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Group Segregation and Urban Violence

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How does segregation shape intergroup violence in contested urban spaces? Should nominal rivals be kept separate or instead more closely integrated? We develop an empirically grounded agent-based model to understand the sources and patterns of violence in urban areas, employing Jerusalem as a demonstration case and seeding our model with microlevel, geocoded data on settlement patterns. An optimal set of parameters is selected to best fit the observed spatial distribution of violence in the city, with the calibrated model used to assess how different levels of segregation, reflecting various proposed "virtual futures" for Jerusalem, would shape violence. Our results suggest that besides spatial proximity, social distance is key to explaining conflict over urban areas: arrangements conducive to reducing the extent of intergroup interactions—including localized segregation, limits on mobility and migration, partition, and differentiation of political authority—can be expected to dampen violence, although their effect depends decisively on social distance.

Recent outbreaks of violence in multiethnic cities across the world highlight the fragility of intergroup relations. Such conflict raises a fundamental issue: what can be done to foster harmonious coexistence in contested urban spaces? In particular, should nominal rivals be kept separate or instead more closely integrated? This question remains unresolved, given ambiguous empirical evidence and contrary theoretical perspectives about causal mechanisms, which together have engendered a vigorous, ongoing debate in the literature.

On the one hand, observations from numerous cities around the world suggest that to mitigate intergroup conflict, nominal rivals are best kept apart. In Belfast during the 1970s, residential, social, and educational segregation attenuated hate crimes by diminishing opportunities for direct intergroup contact (MacGinty 2001). During the Los Angeles riots of 1992, ethnic diversity was closely associated with rioting (DiPasquale and Glaeser 1998), whether as a result of ethnic succession (Bergesen and Herman 1998) or mixing that intensified ethnic competition (Olzak 1992; Olzak, Shanahan, and McEneaney 1996). That same year, Indian cities in Maharashtra, Uttar Pradesh, and Bihar, each of which had a history of communal riots, experienced violence

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principally in locales where the Muslim minority was integrated. In Mumbai, where over a thousand Muslims were killed in predominantly Hindu localities, the Muslim-dominated neighborhoods of Mahim, Bandra, Mohammad Ali Road, and Bhindi Bazaar remained free of violence (Kawaja 2002). Moreover, violence between Hindus and Muslims in Ahmedabad in 2002 was found to be significantly higher in ethnically mixed as opposed to segregated neighborhoods (Field et al. 2008). In Baghdad during the mid-2000s, the majority displaced by sectarian fighting resided in neighborhoods where members of the Shi'a and Sunni communities lived in close proximity, such as those on the western side of the city (Bollens 2008).

On the other hand, from different cities the exact opposite conclusion emerges—members of rival groups should be more closely integrated to avert violence. Race riots in the British cities of Bradford, Oldham, and Burnley during the summer of 2001 were attributed to high levels of segregation (Peach 2007). In Nairobi, residential segregation along racial (K'Akumu and Olima 2007) and class lines (Kingoriah 1980) recurrently produced violence. In cities across Kenya's Rift Valley, survey evidence points to a correlation between ethnically segregated residential patterns, low levels of trust, and the primacy of ethnic over national identities and violence (Kasara 2012). In Cape Town, following the forced integration of blacks and coloreds by means of allocated public housing in low-income neighborhoods, a "tolerant multiculturalism" emerged (Muyeba and Seekings 2011). And across neighborhoods in Oakland, diversity was negatively associated with violent injury (Berezin 2010).

Scholars have advanced conflicting notions about why and when intergroup contact is associated with conflict, i.e., pronounced tension and its manifestation in violence (Dovidio, Gaertner, and Kawakami 2003; Pettigrew 1998; Pettigrew and Tropp 2000, 2006). A prominent segment of the literature indicates that because ignorance breeds prejudice and introversion reinforces intolerance, contact improves intergroup relations (Allport 1954; Williams 1947). More recent studies underscore the logic that positive contact between nominal rivals reduces social distance (Pettigrew and Tropp 2000), prejudice (Pettigrew and Tropp 2006), and sectarianism (Hayes, McAllister, and Dowds 2007), and increases the desire to have ongoing interactions (Gaunt 2011). Meanwhile, low levels of contact have been associated with opposite effects, including reciprocal perceptions of animosity (Lichbach 1995), more effective intragroup communication (Fearon and Laitin 1996), heightened territorial attachment and greater ease of group-based mobilization (Toft 2003), and resistance (Buhaug and Rød 2006), all of which can be conducive to intergroup conflict. Furthermore, limited contact between groups often reflects geographic concentration, especially when congruent with dense social and economic in-group networks. Such concentration has been shown to alleviate collective action problems, providing members with a strategic advantage to communicate and coordinate for conflict (Weidmann 2009).

A competing perspective maintains that conflict occurs regularly alongside high levels of intergroup contact, which not only fail to undermine prejudice, but rather serve to reify cultural stereotypes and group differences (Forbes 1997). Thus, conflict between rival groups does not necessarily abate with higher levels of contact, which instead seemingly enhance the prospects of violence in at least some cases. On these grounds, it appears that reducing intergroup interactions can actually serve as a peacebuilding measure. Indeed, at the extreme, "intermingled settlement patterns create real security dilemmas that intensify violence, motivate ethnic 'cleansing', and prevent de-escalation unless groups are separated" (Kaufmann 1996, 137).

While these competing perspectives can potentially be reconciled, further research is warranted to better understand the consequences of contact for conflict, including the mechanisms that affect this relationship, and to investigate more fully the merits of peace-building approaches that seek to alter how members of different groups relate to one another. A key challenge in this regard is appreciating the repercussions of different options for the spatial and temporal patterns of violence, especially in places like cities, where heterogeneity is the norm and the combination of high population density and physical proximity heightens the latent potential for intergroup interactions. The research to date has been inadequate to assess those relationships, due to the limited availability of relevant microlevel data, study designs that consequently favor analysis at higher levels of aggregation, and a lack of rigorous inquiry into alternative scenarios.

Our goal is to develop, test, and apply a new framework to better understand the sources and patterns of intergroup conflict in urban areas, using an evidence-driven model seeded with microlevel, geocoded data on settlement patterns and violence. This approach allows us to replicate the spatial distribution of violence and model "virtual scenarios" to assess their relative impact on violence. We start by reflecting further on the empirical literature, identifying a causal mechanism that appears to consistently influence *when* and *how* segregation shapes violence. Next, we describe the structure and parameters

of an agent-based model designed to examine this relationship by means of evidence-driven simulation. We then offer an overview of the empirical case—Jerusalem during 2001–2004 and 2005–2009—used to demonstrate the viability and utility of the framework and describe the empirical calibration and validation of the model. After seeding the model with relevant contextual data from Jerusalem, we optimize the model's parameters such that the patterns of violence from the simulation closely fit the actual distributions in the city for each time period. We use the calibrated model to conduct a counterfactual analysis of how various "virtual futures" for the city shape the spatial distribution of violence. The counterfactual scenarios reflect different levels of segregation, including several that would likely ensue in the event of the implementation of peace proposals. We conclude by reflecting on the theoretical, policy, and methodological contributions of our results. Among the notable findings is that besides spatial proximity, social distance is key to explaining conflict over urban areas: while integration is a promising strategy when social distance is small, arrangements conducive to reducing the extent of intergroup interactions—including localized segregation, limits on mobility and migration, and differentiation of political authority—are more effective otherwise.

The Relationship between Segregation and Violence

The divergent findings concerning the relationship between segregation and violence underscore the need to identify a causal mechanism that may consistently account for both perspectives.

A logical explanation for results contrary to the expectations of contact theory is that the conditions necessary to realize the benefits of intergroup interactions do not prevail in all instances.[1] Incidents of conflict may occur between members of groups who cross paths with one another, even frequently, but perceive themselves as being of differing status, pursue divergent goals, prioritize intra- over intergroup cooperation, or receive unequal levels of public support (Horowitz 1985, 2001). Likewise, in the context of intergroup competition in urban settings, collective oppression leads individuals to see members of other groups as potential threats, driven by an admixture of alienation, prejudice, belief stratification, and self-interest (Bobo and Hutchings 1996). The obvious interpretation is that contact alone is insufficient without supporting attitudes, orientations, behaviors, institutions, and policies, which hardly can be taken for granted amid intergroup contestation and may require more intensive, sustained processes and commitments.

Another consideration is that the relationship between intergroup contact and conflict is likely endogenous, with multiple outcomes possible. For example, segregation in Belfast precipitated by violent conflict during the late 1960s and early 1970s (Doherty and Poole 1997) facilitated the politicization of Catholic and Protestant identities and effectively abetted a resurgence of intergroup violence during subsequent decades (Shirlow and Murtagh 2006). In Baghdad, ethnic migration following deadly attacks engendered a decline in violence between rival groups (Weidmann and Salehyan 2013). Similarly, a survey of 6,275 households in Karachi found that in addition to income and ethnic composition, the incidence of violence was a major determinant of the neighborhood choice (Ahmad 1993). In Guatemala City, among the most dangerous urban areas in Latin America, small-scale segregation—the creation of gated communities in peripheral areas—rose in response to high levels of crime and drug-related violence (Roberts 2010). As these examples suggest, residential settlement patterns are endogenous to the very outcome of interest, violence.

