Defining Violence:
A Plausibility Probe Using Agent-Based Modeling
(Corrected Version)

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Science requires observation and comparison. Implicit in the notion of comparison is an expectation of the conceptual stability of boundaries surrounding types of observable events. Determining when one sees an orange and when one sees an apple, requires clear coding rules for what counts as an orange or an apple. The scientific value of the exercise also requires, however, a stable notion of "fruit" so that what is learned about differences and similarities between apples and oranges can be used to generate hypotheses about other things that are to be counted as within the broader class to which apples and oranges belong. So we may learn more from comparing apples and oranges about plums and grapefruit, than about refrigerators or chipmunks.

Few definitional problems are more familiar than those associated with defining "terrorism." Of course one problem ("My terrorist is your freedom fighter.") is the politically and rhetorically fraught aspect of the word that complicates communication and triggers political struggles only thinly disguised as competitive consideration of alternative conceptual strategies. But that is only one difficulty. Another difficulty is the problem of linking any plausible definition of the term with a class of events or behaviors that is narrow enough to permit confident judgments of its absence. For example, if terrorism is defined as efforts to affect the behavior of others by scaring them, we might see the bombing of Hiroshima, the 9/11 attacks, and a parent's threat to withhold allowance if a child's room is not properly cleaned, as relevant observations and therefore require any theory of terrorism to account for or be tested by patterns of outcomes similar to each of these examples. On the other hand, if the definition is narrowed too much (e.g. lethal non-state actor politically motivated attacks on civilians), the theories we can build are likely to be a function of some "accidental" aspect of the particulars of the domain thereby specified, thereby rendering the results of study incomparable with the results of other studies using equally plausible, but equally narrow definitions. Another is the need to construct a definition that is strategically located with respect to theoretically developed fields of investigation. For example, this condition requires a definition so that the coding of an observation does not itself require explicit or implicit deployment of multitudes of theories (sociological, psychological, physical, biological, legal, political, etc.). Thus a definition of terrorism that would require us to establish whether an act was or was not deviant, was or was not intended, was or was not legal, was or was not "political," etc. would tend to conflate the definitional problem with the substantive challenges confronting the disciplines required for operationalizing that definition.

Given the difficulties associated with defining terrorism, it is not surprising that in the 1980s and 1990s the term had much more currency outside of academia, than within, though this has begun to change after the events of 9/11 multiplied the funding available for "terrorism" studies by a gargantuan factor. Certainly social scientists, psychologists, sociologists, anthropologists, political scientists, have traditionally exhibited a much greater willingness to study "violence," than terrorism. However, the focus on violence as opposed to terrorism has not avoided the problems posed by the difficulty of defining terrorism. In fact students of "violence" and even "political violence" have had no more success offering a consistent or even explicit, denotative definition of violence, than

others have had trying to define terrorism. To be sure we have an enormous amount of data about killings, reports of killings, numbers of armed insurrections or armed clashes of different sizes, etc. In political science at least, books, conferences, journal articles, and dissertations abound on the subjects such as violence and politics, the effects of political violence, the conditions that produce violence, and techniques to reduce violence. For the most part however, the question of what is actually meant by "violence" has been avoided. Thus we may learn from this literature about the circumstances that draw particular groups into the killing of others, or about the proportion of killing that is motivated within a civil war by personal as opposed to political motives, or about the strategies of elites that are most likely to reduce participation in deadly riots. But we do not thereby learn about the difference that "violence," per se makes in a situation because the concept of "violence," independent of the damage it causes or the particular way its effects are registered (deaths, per thousand in a population, for example), is almost never specified.

This paper identifies the absence of a coherent and analytically strategic definition of violence as an important problem for comparative political analysis. A candidate for such a definition is then advanced and operationalized in a virtual, agent-based modeling environment. This implementation, within a highly stylized context of an authority structure exposed to violent strikes, provides opportunities to evaluate the soundness of the definition by seeing whether outcomes observed virtually correspond in sensible and systematic ways with standard intuitions.

