

for the swing riots, where *I* is the infectiousness ratio and *x* is the distance. These function are plotted in Figure 10 in the text. More detail on this procedure, the rationale underlying it, and the empirical evidence for it are given in Myers (1997b).