Specifying a Causal Mechanism

Acknowledging that contact alone is insufficient to explain the onset or absence of violence, we subscribe to the notion that a comprehensive measure of segregation should include a social distance matrix, alongside the essential spatial aspect (Reardon and Firebaugh 2002). In this respect, we part company with Weidmann and Salehyan's (2013) analysis assessing the impact of segregation vis-à-vis the "surge" in mitigating violence in Baghdad. Weidmann and Salehyan (2013) utilize a

[1] Allport (1954) posited four conditions for the benefits of such contact to materialize in practice: equal status of groups, goals shared by groups, instances of cooperation between groups, and institutional backing of intergroup interaction. Others have since reinforced, refined, and expanded Allport's hypotheses, arguing that the extent of bias against the out-group—or lack thereof—is influenced by many factors. The list includes perceptions of comparable status (Brewer and Kramer 1985), the sense of common objectives (Chu and Griffey 1985), and indications of intergroup collaboration (Blanchard, Weigel, and Cook 1975). Among the additional factors that have been identified are the general nature of intergroup relations (Sherif et al. 1961), social identities and self-categorization (Tajfel and Turner 1979; Turner et al. 1987), intergroup friendship (Brewer and Miller 1984; Pettigrew 1998), norms and practices (Landis et al. 1984), new information (Gaertner and Dovidio 1986), and behavioral modification (Pettigrew 1998).

geo-referenced model, integrating data on ethnic settlement patterns and the distribution of violence, optimized for a match between simulated and empirical data. We take their analysis as inspiration for our work, yet in contrast to their specification of either a constant attack probability or one that is shaped by the local ethnic mix, we choose not to focus strictly on how people are arrayed geographically and the frequency with which they interact. Rather, we consider that the nature of intergroup relationships, represented by social distance, matters decisively.[2]

We take social distance to encompass a variety of intergroup differences, including those associated with class, ethnicity, religion, race, and gender, with specific variants labeled affective, normative, interactive, cultural, and habitual (Karakayali 2009).[3] Our decision to consider how the nature of intergroup relationships shapes contact is bolstered by at least two reasons. First, relationships can exhibit the distrust, intolerance, and enmity that would seem to be necessary drivers of conflict, which the nature of physical separation alone cannot supply. Second, even if where people reside remains the same, relationships can still vary, providing a source of the dynamics that can account for periodic flare-ups of violence in otherwise static circumstances.

Consistent with the literature on conflict (Cederman and Girardin 2007; Fearon and Laitin 1996; Gur 1970; Horowitz 1985; Olzak 1992), we treat individuals as being affiliated with groups. Of course, groups are neither monolithic nor homogenous. A group's members commonly vary along several pertinent dimensions, such as their affinity with the group, history of interaction with people from other groups, exposure to past episodes of violence, and disposition to participate in violence. Therefore, a proper analysis of the topic at hand cannot be conducted at the level of groups alone. Instead, we represent individuals as quasi-independent actors, while recognizing the influence on their attitudes and behaviors of their group ties, whether ascriptive, willfully adopted, socially constructed, or a by-product of profession. We go further still in linking variation in population distribution, policing, and violence at the level of localities or neighborhoods to variation in behavioral outcomes, an exception in the study of ethnic violence (Green and Seher 2003).

Our theoretical framework specifies the probability p that an individual engages in violence as a function of social distance τ and a violence threshold Γ, such that $p = f(\Gamma - \tau)$ with $0 \leq \tau \leq 1$ and $0 \leq \Gamma \leq 1$. For any given social distance, the probability to engage in violence is assumed to increase as the violence threshold decreases. Figure 1 depicts the probability of violence for individuals with relatively low ($\tau = 0.4$) and high social distance ($\tau = 0.8$). All else being equal, the range of threshold values for which contact is violent will be considerably wider when social distance increases, as represented by the larger shaded area in Figure 1b relative to Figure 1a. While the two extremes—contact as exclusively positive or negative—are included in our framework as the limiting cases for $\tau = 0$ and $\tau = 1$, respectively, it is the region between these extremes that is decisive for most acts of violence. A more detailed description of our theoretical framework follows, as we introduce the model designed to examine the relationship between segregation and violence below.

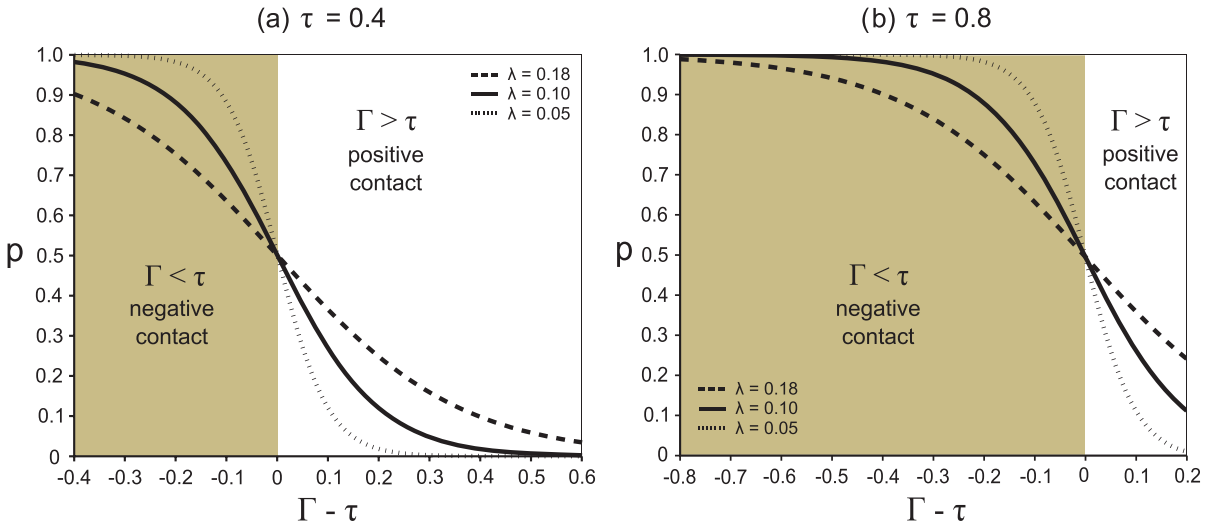
Model Description

For the purpose of our analysis, we opt to rely on agent-based modeling. This computational methodology is suitable and valuable to develop a more nuanced understanding of how the extent of contact between the members of groups—as influenced by segregation and other factors—affects spatial variation in intergroup violence in urban areas, for various reasons. One advantage is the ease of studying individuals, groups, and institutions simultaneously, in an integrated fashion. The flexibility to handle such agent granularity is a hallmark of agent-based modeling. Another advantage is the ability to represent actors interacting on physical landscapes, which enables the exploration of geography and the movement of actors, as well as the timing and sequencing of events. In adopting this methodology, we also extend a line of work that relies on agent-based modeling in studying civil conflict (Bennett 2008; Bhavnani and Backer 2000; Bhavnani, Miodownik, and Choi 2011; Cioffi-Revilla and Rouleau 2010; Epstein 2002), employing an explicitly data-driven approach in which disaggregated empirical data are used

[2]Our approach differs from Weidmann and Salehyan (WS) in still other, notable respects. We specifically (1) analyze more than two groups; (2) endogenize the likelihood of a civilian perpetrating violence as a function of individual-, group-, and neighborhood-specific factors, rather than distinguish *a priori* between nonviolent civilians and insurgents who alone perpetrate violence; (3) relax the assumption that policing occurs with some constant success rate and results in the removal of an insurgent, instead allowing it to mitigate violence in the short term and heighten violence between civilians and security forces in the long term; (4) downplay the salience of migration—a far more central mechanism in the case WS analyze; (5) use fine-grained data on neighborhood ethnic composition, residential settlement patterns, and in- and out-migration; and (6) utilize stricter criteria along multiple dimensions in estimating our model.

[3]We opt to employ affective social distance, first popularized in the Bogardus Social Distance Scale (Bogardus 1925), which focuses on the "reactions of persons toward other persons and toward groups of people" (Bogardus 1947, 306).

FIGURE 1 Causal Mechanisms: Linking Group Segregation to Violence



Note: p denotes the probability to engage in violence for different values of the transition parameter λ.

to seed, optimize, and validate the agent-based model (Benenson 2004; Geller 2008; Weidmann and Salehyan 2013). As such, our framework refines the mechanisms that others have used to study the emergence of ethnic segregation and its link to violence in an effort to focus more sharply on the conditions under which segregation generates—and is in turn generated by—violence.

Our model studies the dynamics underlying violent events brought about by the interaction between members of *g* nominally rival groups in an urban setting, where the likelihood of conflict depends on the social distance between the groups.[4] Agents are geographically distributed in a discretized two-dimensional space that mirrors the actual physical geography of a city, specified with geocoded information on the location, size, and shape of neighborhoods, as well as the general location of housing settlements. The population of each neighborhood is likewise based on empirical data and dynamically updated for each group using a natural rate of growth that reflects statistics on births, deaths, and net migration. Agents interact within their local surroundings and migrate from one neighborhood to another in an effort to minimize their exposure to violence.

