Long-Distance Violence

Cell Phones, Violence, and Space in Africa

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Abstract

Cell phones increase the risk of violent collective action when political violence is taking place nearby. This paper shows that a previously-identified positive relationship between cell phone coverage and political violence is the result of the distance-reducing consequences of mobile phone technology. Using a geographic dataset that operationalizes political violence and cell phone coverage, we show that cell phones increase the risk of political violence only where it is possible for violent organizers in an area experiencing political violence to call would-be violent organizers somewhere else.

1 Introduction

The causes of violence around the world are widely studied and little understood. To the long list of predictors of political violence, Pierskalla and Hollenbach (2013) add cellular telephones. In Africa, Pierskalla and Hollenbach find that cell phone coverage is associated with an increased risk of political violence. They argue that cell phones make political violence easier by providing a cheap communications infrastructure for would-be violent organizers. According to these authors, the increased ease with which actors can come together and organize makes political violence more likely.

In this paper, we develop an alternative explanation for the observed relationship between cell phones and violence. We take seriously the spatial dynamics of violence and more carefully model the ways in which cell phones shape conflict across space. We find that cell phones increase the risk of political violence only where there is already violence nearby and argue against models in which changes in costs of organizing alone are assumed to be sufficient explanation.

The paper uses the PRIO-GRID geographic dataset (Tollefsen and Buhaug, 2012). It extracts the subset of 10,674 grid squares, each 55 kilometers by 55 kilometers in size, that together cover the African continent. Each explanatory variable in the data set—including GDP, previous conflict history, and cell phone coverage—is measured at this grid square level. The measure of violence is also at the grid square level. Data on cell phones were made available by Thomson, and come from a trade association of African telecoms.

2 Pierksalla and Hollenbach's Model

Pierskalla and Hollenbach (2013) demonstrate the relationship between cell phone coverage and political violence by regressing an indicator variable for cell phone coverage in 2007 on a separate indicator of political violence in 2008. For a given grid square, the indicator for cell phone coverage is assigned a value of one if there existed any cell phone coverage in the grid square in 2007 and zero otherwise. The outcome variable takes the value one if there is record of political violence in that square in 2008 and zero otherwise. The outcome variable is constructed using the UCDP Georeferenced Event Data Set, which operationalizes political violence as localized collective action resulting in at least 25 deaths (Eck, 2012).

The model controls for a number of potentially confounding factors that contribute to organized violence so as to isolate the causal effect of the cell phone coverage. The choice of confounders is motivated by a theoretical literature that emphasizes how structural factors, such as poverty and population density, affect the risk of political violence. As such, the model includes as explanatory variables an estimate of GDP per capita in 2000 and the population living in each grid square. Additionally, the model includes explanatory variables that measure the percent of a given square's terrain that is mountainous; the percent of a square's area that is irrigated; the distance from the center of a square to the national capital; the distance from a square to the national border; and the number of observed incidents of political violence in a square between 1989 and 2000.

Pierskalla and Hollenbach (2013) hypothesize, in line with existing literature, that mountainous terrain confers advantages to guerilla tactics that make violence more likely. They justify their inclusion of the capital distance and border

Table 1: Reproduction of Table 1. Binary DV Models

	Dependent variable:			
	Conflict in 2008			
	logistic		*rare events logistic*	*OLS*
	(1)	(2)	(3)	(4)
Pre-2000 Conflict	0.020*	0.019*	0.019*	0.002***
	(0.011)	(0.011)	(0.011)	(0.001)
Border Distance	0.0002	0.0005	0.0005	−0.00004***
	(0.001)	(0.001)	(0.001)	(0.00001)
Capital Distance	0.0003	0.0004*	0.0004*	−0.00000
	(0.0002)	(0.0002)	(0.0002)	(0.00001)
Population	0.00000**	0.00000***	0.00000**	0.00000**
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Pct Mountainous	1.641***	1.578***	1.578***	0.056***
	(0.226)	(0.219)	(0.219)	(0.011)
Pct Irrigation	−0.027	−0.031*	−0.028	−0.001***
	(0.017)	(0.018)	(0.018)	(0.0004)
GDP pc	−0.0002***	−0.0002***	−0.0002***	−0.000
	(0.0001)	(0.0001)	(0.0001)	(0.000)
Cell Phone Coverage		0.390**	0.395**	0.027***
		(0.161)	(0.161)	(0.005)
Observations	9,343	9,343	9,343	9,343
R^2				0.098
Adjusted R^2				0.093
Log Likelihood	−1,126.780	−1,122.891	−1,122.891	
Akaike Inf. Crit.	2,269.560	2,263.781	2,263.781	
Residual Std. Error				0.161 (df = 9291)
F Statistic				19.686*** (df = 51; 9291)
Note:				*p<0.1; **p<0.05; ***p<0.01