The absence of and need for a precise definition of "violence" was acknowledged by all participants in a panel at a recent American Political Science Association meeting featuring leading researchers working in the area of political violence. In answer to this author's question about the formal definition of violence, as opposed to the damage caused by violence, that participants in the panel were using in their work and commentary, each panelist, along with the chair and the discussant, responded that no specific definition had been formulated. The response that secured the support of most participants, offered by Professor Jeremy Weinstein of Stanford, was that such a definition was not to be expected as yet since the study of political violence was "still in its infancy."[1]

Sociologists have exhibited somewhat more concern with the definition issues involved with the study of violence than have political scientists. A particularly pointed and thorough review of attempts that have been made to define violence explicitly was published in 2002 by the sociologist Mary Jackman, who noted the failure of social scientists to offer a clear definition of violence. Jackman's treatment emphasizes the crippling analytic difficulties she sees as identified with available, explicit, definitions of violence before offering a 'generic' substitute definition."2

> Much as some scholars have bemoaned the lack of cohesion in research on violence…most scholars have proceeded without hesitation as though the conceptual tangle had been cleared. Researchers commonly refer to a

> phenomenon called violence that implies a clearly understood, generic class of behaviors, and yet no such concept exists.[3]

Jackman's critique of existing definitions stresses what she regards as a distorting displacement of attention to one or more particular aspects of certain kinds of acts commonly viewed as violent without identifying what, generically, is to be considered "violence." These incidental aspects include malicious motivation, corporal (as opposed to psychological) injury, deviance, physical behaviors, coercive rather than self-inflicted or invited acts, legality, perpetration by individuals rather than organizations or communities. Her own solution to the problem is drastic, and to my mind, unacceptable. She offers a "comprehensive" definition of violence with which she means to avoid excluding any behaviors or events which might be considered violence. "Violence" as Jackman defines it, refers to "actions that inflict, threaten, or cause injury. Actions may be corporal, written, or verbal. Injuries may be corporal, psychological, material, or social."[4]

With this definition Jackman does avoid the problem of other definitions that exclude events analysts, or some analysts, might want to include. However, this is achieved at the cost of a conception of violence that is essentially identical to the concept of "damage." Two problems arise. One is the problem of coding "injury" or "damage." Surgery involves injury before it helps to heal. Thus violence could be a matter of time frame, or, of course, perspective. Is the destruction of a mountain by a mining company injury to the beauty of the local community's environment or assistance to the local economy or the national aspiration to achieve energy independence? Another more fundamental problem is that with a definition this broad Jackman can offer no theoretical guidance to researchers. A concept of "damage" or of actions that produce, or could produce, damage or injury subsumes so many phenomena and so many circumstances that research on "violence" would end up as virtually coextensive with research on society and politics. The definition is simply too capacious too to avoid the crippling problems associated, for example, with efforts in political science to treat "power" as a causal variable.

Jackman's survey of research on violence, along with extensive work in political science that similarly fails to define that key term, testifies to the odd fact that despite the in principle necessity of clear definitions, social scientists using traditional methods (discursive, statistical, or formal closed-form approaches) can often push research programs ahead that entirely ignore basic definitional issues. We see that in the immense amount of attention given, as noted earlier, to modeling the causes or effects of violence, without ever modeling violence itself.

For agent-based modelers the challenge of defining violence is no different, it is just less avoidable. In work done with PS-I on political violence and its effects on political stability and foreign policy outcomes in the Middle East, the inability to define violence itself required that virtual worlds created for this project not incorporate that variable, but rather feature the conditions believed to give rise to "violence" as the independent variable and patterns of outcomes believed likely to be immediately

produced by violence as the dependent variable.[5] Indeed it was in part frustration with the absence of violence itself from the Mepolity model, and the inability to incorporate it without a clear, but analytically limited denotative concept of violence, that has produced my interest in achieving a clear, and therefore operationalizable, definition of violence.

In the balance of this paper I will provide my definition, justify it, and then analyze experimental results using an agent-based modeling operationalization of it.

A Definition of Violence

What is it about a particular behavior, event, or situation, independent of the damage it causes (damage that could be caused non-violently, for example) or its legality or morality, that can be coded as "violent?" Are all insults violent? Are lawsuits resulting in the destruction of whole villages violent? Are unintended casualties the result of violence? Is the prolonged application of steady, low level pain violent? Can threats, per se, be violent? Must violence be physical? Are protestors massing themselves against the movement of traffic violent? Does human action have to be involved? Was the tsunami, which struck so "violently" and killed so many, "violent?" It did have political effects, for example on the insurrection in Acheh, the Indonesian government's policies there, and on international attitudes toward that region. Will we recode it as violent if we discover, in twenty years time, that it was actually triggered by a Chinese device that was purposely used to trigger the earthquake/tsunami?