A simulation run begins with the random assignment of agents designed to constitute the aggregate population of each neighborhood *N*. Agents are then updated in a random sequential order, with a time step defined as the number of simulation steps in which 10% of the population has been updated.[5] In each step of a simulation run, agent *i* first *interacts* and then decides whether to *migrate*. Specifically, agent *i* engages in a pairwise interaction with another agent *j* randomly selected from her immediate surroundings *R*, which in contrast to the geographical neighborhood *N*, is constructed concentrically around every given site.[6]

Defining interactions on *R* rather than on the larger geographical unit, the neighborhood *N*, is both theoretically and empirically motivated. First, local contact between residents within *R*—interaction in areas smaller than the neighborhood *N*—is central to the theoretical question we address. To operationalize these "local interactions," partners are chosen from the immediate surroundings in which contact takes place—ensuring the comparability of interaction areas across the city. Second, residential areas may only comprise a small part of a neighborhood, resulting in little or no sustained contact between residents located at opposing edges of *N*. Third, violence may often arise at the intersection of neighborhoods, along boundaries; simply selecting interaction partners from within *N* would effectively neglect these important dynamics, whereas permitting interaction with all surrounding neighborhoods would bring together residents characterized by little or no recurrent contact. Interactions on *R* naturally account for these dynamics since all residents in a locality—independent of administrative boundaries—are considered.

[4]The supporting information for this article provides a detailed description of the model implementation, calibration and validation procedures, data and sources, as well as the operationalization of our counterfactual scenarios.

[5]This (arbitrary) definition of a time step is offset by only considering aggregate simulation statistics.

[6]See section 2.2 in the supporting information for further details.

The probability that agent *i* engages in violence when interacting with agent *j* is specified by the following function, depicted in Figure 1:

$$p_{i,j}(t) = \left(1 + \exp\left[\frac{-(\tau_{i,j} - \Gamma_i)}{\lambda}\right]\right)^{-1}.$$

The abstract social-distance metric $\tau_{i,j}$, which represents the level of tension between the groups that agents *i* and *j* represent, has $(g^2 - g)$ nonzero entries. For intragroup relationships, we set $\tau_{i,i} = 0$, which implies that only interactions between members of different groups are assumed to generate violence. The transition parameter λ controls the shape of the violence probability curve (see Figure 1), and the parameter Γ_i constitutes a violence threshold. Thus, the degree of social distance influences whether contact is predominantly violent or nonviolent. For any given social distance, the probability of violence increases as the violence threshold decreases, whereas the likelihood that interaction is nonviolent, though conceivably hostile, rises with the threshold to engage in violence.[7]

The violence threshold Γ_i is calculated dynamically as a simple linear combination of three factors:

$$\Gamma_i = \frac{(1 - v_R) + (1 - d_G) + s_N}{3}$$

In this equation, v_R represents the memory of past violence in agent *i*'s locality *R*, d_G is the perception of discrimination by members of agent *i*'s group *G*, and s_N represents the level of state policing in *i*'s neighborhood *N*. All three factors are drawn from the literature on intergroup conflict and particularly pertinent to the empirical case we examine, as key determinants of the propensity to engage in violence in an urban area.

The memory of past violence is an individual-level parameter that addresses several considerations. As mentioned earlier, segregation appears to be endogenous to violence. In addition, the diffusion and contraction of violence likewise appear to be endogenous. This is demonstrated by the fact that homicides are often retaliatory in nature (Black 1983; Block 1977; Morenoff, Sampson, and Raudenbush 2001). Also, prior riots have been found to increase the likelihood of racial strife (Olzak, Shanahan, and McEneaney 1996), resulting in relocation and escalation diffusion, i.e., the spread of violence to adjacent locations and an increase in its scale (Schutte and Weidmann 2011). In our model, the memory of violence v_R, defined as the average of memories in agent *i*'s immediate surroundings *R*, is affected by both violent and nonviolent contact. At the outset, we assume all agents have no memory of intergroup violence. If violence ensues, the memory of violence increases among all affected neighbors in the victim *j*'s immediate surroundings. The outcomes of interactions further in the past are discounted relative to those of more recent interactions by having memories decay exponentially on a characteristic time scale *t*. Since v_R increases after episodes of violence, this raises the probability of future violence ($\Delta\Gamma < 0$). By contrast, periods of nonviolence reduce v_R over time, thus lowering the likelihood of further violence ($\Delta\Gamma > 0$).

Discrimination d_G is specified at the level of each group *G* and increases the likelihood of violence. The logic that frustration breeds aggression is demonstrated in various studies that highlight the link between violence and relative deprivation (Gurr 1970; Østby, Nordås, and Rød 2009), exclusionary policies targeting specific ethnic groups (Cederman and Girardin 2007; Horowitz 1975; Wimmer, Cederman, and Min 2009), and the related notion of horizontal inequality (Cederman, Weidmann, and Gleditsch 2011; Østby 2008; Stewart 2008). Discrimination affects the orientations of members of a group toward the members of all other groups, with higher levels conducive towards a greater propensity to engage in violence.

State policing is defined at the neighborhood level and has the effect of deterring individuals from engaging in violent activity.[8] Policing has been shown to reduce violence when above a critical ratio of law-enforcement officers to residents (Fonoberova et al. 2012), consistent (Lichbach 1987), effective (Fearon and Laitin 2003; Poutvaara and Priks 2006), timely (Weidmann and Salehyan 2013), and capable of imposing high punishment costs (DiPasquale and Glaeser 1998). In our model, the policing parameter s_N can vary from no police presence (0) to very strong police presence (1) and changes endogenously based on the model dynamics. Starting initially with a value of 0, s_N is set to 1 whenever an incident

[7]Our specification ensures that while thresholds are situation-specific, behavioral decisions exhibit a measure of continuity (Granovetter 1978).

[8]We readily acknowledge that state-sanctioned and intergroup violence differ with respect to their causes and effects. As a result, we explicitly model violence perpetrated by social groups, whereas state-sanctioned violence is implicitly captured through the level of policing, which increases as a direct response to violent incidents rather than as a function of local conflict dynamics and intergroup tension. The primary effect of policing is to counteract further violence; however, an increased police presence also leads to more interaction between civilians and security forces and may therefore serve to incite violence directed at the police. In the model, security forces are assigned to each neighborhood in numbers proportional to the level of policing and have no specific location. Interaction partners are then randomly drawn from (1) all civilian agents within *R* and (2) security forces; the latter are selected with probability proportional to s_N. See section 2.2 in the supporting information.

TABLE 1 Model Overview

	Variables	Values
Explanatory Variables (estimated)	τ: social distance between groups	$0 \leq \tau \leq 1$
	$d_{G:}$ perception of discrimination for group G	$0 \leq d_G \leq 1$
Endogenous Variables	v_R: past violence in local surroundings R	$0 \leq v_R \leq 1$
	s_N: level of policing in neighborhood N	$0 \leq s_N \leq 1$
Empirical Parameters (fixed)	m_G: mobility of group G	$m_U = 0.01$
	Empirical data also define the demography of each neighborhood, population size, city topography, and locations of settlements	$m_S = 0.02$ $m_P = 0.03$
Interaction Parameters (estimated)	r: size of local surroundings R	$r = 5$
	λ: scale of logistic threshold function	$\lambda = 0.05$
	t: time scale for violence memory and policing decay	$t = 30$ sim. steps

Note: *S*: Secular/Moderate Orthodox Jews, *U*: Ultra-Orthodox Jews, *P*: Palestinians. The derivation of the values for m_G is detailed in section 2.3 of the supporting information.

of violence occurs, then decreases on a characteristic time scale t when violence is absent. The impact of policing is also conditional on intergroup relations: for small social distances, policing will tend to result in less violence, whereas in the context of high social-distance policing—well intentioned or not—it is generally considered to be provocative and leads to more violence. Our specification reflects these features.

While the primary mechanism in our model is pairwise interaction between agents, an endogenous link between the resulting dynamics and the distribution of the population on the model topology is established via migration. The migration mechanism permits individuals to relocate to less violent neighborhoods in which a majority or significant fraction of their group resides (Schelling 1978). In addition, all individuals may migrate to less violent neighborhoods or out of the city under conditions of endemic violence (Doherty and Poole 1997; Weidmann and Salehyan 2013). Specifically, the migration of an agent from neighborhood N to a new neighborhood N' is executed with probability m_G, an empirically based mobility factor for each group.[9]

Since the outcomes of previous time steps affect the subsequent states of the simulation, the results of our agent-based simulations have an element of path dependence. While the occurrence of violence or nonviolence matters for what transpires subsequently, it does not define a single course of events given several sources of variation: migration decisions are probabilistic and contingent on the continually changing context of group distribution and violence; agent pairings are randomized; agent behaviors are probabilistic and contingent on evolving conflict drivers; and the influence of past interactions progressively fades. Consequently, the model is not deterministic: identical parameter configurations yield a range of similar outcomes for different random simulation seeds. We provide a summary of the model's parameters in Table 1.

As part of the analysis of a specific case, the model is calibrated and validated with respect to a baseline of empirical data on (1) the number of violent incidents per neighborhood; (2) the location of violence; and (3) the distribution of attack targets, by group, across the entire city (which ensures a correspondence to overall perpetrator/victim patterns).[10] This step involves an exhaustive, enumerative calibration procedure whereby we vary the social distance and discrimination parameters—i.e., the variables not endogenous to the simulation—and identify values for which the model best fits the baseline empirical data.[11] Social distance influences whether contact is predominantly violent or nonviolent, whereas discrimination alters the likelihood of violence independent of social distance; social distance is specified dyadically, whereas discrimination is not explicitly directed toward out-group members. Both parameters feature as key drivers of violence and have clear empirical referents. In addition, we include the full set of interaction parameters λ, r, and t—the scale of the logistic threshold

[9] See sections 2.1 and 2.3 in the supporting information.