distance variables on the basis of previous work, which had shown that violence is more likely to occur in a region that is either near a nation's capital or along its border (Buhaug and Rod, 2006). The measure of prior conflict levels controls for conflict-ridden regions in which conflict is not explained by any of the already mentioned confounders. Controlling for these known predictors of violence, Pierskalla and Hollenbach find cell phone coverage is positively associated with violence in PRIO-GRID cells. We reproduce these results in Table 1 and draw special attention to their cell phone coverage variable in Figure 1.

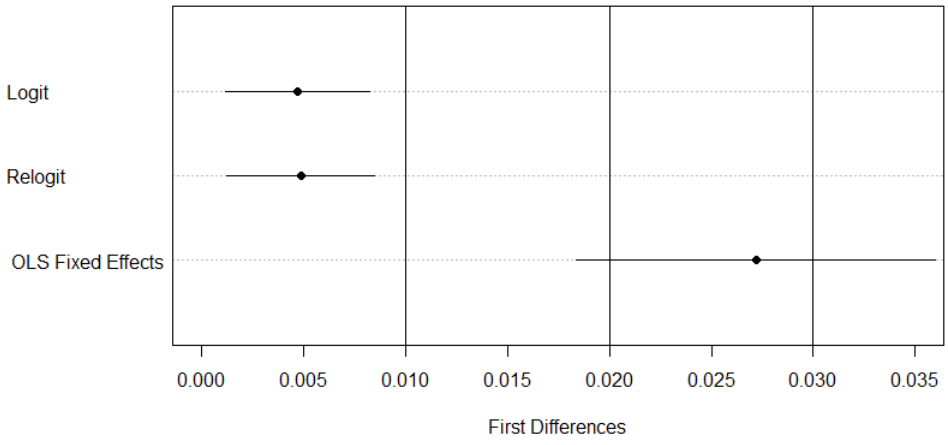

Figure 1: First Differences on Cell Phone Coverage

The figure above shows the first differences on the cell phone coverage indicator for three of the models specified in Pierskalla and Hollenbach (2013). Across all three models presented in their paper, the cell phone coverage indicator is estimated to increase the probability of conflict at a α=0.01 significance level.

Pierskalla and Hollenbach advance a simple logic to explain the positive effect of cell phones on political violence. Violent organizing is governed by all the incentives that shape and make difficult collective action. Following Olson (1965), they work from the assumption that collective action, whether violent or not, will

only occur when the expected benefits of organizing exceed the expected costs. In Pierskalla and Hollenbach's view, cell phones are all-purpose cost-reducers. By reducing the costs of organizing, they make collective action more likely. Political violence is just one of many group activities made more likely after the introduction of the cell phone. This logic suggests that insofar as violent collective action is more likely where there is cell phone coverage, so too are basket-weaving clubs and badminton leagues, for the same reasons. If violent collective action is in any way different from other kinds of collective organizing, this approach will not be able to identify that difference.

Pierskalla and Hollenbach place the whole explanatory burden of their paper on the power of cell phones to alter the costs of collective action. Applying the logic of collective action in this way to other variables in their model raises a problem. Their approach cannot explain the positive correlation they (and many others) find between mountainous terrain and violent political action. It is important to note that in Table 1, cell phone coverage is the second best predictor of violence—after mountains. The difficulty of access in a mountainous region makes it possible for violent organizers to use mountains as cover. That same difficulty of access also makes organizing more difficult simply because it is harder for organizers to move around. Mountains make organizing harder, but are a strong positive predictor of political violence. Changes in the costs of collective action generally is not sufficient to explain the risks of political violence.