The definition of violence, and of violent events, whose usefulness I am evaluating focuses on the element of a sudden and drastic increase in the negativity of the stakes in an encounter. Physicality, for example the throwing of a punch, because it is intrinsically difficult to be sure exactly what the effect of the blow will be, is likely to be closely associated with violence, but NOT by definition. Will the blow be annoying, a bit painful, very painful, incapacitating, or fatal? As the fist is traveling toward me, I just don't know, and neither really does the person throwing the punch. Insults can do damage, perhaps even violently by my definition, but since the effects are processed through social, linguistic, and emotional sieves, and can be reprocessed and re-interpreted or reframed, we can expect, or at least hypothesize, that violence will more often be associated with physical actions and threats of physical actions, than with insults drained of perceptions of the imminence of physical attack (for example, threats delivered across a telephone line or the internet, or shouted across a wide river). Accordingly I define violence, in the social world, as follows.

A situation or event is violent to the extent that a sudden and drastic increase occurs in the scale of negative values at stake. The more drastic and rapid the increase, the more negative, and the more people who experience this increase, the more violent is the situation or event.

According to this definition, large-scale destruction or damage is not necessarily to be regarded as, or to indicate, violence. If the damage or destruction were inflicted slowly and predictably it would certainly not be coded as violence by this definition.

Thus, to take a particularly unsettling example, while the initiation of torture might well be coded as violent by this definition, torture entailing the slow prolonged, inexorable infliction of discomfort or annoyance would not be. The definition discourages use of intentionality, legality, or modality (psychological, physical, financial, etc.) of interactions, not because they are deemed unimportant, of course, but so that they can be preserved, outside of the definition, as empirical questions. To what extent is violence possible without physical destruction? What is the balance in the extent of violence in different kinds of situations that is or is not attributable to intention? How do the political effects of violence differ if it is legal as opposed to illegal?

There are a variety of fascinating probes of this definition that may be considered—probes normally used to evaluate definitions in terms of their consistency, intuitive appeal, and theoretical usefulness. For example, if someone does not know a piano is about to land on his head, is the event violent when it does occur? (Yes, because an outside observer can see the sudden appearance of death in connection with a casual stroll.) Is the violence in the act or in the head of the observer? (Violence as a social fact is in the heads of observers. The extent to which this requires the actuality of particular kinds of actions or events in the world is an empirical question.) Is there violence in the confrontation between two gangs, before any action or explicit threat has occurred? (There is a difference between violence and violence potential. Unexploded dynamite has violence potential. The sudden appearance of dynamite in the hand of an interlocutor, just as the sudden confrontation of two silent gangs, might themselves be coded as violence, though the level of violence might well decrease rapidly unless actions or threats were made.)

However, my purpose in this brief paper is not to engage in an extended discussion of the hardest questions that can be posed to this definition. In any case most questions that arise relate to the difference between intuitive desires to use violence as an extensive category for events and situations we somehow feel are "violent," regardless of whether there is a principle of consistency at work that could be expressed by an intensive definition of the term. As an agent-based modeler, I need an intensive definition violence, and so I strive for a formulation that, while not entirely devoid of intuitive appeal and not entirely different from what it is standardly, if incoherently, considered to be, is both clear enough to be implemented unambiguously in a virtual world and designed strategically and efficiently enough to avoid solving by definition important empirical questions.

Operationalizing This Definition of Violence in PS-I

PS-I is a sophisticated platform for producing agent-based modeling templates. It is designed with point and click and Boolean operator interfaces that do not require knowledge of Java or other programming languages and which reduces requirements for quasi-code syntax to a minimum, even in the design of relatively complex models. Key elements within PS-I include agents within a cellular grid "activated" on one of a repertoire of "states" (standardly referred to as "identities") available to that agent. Both the activation of a particular state by a particular agent and the complexion of the

repertoire of indivual agents change according to updating rules that allow agents to monitor their surroundings with stipulated levels of sensitivity. In addition to monitoring proximate and remote neighborhoods, depending on agent characteristics, agents can also monitor knowledge available to all agents. These valence signals are referred to as "biases." Biases are exogenously generated stipulations of marginal reductions or increases in the attractiveness of particular states. These stipulations can change over time with a volatility, predictability, and within ranges of variation stipulatable by the user.