[10] There are a number of common techniques to quantify correspondence with empirical data; here, we employ Pearson's correlation and various root-mean-square measures.

[11] Note that we optimize the model to account for aggregate violence statistics in each period, given that data are too sparse for a year-by-year matching; however, optimizing for subperiods also yields parameters consistent with those obtained for the aggregate statistics. See section 4.1 in the supporting information.

function, the size of the local surroundings R, and the time scale for memory decay—in our calibration routine.[12]

The Empirical Context: Segregation and Violence in Jerusalem

> One Palestinian male was physically assaulted by Israeli settlers, who entered Jabal al Mukaber village and stoned Palestinians and their properties in response to the killing of eight Israelis on 6 March by a resident of the village.[13]
>
> Tension ran high this week in the Sheikh Jarrah neighbourhood in East Jerusalem following the 2 August evictions of the two extended Hanoun and Al Ghawi families (nine family units) from two residential structures. Several confrontations occurred during the week between Palestinian residents of the neighbourhood and the residences' new Israeli occupants, with Israeli settlers harassing Palestinian residents of the neighbourhood, throwing stones, physically assaulting pedestrians, and in one incident, firing live ammunition into the air. On two occasions, unarmed clashes occurred between Palestinians and Israeli settlers resulting in the injury of five Palestinians and one Israeli settler.[14]

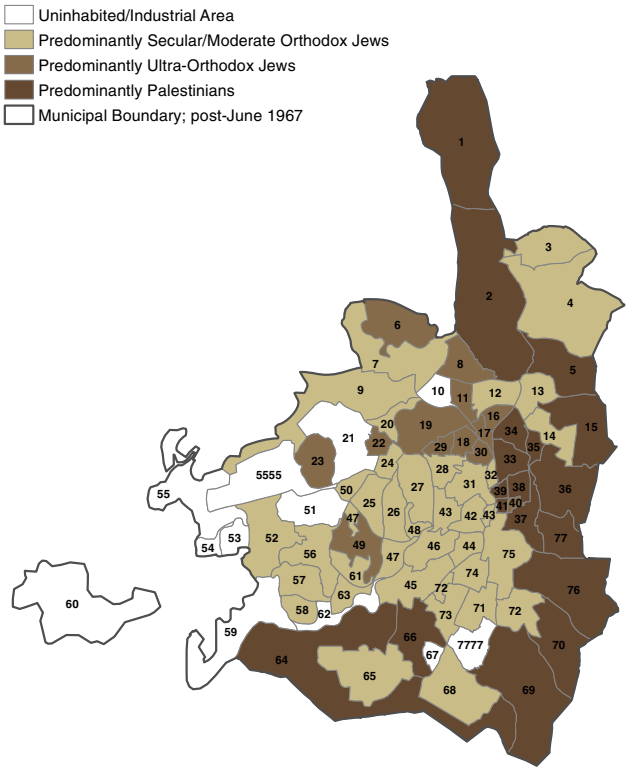
As these anecdotes illustrate, Jerusalem is among the most contested cities in the world, characterized by an unremitting struggle for territorial control—neighborhood-by-neighborhood and even house-by-house. Since the British control of Palestine (1917–48), the city's geography has evolved from a unified, multiethnic entity to one that is physically, ethnically, and politically divided. Following the 1967 war and annexation of approximately 70 square kilometers to the east, north, and south of what was formerly Jordanian Jerusalem, all of the city's 77 neighborhoods fell under exclusive Israeli control. Widespread construction of new Jewish settlements around the city, facilitated in no small measure by the expropriation of nearly a third of all annexed territory, resulted in a patchwork of ethnic neighborhoods (Bollens 1998; Margalit 2006; Romann 1984, 1989; Romann and Weingrod 1991), depicted in Figure 2.

[12] See section 3.1 in the supporting information.

[13] OCHA, Protection of Civilians Weekly Report, 12–18 March 2008.

[14] OCHA, 5–11 August 2009.

FIGURE 2 Neighborhood Composition (2001–2009 Population Averages)

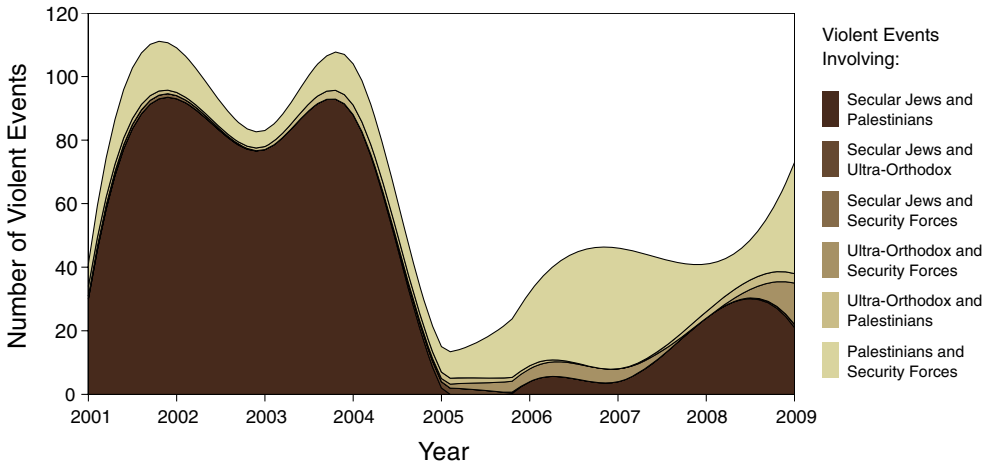


Two of the neighborhoods populated by predominantly Secular/Moderate Orthodox Jews, *Pisgat Ze'ev* (neighborhood #4) and *Gilo* (#65), are in areas annexed to the city after the 1967 war. Ultra-Orthodox Jews, who traditionally clustered and continue to reside in densely populated neighborhoods in and around West Jerusalem's center, have also migrated to neighborhoods in East Jerusalem. As a result, two of the most heavily populated Ultra-Orthodox neighborhoods, *Ramot Haredi* (#6) and *Ramat Shlomo* (#8), are also in annexed areas. Palestinians tend to reside in East Jerusalem, though some reside in West Jerusalem, and others have recently been migrating to Jewish neighborhoods in the north, creating small but notable minority clusters, such as those in *Pisgat Ze'ev* (#4) and *French Hill* (#13).

The recent construction of a barrier between Israel and the West Bank, which separates the city's Arab population from the Palestinian hinterland, has further altered Jerusalem's ethnic landscape by encouraging Palestinian Jerusalemites to resettle within the city's boundaries from the West Bank, overcrowding Palestinian residential areas and increasing intergroup animosity (Kimhi 2008).

Palestinian-Jewish civic relations are further strained by the asymmetric, disproportional distribution of public

FIGURE 3 Empirical Perpetrator/Victim Dynamics, 2001–2009



services and employment, as well as formal restrictions and pronounced inequities in the housing and construction sectors. The former has been exacerbated by the separation barrier, the latter exemplified by the expropriation of 40% of private land for public use and the inhibition of new Palestinian construction (Kaminker 1997; Margalit 2006). Indeed, discrimination of Palestinians by the Israeli state is repeatedly identified as a key conflict driver in Jerusalem (Margalit 2006).

Policing also features prominently in Jerusalem. Nonresident Palestinians who wish to enter the city from the West Bank undergo physical checks at the separation-barrier checkpoints (OCHA 2009). The Israeli Security Agency (i.e., Shabak) utilizes informants from Jerusalem's Palestinian population to monitor political activity and conducts periodic arrests (Cohen 2007). Barracks of the Israeli Border Police are stationed next to the former borderline, where Palestinian neighborhoods were taken over in north and south Jerusalem, as well as within the old city, in the Muslim and Jewish quarters (Israeli Police 2012).

The scholarship on Jerusalem considers intergroup violence to be one of several aspects of Jewish-Palestinian and Secular-Ultra Orthodox relations (Hasson 1996, 1999, 2007). Few studies focus on violence per se, much less its links to the social geography and contact between communities (see Hasson 1996, 2001; Romann and Weingrod 1991; Shilhav and Friedmann 1997), with the exception of Bollens (1998, 2000), who examines how urban planning can intensify violence based on a comparison of Jerusalem, Johannesburg, and Belfast but stops short of probing the dynamics in depth. The question as to how further segregation of the city's population or greater mixing will likely affect violence remains largely unaddressed.

In a concerted effort to study the spatial patterns of violence in Jerusalem, we consider murders, severe assaults (e.g., gunfire, stabbings, attempted suicide bombings) and minor assaults (e.g., stoning, throwing Molotov cocktails) within municipal boundaries and at permanent checkpoints on the city's outskirts between 2001 and 2009.[15] Each event in our empirical data involves a member of a group—Secular/Moderate Orthodox Jews, Ultra-Orthodox Jews, Palestinians, security forces—attacking a member of another group.[16] The security forces are not a social group per se, but they represent an important actor in the conflict.

We consider two distinct time periods, 2001–2004 and 2005–2009, given an abrupt change in the nature of violence before and after 2004 in our empirical data (Figure 3). From 2001 to 2004 (the Al Aqsa Intifada), violence occurred primarily between secular Jews and Palestinians, whereas violence between security forces and Palestinians accounts for the largest share of events between 2005 and 2009. In addition, the violence during the second period is not limited to a single, central conflict, but rather it is composed of multiple, local conflicts between different social groups. Consequently,

[15]Note that our definition excludes domestic violence and violence against property.