Despite its elegance, the theory proposed by Pierskalla and Hollenbach (2013) does not fully capture the mechanism through which cell phone coverage affects violent political action. In the next section, we suggest that the causal mechanism can be better understood with models that account for the spatial

autocorrelation of violence.

3 Spatial Dynamics of Violence and Cell Phones

Pierskalla and Hollenbach (2013) find a positive relationship between cell phone coverage and violence for two reasons:

- They have not appropriately accounted for the spatial dynamics of violence
- They have not accounted for the effect of cell phones over long distances

Without accounting for the spatial dynamics of violence and the effect of cell phones over long distances, Pierskalla and Hollenbach (2013) are unable to identify the interactive dynamics of violence and cell phone coverage. They have not constructed the tools necessary to understand how cell phones facilitate the spread of violent collective action across space. As a result, their analysis mischaracterizes relationship between cell phone coverage and violence.

Violence and cellular coverage are both spatially bounded phenomena. As such, one of the best predictors of cell phone coverage in a grid square is cell phone coverage in the surrounding squares. Similarly, violence in a given grid square is a strong and positive predictor of violence in each of its neighbors. Violence in one place often spreads to other places, making violence in one area a good predictor of violence in neighboring areas. This process of spreading is likely to be conditioned by a number of things, including the ease of movement from one place to another, the tendency of people in one area to move to another, the frequency with which people in one area interact with people in other areas, and people's ability to get information about what is happening in other areas.

3.1 Operationalizing Violence over Space

The PRIO-GRID data set used in this paper consists of information about 10,674 cells, each of which is a 55 x 55 kilometer square. The squares are overlaid on a map of Africa, dividing the continent into a neat grid. The squares remain square even if they cross a national border. Thus unlike a dataset based on administrative units, these units have no borders in the real world. People can be expected to move completely freely within and across grid squares. Any behavior that might be expected to be bound to some degree by borders will not be bounded by the lines demarcating these grid squares. Violence in a cell is thus likely to be accompanied by violence in another cell, if in any way violence clusters in space.

To adequately incorporate this dynamic into our models, we created a set of variables that provide information about every cell's first and second neighbors. First neighbors are understood as cells immediately adjacent to a reference cell. They share a border or a corner with the reference cell. Our decision to include as first neighbors those cells which only share a corner with the reference cell derives from our operationalization of violence over space in terms of radial distance from the reference cell. A circle that extends to the edge of each cell that shares a full side with the reference cell would also include the majority of each corner cell.

Second neighbors are neighbors-of-neighbors; they are cells which border or share a corner with a first-neighbor cell. The cells that share only a corner with a first-neighbor cell are included for the same reason. Figure Two shows the nine first and 16 second neighbors of a reference cell. This five-cell by five-cell adjacency grid corresponds to a 275 x 275 kilometer area of Africa.

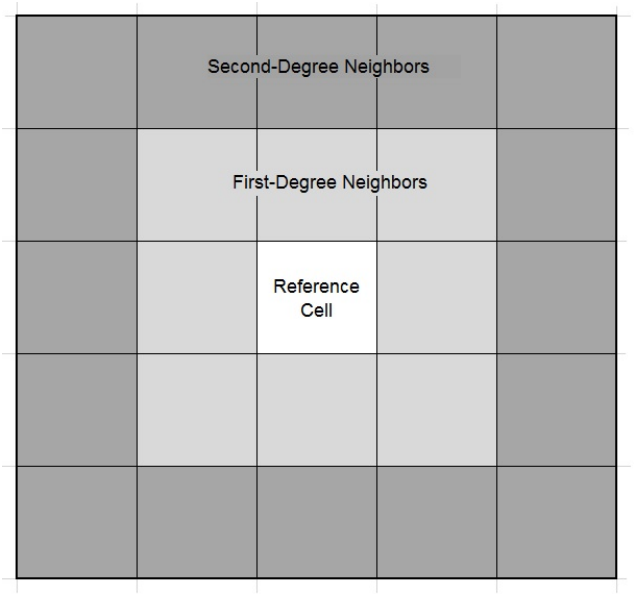

Figure 2: First and Second Neighbors of a Reference Cell

3.2 Spatial Correlation of Violence

Violence is spatially bound. Violent collective organizing can occur only in certain areas—in areas where there are people to perpetrate violence and people or property against whom to perpetrate that violence. This means that one of the best predictors of violence in one area is violence. When there is violence nearby, organizers are more likely to consider violence as an option (Tarrow, 1994). With cell phones, violent collective action no longer has to be seen, in the strict sense of the word, to provoke or serve as an example.