The definition of violence presented above was operationalized in PS-I as follows. A distinct "violent" agentclass was created. Members of this agentclass have settings similar to those of basic agents for repertoire size, readiness to change activation states, readiness to change repertoire complexion, sight radius, etc. What distinguishes them is that although normally endowed with an influence level (in the calculations of other agents) of "1"—equal to that of a basic agent, they can suddenly exert the extraordinarily high influence level of "30."

Influence per se, is not violence, so even when exerting an influence level of 30, these agents are not intrinsically "violent." However, when their influence level is briefly but drastically increased to the 30 level they do introduce violence into the social array. This sudden intrusion of extremely negative values is accomplished by an instruction from a script that does two things simultaneously:

- It changes some set of basic agents (randomly selected within a particular region if desired) into "violent" agents.

- It forces these selected agents to activate, for just two time steps,[6] on a tag ("identity" 20 in our model), to which has been assigned a permanent and very low negative bias of –10.

The violent effect is achieved by the sudden and essentially arbitrary (from the point of view of each agent that has been seeking to adapt to marginal changes in neighborhood and environmental "bias" conditions) eruption of extreme negativity into encounters between these briefly "violent" agents and their neighbors.

The immediate reaction of agents experiencing the transformation of a neighbor into a "violent" agent, with influence of 30 and a identity assigned a bias of –10, is to activate on the tag of "20," despite its extreme negative valence. Such an agent could remain for more than one or two time steps on this "identity," but with alternatives available and with the bias assigned to that identity so low, it is very likely instead to resume or seek to resume its adaptive course. In any case the world, both internally and externally, will have been changed in possibly irrelevant or possibly crucial ways by the "shock" of the encounter with the violent agent, by the removal from the agent's repertoire of one of its identities when identity 20 was forced upon it, and by the interruption in the pattern of activation by neighbors that may have achieved or enforced a local equilibrium that might not be reattained. In addition, the agents that were

transformed into “victims” by the intrusion of violence into the cell positions they inhabit will be lastingly marked as having experienced “violence” and may, without the definition requiring it be so, manifest distinctive post-violence patterns of “victimized” or “traumatized” behavior.

The “empirical” questions in this virtual world about the aftermath of “violence” correspond to the questions of crucial social scientific importance in the study of political violence: under what conditions and with what likelihood will violence have different implications for perpetrators, regimes, mobilized, and/or unmobilized groups?

Plausibility Probe

To examine whether implementing violence in this way would have effects in patterns consistent with reasonable stories analysts might tell about the effect of violence in a salient kind of political situation, a template called “Viol” was created in a square topology with 64 cell sides. A highly stylized “authority structure” was created as a symmetrical web of influential agents activated on the same “regime” identity. This web of influential agents is located in the center of a larger landscape. Aside from the activation of regime influentials on the regime identity (“0” or red), and the exclusion of identity “20” from the repertoires of all agents, all twenty normal identities, including the regime identity, are distributed randomly to all agents every time the model is initialized.

Figure 1 shows Viol at time 0. Cells marked by icons are influentials, radiating in a regular pattern originating with a “Great Leader” of influence 4 (circle), then “Lords” with influence 3, then Vassals with influence 2, and finally Lackeys with influence 2.