[16]Our data sources include the Israeli Police Statistics and Mapping; *B'Tselem*, the Israeli Information Center for Human Rights in the Occupied Territories; OCHA oPT, the UN Office for the Coordination of Humanitarian Affairs; AIC, the Alternative Information Center; as well as content analysis of all the daily issues of Yediot Aharonot from 2001 to 2009. These sources were used to (1) assemble a wide universe of events of deadly and nondeadly violence in Jerusalem; (2) cross-check and validate the coding of events; and (3) compensate for biases in the data introduced by relying on a single source. See section 1 in the supporting information.

the spatial nature of violence differs across the periods (Figures 4a and 4b). During the first period, most parts of Jerusalem were affected, with a total of 337 incidents of violence occurring in 53 of the city's 77 neighborhoods. A majority of events occurred along the border separating predominantly Jewish areas in the West from largely Palestinian areas in the East. By contrast, the second period exhibited a reduced number of violent events, 207 in all, which affected only 37 of the city's 77 neighborhoods and were concentrated in the East.

Model Results

Figure 5 displays the subset of social distance and discrimination-parameter combinations that generate the best fits with respect to the empirical data on the locations of violence, the number of violent events per neighborhood, and the targets of violence by group.[17] A circle denotes the occurrence of a given parameter value within the subset; the larger the circle, the more frequent its occurrence. A narrow distribution of values (i.e., fewer and larger circles) suggests that a parameter is particularly relevant for generating a good model fit; values of the best-fit parameter vector are circled in bold. As an indication of the internal validity of the mechanisms underlying our model, these values are both theoretically plausible and consistent with observed levels of intergroup tension and discrimination in Jerusalem: low social distance between Jewish groups, with considerably higher levels between Jews and Palestinians; high distance between Israeli security forces and Ultra-Orthodox Jews, reflected in the latter's relatively high perception of discrimination; even higher levels of discrimination and distance on the part of Palestinians, but little or no discrimination perceived by Secular/Moderate Orthodox Jews. Temporal and spatial slicing of the data set provides further confirmation that our model wields considerable in-sample predictive power. We further establish the significant value added of our model relative to a simple statistical (baseline) model that predicts future violence based on past violence.

The distributions of violence generated by the best-fit parameters underscore the internal validity of the model (Figures 4c and 4d). Our simulations accurately reproduce the occurrence of violence in 59 of 77 neighborhoods (76.6%) for the 2001–2004 period and in 64 of 77 neighborhoods (83.1%) for the 2005–2009 period (Figures 6a and 6b) and match the citywide distribution of targets for each group with high precision. The correlations between the simulated and actual numbers of violent events in neighborhoods are 0.33 and 0.65 for the 2001–2004 and 2005–2009 periods, respectively; the considerably higher quantitative agreement of the model in the latter period is a consequence of our model's ability to better capture spatially localized violence dynamics. The per-neighborhood predictions lie within two standard errors of the empirical data for all but three neighborhoods during the first period and all but four neighborhoods during the second period.

Overpredictions of the severity of violence during 2001–2004 were concentrated either in predominantly Jewish or Palestinian neighborhoods in East Jerusalem or along the pre-June 1967 East-West border, whereas notable underpredictions for the same period were observed principally in the Jewish neighborhoods of West Jerusalem (Figure 6c). These disparities are often consistent with aspects of the second Intifada that the model does not explicitly account for, including clashes over symbolic areas such as the old city and the Jewish city center and the fact that during the Intifada many individuals perpetrated violence in locations distant from where they resided. Notable overpredictions during 2005–2009 were observed for the southern and northern parts of the city (mostly in East Jerusalem), whereas underpredictions were clustered around the city center and in the *Atarot* neighborhood (#1) (Figure 6d). Both areas of the city are highly symbolic, with violence in the city center often triggering a response in *Atarot* and vice versa—nonlocal dynamics our model does not explicitly account for.

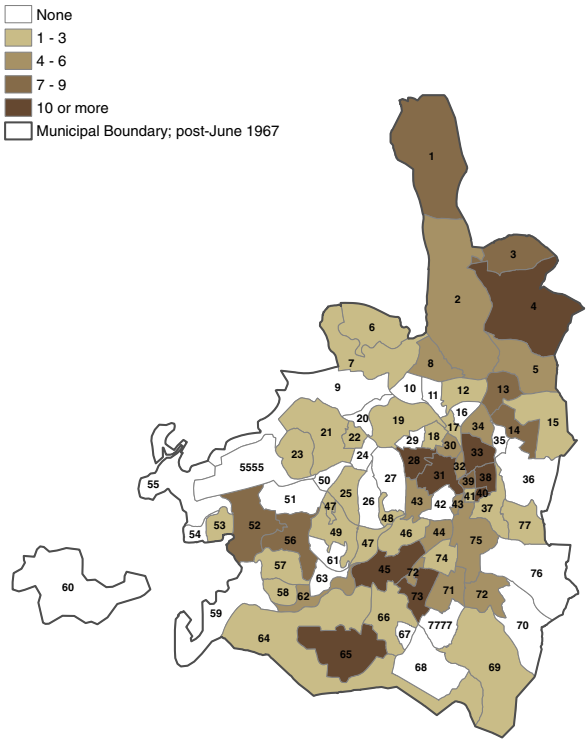
The Virtual Futures of Jerusalem

With confidence in the fidelity of our model, particularly in the recent post-Intifada period, we next undertake an exercise to estimate the expected impact on patterns of violence of alternative arrangements for dividing the city—the status quo (or *Business as Usual*), a *Return to pre-1967* borders, the *Clinton proposal,* and a *Palestinian Proposal.* Specifically, we explore (1) changes in the population structure; (2) variation in mobility within the city; and (3) the effects of the transfer of authority from Israelis to Palestinians. Simulations are used to generate corresponding counterfactuals, each of which is compared to a reference scenario based on the best-fit run for the 2005–2009 period. We report mean

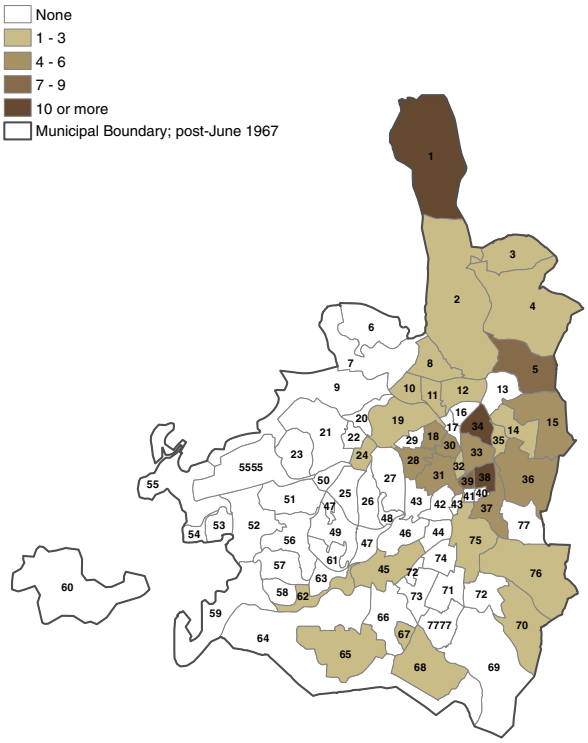
[17] Our approach follows Weidmann and Salehyan (2013). Here, we discuss results for the 2005–2009 period; corresponding results for 2001–2004 may be found in section 4.3 in the supporting information.

FIGURE 4 Empirical and Simulated Results: Number of Violent Events by Neighborhood