Violent organizing is shaped by perceptions of the local opportunity structure and the probability that violent collective action will be successful (Kitschelt, 1986; Olson, 1965). In places that are close to one another, local opportunity structures tend to be similar. Perceptions of the probability of success and the nature of the local opportunity structure will be even more similar across space

if violent organizers can move easily across space. The flow of people and information between neighboring locations will cause behavior in the two locations to converge.

All of the things that lead us to believe that violence has a strong spatial aspect also lead us to believe that violence in cells closer to the reference cell will be a stronger predictor of violence in the reference cell than violence in cells further away. A comparison between the predictive power for a reference cell of violence in its first-neighbor and second-neigbor cells shows that accounting for distance is crucial to accurately modeling violence. As predicted, closer cells are better predictors than those further away.

Figure 3 shows two important elements of the spatial correlation of violence. In this plot of predicted probabilities, there is a secular increase in the probability of violence in a cell as the number of first-neighbor cells with violence increases. Note that there are no observations in which a cell had only one violent neighbor. This is additional evidence that violence in a neighbor cell predicts violence in its neighbors. Although it is difficult to see, there is a significant, small, and positive association between violence in two neighbors and violence in the reference cell. The small effect (and tiny confidence interval) are the result of the small number of observations in which this condition is met. Beyond two neighbor cells with violence, the marginal probability of violence actually increases. Thus the the number of neighbor cells with violence and the probability of violence in the reference cell have a non-linear relationship that might be inappropriately described by the coefficient in a logit or OLS model. After Table 2, violence in adjacent cells is reported as a binary variable that indicates whether one or more of a reference cell's neighbors experienced violence in that year. This parameterization better

captures the fact that violence in one neighbor cell usually means violence many neighbor cells.

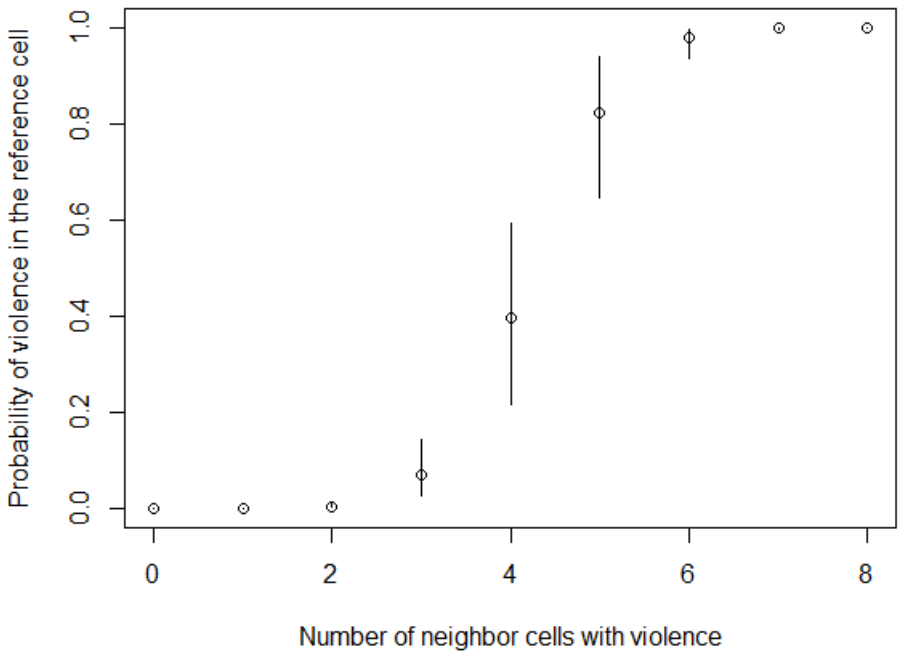

Figure 3: Predicted Probabilities of Violence in a Cell as Number of First Neighbors with Violence Increases

This figure displays the predicted probability of violence and 95-percent confidence interval for a grid square, conditional on the number of first-neighbors that had violent conflict in the year 2008. It strongly suggests the presence of spatial autocorrelation in the violence data.