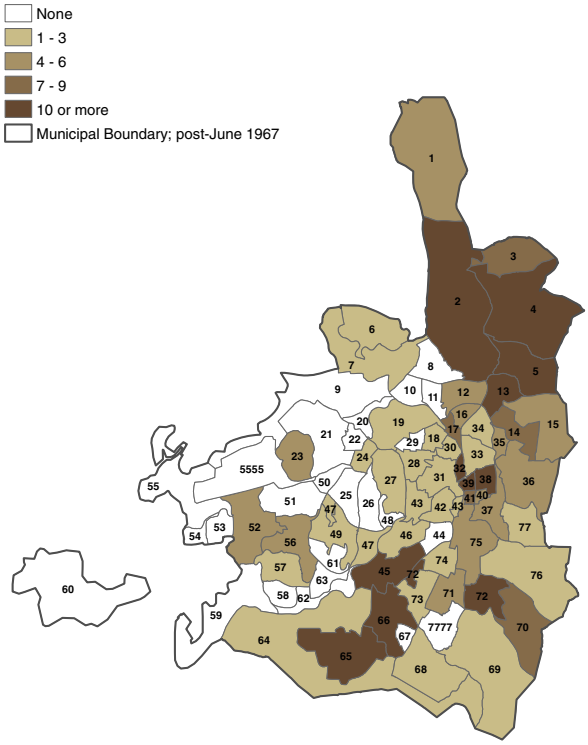
(a) Empirical, 2001-2004



(b) Empirical, 2005-2009



(c) Simulated, 2001-2004



(d) Simulated, 2005-2009

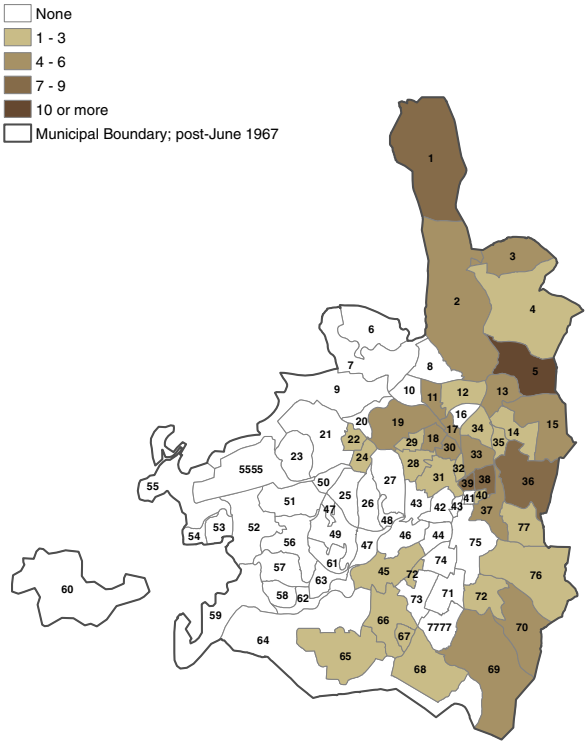
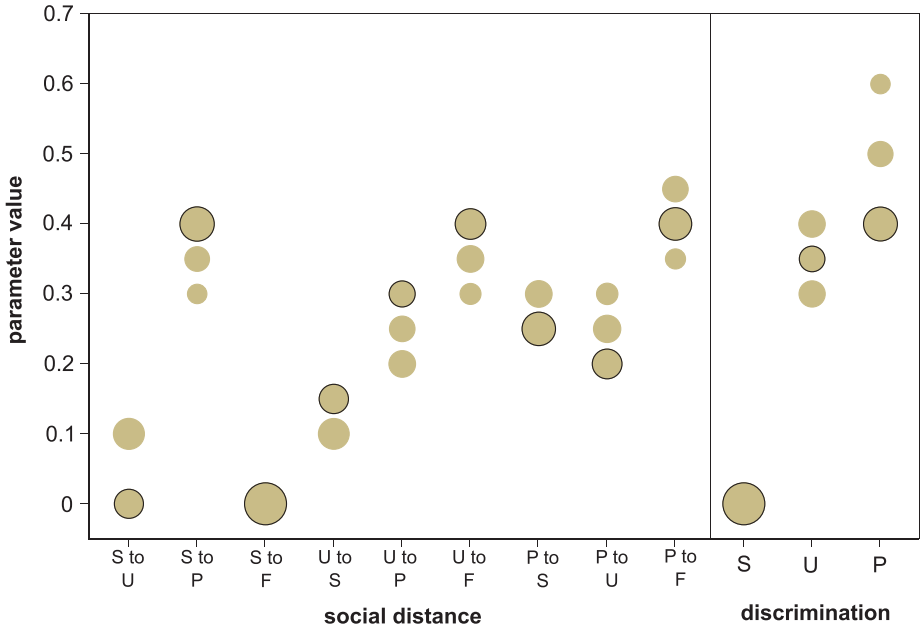


FIGURE 5 Distribution of Parameter Values in the Subset of Good Fits



S: Secular/Moderate Orthodox Jews, U:Ultra-Orthodox Jews, P: Palestinians, F: Security Forces

counterfactual trends,[18] illustrated by representative runs (Figure 7). Generally, we anticipate observing several patterns in the counterfactuals. One hypothesis is that levels of violence will be lowest for those measures that go the furthest in segregating groups, given high levels of social distance and, hence, intergroup tension. Another hypothesis is that Jewish-Palestinian violence would occur primarily along new dividing lines. Table 2 summarizes both the structure of our experiments and associated results.

Business as Usual

The first counterfactual adopts Israel's official stance on the future of Jerusalem, whereby Israel would retain full sovereignty over the city, maintain current municipal boundaries, and continue to encourage Jewish migration to East Jerusalem.[19] We start with the 2008 population for each neighborhood and then implement changes to reflect a preference for the Palestinian population to reside in the East, an increase in the growth of the Ultra-Orthodox population, and migration to neighboring Secular/Moderate Orthodox quarters. We further assume the continued expansion of Jewish settlement in the old city. Therefore, the scenario explores the impact of structural change and migration patterns within the city.

The *Business as Usual* counterfactual yielded a marginal increase in the frequency of violence (+6%), spread across a modestly greater number of neighborhoods (+3%) relative to the 2005–2009 reference scenario (Figure 7a).[20] The brunt of the impact continues to be in East Jerusalem (70% of the violent neighborhoods, of which 61% are predominantly Palestinian and 39% are predominantly Jewish), where the frequency of violence is significantly higher than in West Jerusalem. Thus, this scenario suggests that a future in which Israel continues to exert control over the entire city and continues its current policy would result in a modest increase in violence. While some new violence is also observed in Jewish neighborhoods in West Jerusalem, neighborhoods in the East would be most noticeably affected.

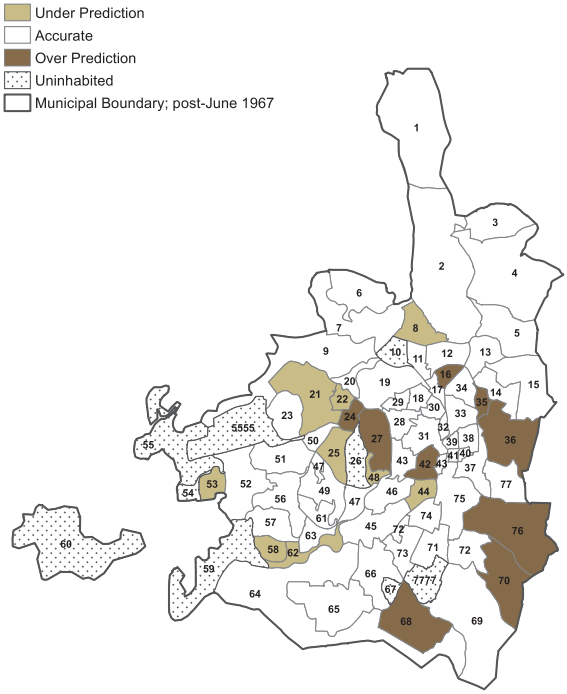
[18]To account for the influence of randomness in the model on the (potential) course of events, we simulate 100 realizations of each scenario that only differ in their random seed and report the average trends.

[19] *The Jerusalem Post*, May 12, 2010.

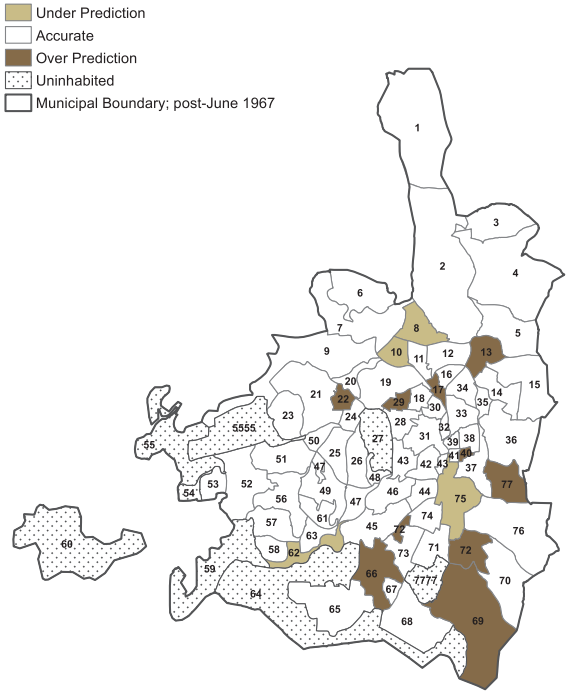
[20]Relative to the reference scenario, we find no significant difference with regard to violent and nonviolent neighborhoods (McNemar test $p > 0.1$, using a binomial distribution).