To understand the relative importance of neighbor violence, we added the binary indicator of neighbor violence to the model presented in Pierskalla and Hollenbach (2013). The results are presented in Table 2 (p. 12). Once first-neighbor violence is included in the model, it surpasses mountainous terrain as the single most important predictor of violence in a cell. Our concern regarding the

original models' failure to account for this spatial autocorrelation is warranted.

Second-neighbor violence is also strong predictor of violence, but not as strong as first-neighbor violence. This suggests that violent organizing has a strong spatial component. The predictive power of violence in a cell should be thought of as a decreasing function of the distance between those two cells. This is consistent with the fact that when both first- and second-neighbor violence are included, the predictive power of second-neighbor violence is diminished. If second-neighbor violence has predictive power, it is because it increases the probability of violence in one of the first-neighbor cells between the reference cell and the second neighbor.

3.3 Operationalizing Cell Phones and Neighbor Violence

Cell phone coverage is a crucial element of the communcations network that allows potential organizers to communicate directly with one another. We predict that by enabling people in a violent cell to communicate with others outside of that cell, cell phones increase the distance over which an act of violent collective action can be expected to matter. Such communication can only take place where there is cell phone coverage in both cells, and violence in one of them. To better model the long-distance effects of cell phones, we create a variable that describes whether a person in a reference cell could make or receive a call to a person in a neighboring violent cell.

This variable takes on a value of one for a given reference cell if three conditions are satisfied: there is cell phone coverage in the reference cell, there is violence in at least one of its neighbor cells, and there is cell phone coverage in the cell where that violence occurred.

Table 2: Logit Models with Neighbor Violence

	Dependent variable:		
	Conflict in 2008		
	(1)	(2)	(3)
Pre-200 Conflict	0.011***	0.016**	0.011***
	(0.004)	(0.008)	(0.004)
Border Distance	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Capital Distance	0.0001	0.0003	0.0001
	(0.0002)	(0.0002)	(0.0002)
Population	0.00000***	0.00000***	0.00000***
	(0.00000)	(0.00000)	(0.00000)
Percent Mountainous	0.348	0.784***	0.370
	(0.314)	(0.264)	(0.308)
Percent Irrigated	−0.015	−0.015	−0.015
	(0.018)	(0.015)	(0.018)
GDP Per Capita	−0.0001***	−0.0002***	−0.0001***
	(0.00004)	(0.0001)	(0.00004)
Cell Phone Coverage	0.148	0.301*	0.154
	(0.177)	(0.173)	(0.177)
First-neighbor Violence	1.243***		1.269***
	(0.059)		(0.102)
Second-neighbor Violence		0.552***	−0.026
		(0.037)	(0.068)
Observations	9,343	9,343	9,343
Log Likelihood	−713.531	−935.890	−713.373
Akaike Inf. Crit.	1,447.061	1,891.781	1,448.747
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 3:

	Dependent variable:		
	Violence Dummy		
	(1)	(2)	(3)
Pre-2000 Conflict	0.014***	0.016**	0.014***
	(0.004)	(0.007)	(0.005)
Distance to Border	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Distance to Capital	0.0004**	0.0004**	0.0003*
	(0.0002)	(0.0002)	(0.0002)
Population in 2005	0.00000***	0.00000***	0.00000***
	(0.00000)	(0.00000)	(0.00000)
Percent Mountainous	0.393	0.853***	0.583**
	(0.253)	(0.245)	(0.242)
Percent Irrigated	−0.012	−0.015	−0.016
	(0.020)	(0.015)	(0.017)
GDP Per Capita	−0.0001***	−0.0001**	−0.0001**
	(0.00004)	(0.0001)	(0.00005)
Cell Phone Coverage	−0.635***	0.020	0.100
	(0.215)	(0.195)	(0.190)
First-Neighbor Violence	3.411***		3.486***
	(0.212)		(0.289)
First-Neighbor Interaction: Cell Phones and Violence	0.597***		
	(0.093)		
Second-Neighbor Violence		2.230***	0.458*
		(0.208)	(0.263)
Second-Neighbor Interaction: Cell Phones and Violence		0.262***	0.108*
		(0.060)	(0.056)
Constant	−5.397***	−5.096***	−5.745***
	(0.262)	(0.271)	(0.279)
Observations	9,343	9,343	9,343
Log Likelihood	−738.880	−937.265	−764.939
Akaike Inf. Crit.	1,499.761	1,896.531	1,553.877