FIGURE 6 Comparison of Empirical and Simulated Data

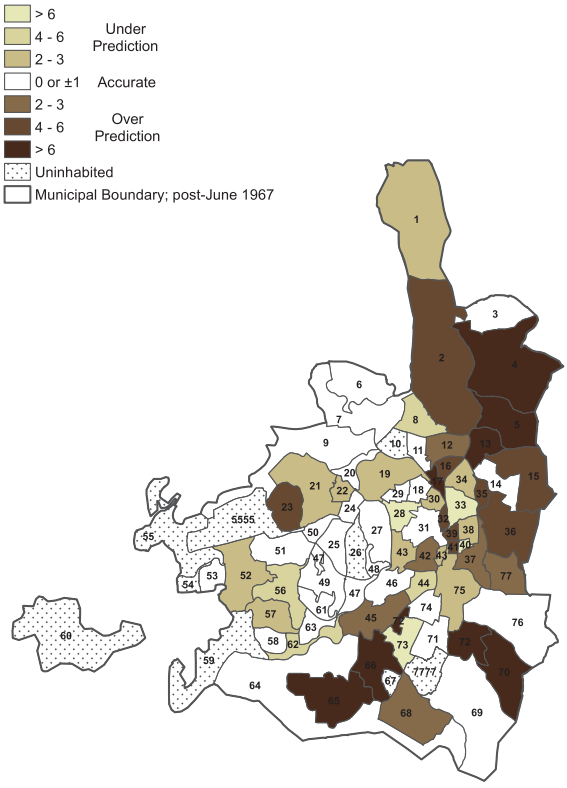
(a) Violence Onset, 2001-04



(b) Violence Onset, 2005-09



(c) Violence Magnitude, 2001-04



(d) Violence Magnitude, 2005-09

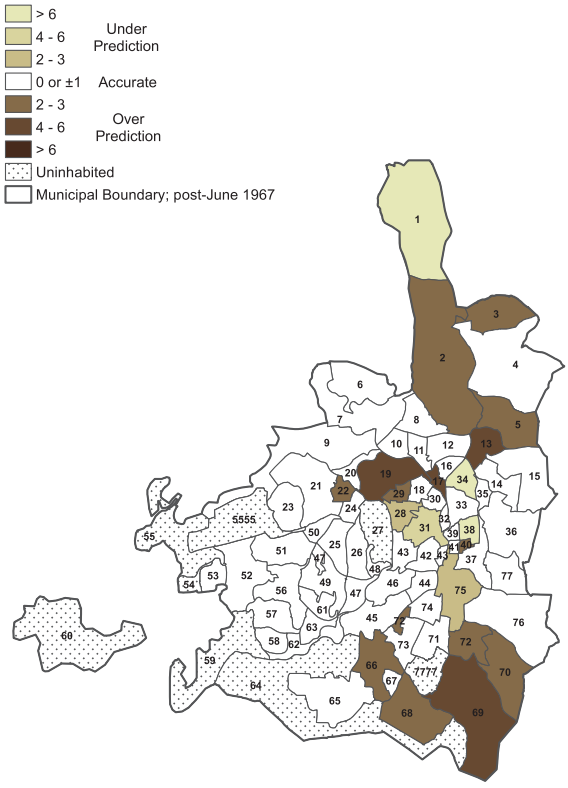
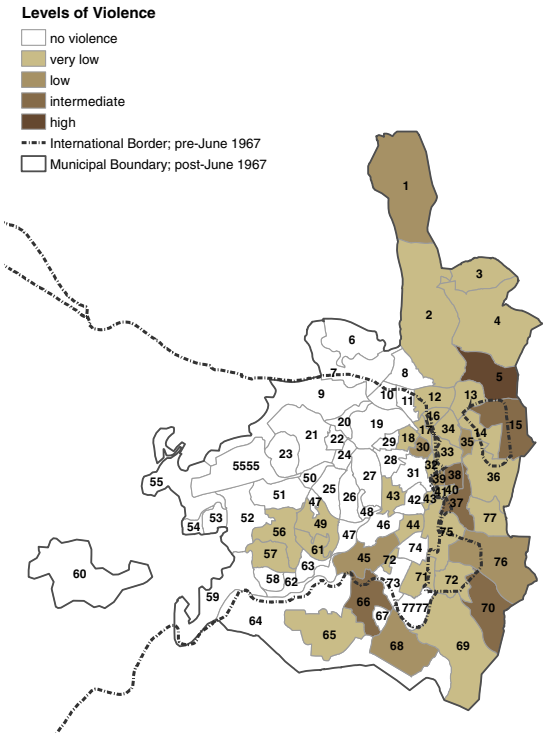
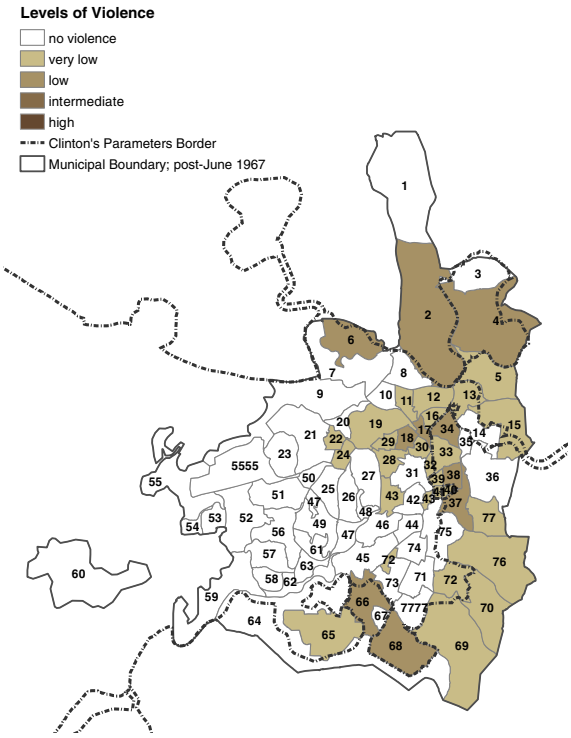


FIGURE 7 Policy-Relevant Counterfactual Results

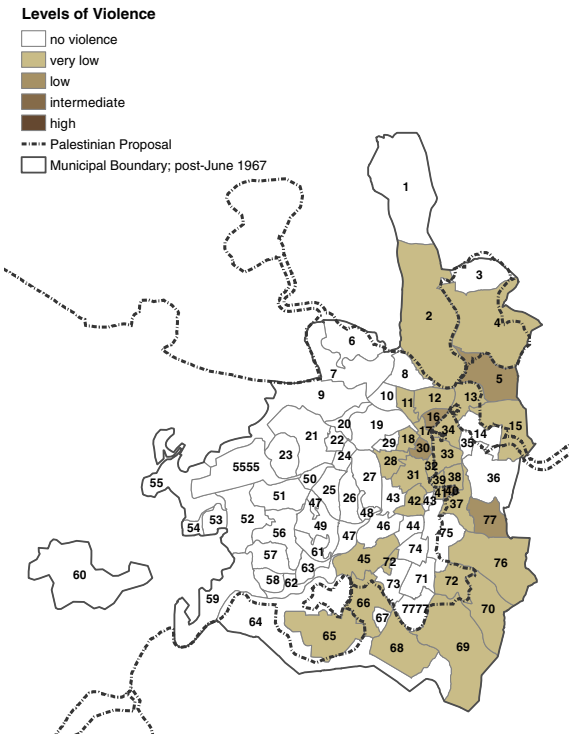
(a) Business as Usual



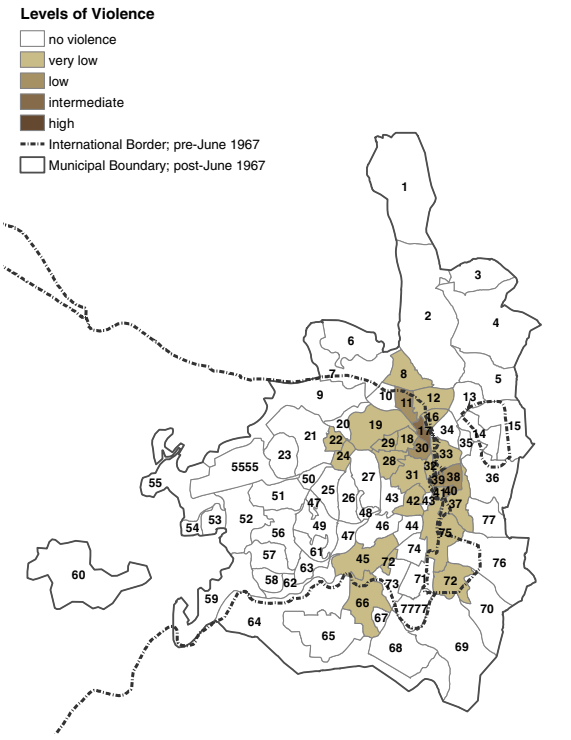
(b) Clinton Parameters



(c) Palestinian Proposal



(d) Return to 1967



Note: The categories of violence in these figures are comparable to those of the reference scenario (4d); we use qualitative categories to emphasize that the figures demonstrate forecasts of general trends and are not precise predictions of the expected number of violent incidents by neighborhood.

TABLE 2 Overview of Counterfactual Scenarios

	Business as Usual	Clinton Parameters	Palestinian Proposal	Return to 1967
Dimensions of Change	population structure and mobility	population structure, mobility, and authority	population structure, mobility, and authority	major changes to population structure, mobility, and authority
Number of Violent Neighborhoods	+ 3% (std. 8%)	− 10% (std. 9%)	− 19% (std. 9%)	− 32% (std. 9%)
Number of Violent Events	+ 6% (std. 8%)	− 33% (std. 8%)	− 42% (std. 8%)	− 52% (std. 8%)

Note: Results are relative to a baseline provided by the reference scenario depicted in Figure 4d.

Clinton Parameters

The second counterfactual captures the idea that predominantly Palestinian and predominantly Jewish areas should be annexed by their respective states as part of a peace agreement.[21] The implication is that the city remains integrated with no territorial exchange, albeit with authority in significant parts of East Jerusalem transferred to the Palestinians, excluding Jewish neighborhoods that would remain under Israeli sovereignty. This de facto division of the city would limit mobility between Palestinian and Jewish neighborhoods, with any further migration preserving this division. Thus, the scenario goes beyond the previous counterfactual in exploring not only structural change and a major shift in mobility but also the potential impact of a transfer of authority. The simulation results exhibit a reduction in the number of violent events (–33%) and violent neighborhoods (–10%) relative to the reference scenario (Figure 7b).[22] Violence tends to be clustered in neighborhoods along the newly created divide and concentrated in areas under Israeli control (59% of violent neighborhoods), including parts of East Jerusalem that would be annexed to Israel as part of the agreement (26% of violent neighborhoods). The frequency of violence in East Jerusalem is nearly twice what is observed in West Jerusalem,[23] though well below the level of the reference scenario.

[21] Israeli Ministry of Foreign Affairs, December 23, 2000.

[22] McNemar test $p > 0.1$ indicates no significant difference relative to the reference scenario.