Note: *p<0.1; **p<0.05; ***p<0.01

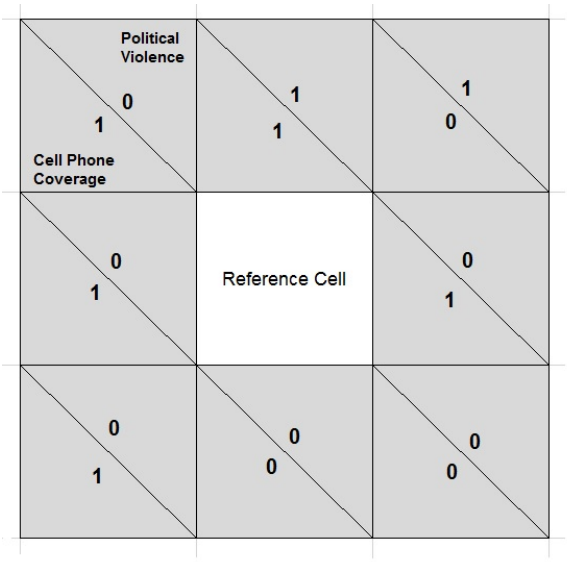

Figure 4: Violence and Cell Phone Measures for Neighbor Cells

To construct the interaction variable, the indicator of political violence and the indicator of cellphone coverage in each neighbor of a given reference cell and the resulting products were summed over the first- and second-neighbor adjacency matrices. Any non-zero values are coded as one.

In models that incorporate nearby violence and the interaction variables, uninteracted cell phone coverage in the reference cell ceases to be a meaningful predictor of violence. In fact, in some models (see Model 1 of Table 3, p. 13), cell phone coverage is associated with a lowered risk of violence. In these models, satisfying the conditions of the interaction variable—having at least one violent neighbor cell with cell phone coverage and coverage in the reference cell—leads to an increased risk of political violence even when controlling for first- and second-neighbor violence. This makes sense in a theoretical framework that stresses how cell phones reduce distance by facilitating the flow of information across space.

The relationship between political violence and cell phone coverage observed by Pierskalla and Hollenbach reflects a real phenomenon. The mechanism is not,

however, a generalized reduction in the costs of collective action. We should instead understand the relationship between cell phones and violence in terms of cell phones' ability to shrink distances and expand the range over which violence in one cell can affect for violence in another cell.

4 Conclusion

We are sympathetic to Pierskalla and Hollenbach's claim that "private mobile long-distance communication addresses crucial free-rider and coordination problems endemic to insurgent activities.' We agree that "given the motivation and opportunity for political violence through structural context conditions, cell phone coverage, *ceteris paribus* should then increase the likelihood of violent collective action" (208). However, in focusing on the effect of cell phones on reducing the costs of *all* collective action, Pierskalla and Hollenbach (2013) lose sight of cell phone's ability to provide cheap communication *between actors over long distances*. By considering the spatial dynamics of violence, we reinterpret the causal relation as follows: cell phones contribute to violence by increasing the distance over which an act of organized political violence in one area has consequences for other areas. We arrive at two conclusions.

First, violence is spatially determined, and thus models of violent organizing need to incorporate spatial autocorrelation in ways that appropriately incorporate the interaction between spatial dynamics and other variable of concern.

Second, focusing on collective action costs in general takes attention away from the collective action organizers. This is a serious flaw when the technology being used is communications technology—tools that allow organizers to commu-

nicate with one another. Studies that incorporate communications technology as explanatory variables need measures that capture how that technology can be used. Simply coding for the presence of communication technology is not adequate to capture its consequences.

The most important change introduced by our model is the operationalization of the way in which cell phones make person-to-person communication easier over distances. Our interaction variable takes on a value of one only where it would be possible for a person in a cell with violence to call a person in another cell. It helps demonstrate that cell phone coverage has no independent effect on the probability that violence might occur in a given place. Where cell phone coverage shrinks the distance between violent organizers, it facilitates the spread of violence from one place to another.

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