[23] East Jerusalem here still refers to the common distinction based on the 1967 boundaries; considering the redrawn boundaries in this scenario, the frequency of violence in the Israeli-controlled areas is around 40% higher than in the Palestinian-controlled neighborhoods.

Palestinian Proposal

The third counterfactual is based on recent media revelations of an unofficial Palestinian framework.[24] The key details mirror the *Clinton Parameters* with several notable exceptions: (1) a strict division between East and West Jerusalem that would limit mobility; (2) the dismantling of Jewish neighborhoods constructed after the Oslo Accords, including the *Har Homa* neighborhood (#68) in Southern Jerusalem, which would be placed under Palestinian authority; and (3) as a concession to Israeli interests, Palestinian agreement to relinquish control over the controversial settlement *Shimo'n Hatzadik* in the *Sheikh Jarrah* (#34) neighborhood, including the nearby sacred graves and the Jewish and Armenian quarters in the old city. In line with the Clinton proposal, authority in East Jerusalem would be transferred to the Palestinians, including the responsibility for guaranteeing public security.

The simulation results (Figure 7c) indicate a more substantial decrease in violence relative to the reference scenario than in the *Clinton Parameters*, both in the number of violent events (–42%) and the number of violent neighborhoods (–19%).[25] Most of the violence would continue to appear along the inner-city divide and in areas under Israeli control (55% of the violent neighborhoods), including several of the Jewish enclaves in East Jerusalem that would be annexed and under Israeli control (26% of violent neighborhoods). The frequency of violence in neighborhoods controlled by Israel is more than 30% higher than what is observed in the Palestinian-controlled areas. In sum, violence falls substantially but

[24] *The Guardian*, January 24, 2011.

[25] McNemar test $p < 0.05$ indicates a significant difference relative to the reference scenario.

is not eradicated, and its locus shifts to the newly created boundary.

Return to 1967

The fourth counterfactual approximates the official Palestinian position.[26] The centerpiece of this plan involves repartitioning the city along the borders of June 5, 1967, leading to a strict separation between East and West Jerusalem, with the East under Palestinian administrative and security control. Jewish neighborhoods in East Jerusalem would be dismantled and handed over, with the residents being relocated to West Jerusalem or to other Jewish cities, permitting the relocation of Palestinians to the vacated neighborhoods from other parts of Jerusalem as well as from the West Bank. A special international regime would be established to govern the *Old City* (#38-41) and the *Mount Scopus* (#14) neighborhoods. The scenario reflects the most significant structural changes considered together with the most stringent restrictions on mobility; it also goes furthest with regard to transferring authority to the Palestinians.

The simulation results indicate a substantial reduction in violence: 52% fewer events and 32% fewer neighborhoods affected, relative to the reference scenario (Figure 7d).[27] Most of the violent neighborhoods are located along the reestablished inner boundary. A majority of these neighborhoods fall to the West of the new divide (52%). The frequency of violence in Israeli-controlled West Jerusalem is modestly higher (+10%) than what is observed in Palestinian-controlled East Jerusalem. Thus, a return to the 1967 boundaries can be expected to significantly reduce the points of friction and to decrease, but not eliminate, incidents of violence.

Discussion

The results of the counterfactual analyses largely conform to our expectations, with some notable differences in the location and frequency of violence. In contemplating what is driving these results, it is crucial to consider the implications of the different alternatives for where people are allowed to go and live and those with whom they can conceivably come in contact with, including security forces. Because mobility is restricted in the *Return to 1967* and the *Palestinian Proposal* counterfactuals, the probability of residents of East and West Jerusalem interacting with one another is greatly reduced. Consequently, intergroup contact between Jews and Palestinians would be lower, relative to the reference scenario. Both of these counterfactuals also partition the city and limit migration options, such that Palestinians are confined to East Jerusalem and Jews to West Jerusalem. While the *Clinton Parameters* counterfactual involves fewer formal, strict constraints, in practice Palestinian access to majority Jewish neighborhoods would be lower relative to the reference scenario. Furthermore, in all three of these counterfactuals, East Jerusalem neighborhoods lie under Palestinian authority, thereby reducing friction between Palestinian civilians and Israeli security forces.[28] The *Business as Usual* counterfactual differs qualitatively from these previous scenarios, as the effort to expand the Jewish presence in East Jerusalem does not entail segregation and has the consequence of bringing more Jews and Palestinians into closer proximity.

Thus far, our counterfactual analyses rest upon the assumption that intergroup relations remain unchanged. Yet, the political wrangling behind the adoption of a particular policy for the city's future status may shift sentiments, with one group viewing the outcome as a victory or defeat. To develop an intuition for the degree to which the "futures" are contingent upon changes in intergroup relations, we explored a "worst" and "best" case realization of each scenario in which social distance between Palestinian and all Jewish groups was increased or decreased, as was discrimination toward Palestinians.[29] The analysis suggests that even small changes in intergroup relations profoundly alter the distribution of violence, albeit with a significant difference between the best and worst case, as these examples illustrate: in the best case, the *Clinton Parameters* scenario exhibits a decrease in the level of violence comparable to that of *Return to 1967*; in the worst case of the same scenario, however, any reduction in violence brought about by a repartitioning of the city is offset by deteriorating intergroup relations; in the best case, the *Business as Usual* scenario sees a reduction in violence similar to that observed in *Return to 1967*; whereas the worst case of the same scenario exhibits a sizeable increase in violence.

[26] *Haaretz*, August 8, 2010.

[27] McNemar test $p < 0.005$ indicates a highly significant difference relative to the reference scenario.

[28] Across all groups in Jerusalem, approximately 1 in 1,000 simulated interactions is violent, primarily as a consequence of state policing. When intergroup tension is most elevated, as in Palestinian interactions with the Israeli security forces, this rate rises to 1 in 10. Thus, for members of nominally rival groups, our model effectively captures the notion that interaction may be hostile but nonviolent when the threshold to engage in violence is sufficiently high.

[29] See section 5 in the supporting information.

The results from our counterfactual analysis of Jerusalem are instructive in relation to debates about intergroup relations, peace building, and contact theory because they underscore the notion that the level of intergroup contact alone is insufficient to explain violence. These findings indicate that the effect of structural changes—segregation in particular—on violence depends decisively on levels of intergroup tension, i.e., social distance.

Conclusion

This study is motivated by the desire to better understand the relationship between factors that affect the extent of intergroup contact, including residential segregation, and spatial patterns of intergroup violence in urban areas. A vibrant, ongoing debate in the literature, to which this study contributes, is whether the basic tenet of contact theory is true: do measures that foster proximity and engagement between different groups curb or exacerbate the incidence, frequency, and severity of intergroup violence? And should nominal rivals then be kept separate, or instead more closely integrated?

Our approach suggests that the answer depends on social distance: while changes in settlement patterns shape the distribution and intensity of violence, levels of intergroup tension effectively moderate this relationship. Thus, short of fundamental changes designed to ameliorate group relations—curbing Jewish expansion in the Old City and East Jerusalem, increasing spending to improve Palestinian living conditions, raising investment to boost employment and improve infrastructure in Palestinian neighborhoods, programs that foster tolerance and mutual respect—our results suggest that arrangements conducive to reducing the extent of intergroup interactions—including localized segregation, limits on mobility and migration, partition, and differentiation of political authority—can be expected to dampen current levels of violence. Given high social distances, the greatest benefits in terms of conflict mitigation are achieved with comprehensive strategies that would transform the current geography of Jerusalem. To be clear, we are agnostic about whether such a fundamental reconfiguration of the urban space in this city or any other is necessarily desirable, even leaving aside issues of feasibility. This is especially the case, given our finding that even small changes in intergroup relations may profoundly offset any positive effects associated with group segregation.

Of course, reducing violence is a worthwhile ambition. Our mindset, in turn, is that decisions about peacebuilding measures ought to be informed by reliable evidence, wherever available, about the repercussions for patterns of violence. Assessing the prospects of various political scenarios can present a challenge, given common inadequacies in the available data and hurdles to rigorously studying hypothetical scenarios. Therefore, we advocate using an empirically grounded agent-based approach to explore alternative scenarios that would otherwise not be quantitatively comparable. This powerful and versatile methodology is suited to simulate the geographically differentiated impact of different policy and programmatic options. It can do so in a manner that is amenable to calibration and validation and thus has real-world plausibility and applications. Our microlevel approach further reflects the limits of explaining violence exclusively through structural factors. Instead, we highlight the agency of individuals, who can have distinctive traits and exercise a degree of autonomy, but are also embedded within and influenced by a context that includes the residential landscape, their sphere of interpersonal interactions, and their links to social groups.

As with any modeling exercise, caveats are in order. Our use of an intentionally simple model of an otherwise complex environment yields a reliable match and meaningful interpretation of empirical data. Yet, we caution against reading too much into the numerical values of such results. Rather, it is the relative reduction in violence brought about by each alternative to the *Business as Usual* scenario that is noteworthy. We are, furthermore, fully aware that a sizeable proportion of violence is nonlocal in nature; that is, driven by the larger conflict at hand. And we have deliberately chosen to exclude political factors from the analysis, as well as income-based factors. Our effort highlights the plausibility of a simple, social-distance-based mechanism—one that begins to untangle theoretical debates regarding the relationship between violence and the spatial separation of different groups.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

1. Empirical Data
2. The Agent-Based Model
3. Model Estimation
4. Validation
5. Counterfactual Scenarios