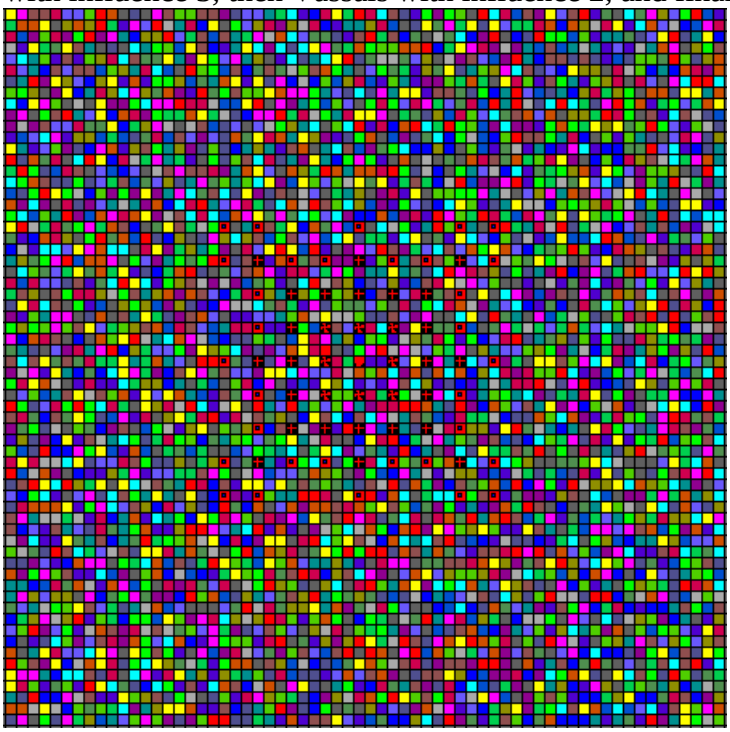

Figure 1. Typical initialization of Viol (Vers.1)

A zoomed-in version of the screenshot in Figure 1 is displayed as Figure 2, focused on Auth_shape [a 32X32 bloc of cells surrounding the regime authority structure] and the Regime authority structure within it. The different icons marking different ranks of influentials are clearly discernible: Great Leader, circle; Lord, propeller; Vassal, cross; Lackey, small central square.

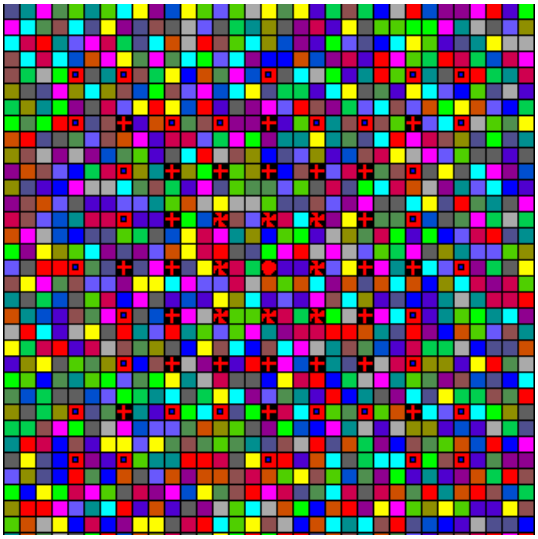

Figure 2. Zoomed-in view of Auth Shape, t=0

In addition to their own activated state, all agents monitor their Moore neighborhoods (the eight adjacent agents, including those touching at the corners) and update simultaneously on even time steps. Influential agents have six identities including the activated identity. Other (basic) agents have six or seven identities in their repertoires. All agents operate according to the same updating rules, described in Table 1.

Updating Trigger	Meaning	Identity Weight Margin Required to Effect Change[7]
Rotation	An identity in the agent's repertoire is activated and the activated identity is "rotated" back into the non-visible repertoire	2
Substitution	An identity not in the agent's repertoire is brought into that repertoire and a non-activated identity is discarded from the repertoire	5
Substitution and Activation	An identity not in the agent's repertoire is brought into that repertoire, a non-	7

	activated identity is discarded from the repertoire, and the newly incorporated identity is activated.	

Batches of 100 different initializations of this model were run to time 300 under twelve different conditions. These conditions were produced by crossing three variables:

Violence: no violence;
one violent strike on the "southwestern" corner of the regime's authority structure entailing a two time step punctuation at t=50 entailing the transformation of 50 per cent of basic agents in the targeted area into "violent" agents;
one strike on a region of identical size in the center of the regime's authority structure entailing a two time step punctuation at t=50 entailing the transformation of 20 per cent of agents in the targeted area into "violent" agents.

Stability[8] of Political Environment: stable conditions (low bias volatility "250");
volatile conditions (increased bias volatility "500").

Challenger Identity: no challenger present;
challenger present (all agents within "Auth-Shape" not having the regime identity in their repertoire at t=0 re endowed with the challenger identity [identity 16, yellow]).

Figures 3 and 4 display the same version of Viol used to produce the first two figures. In Figures 3 and 4 are highlighted all agents with identity 16 (the Challenger identity) in their repertoires but not identity 0 (Regime identity). Note that in Figure 3 this is a random distribution while in Figure 4, representing the "Challenger Present" condition, the overwhelming majority of agents have the Challenger identity in their repertoires (while only a normal random sample are activated on that identity). Figure 5 shows the areas subject to violence in the Southwest and Center violence conditions, respectively. Figure 6 shows an example of the violent event as it appears at time step 50.

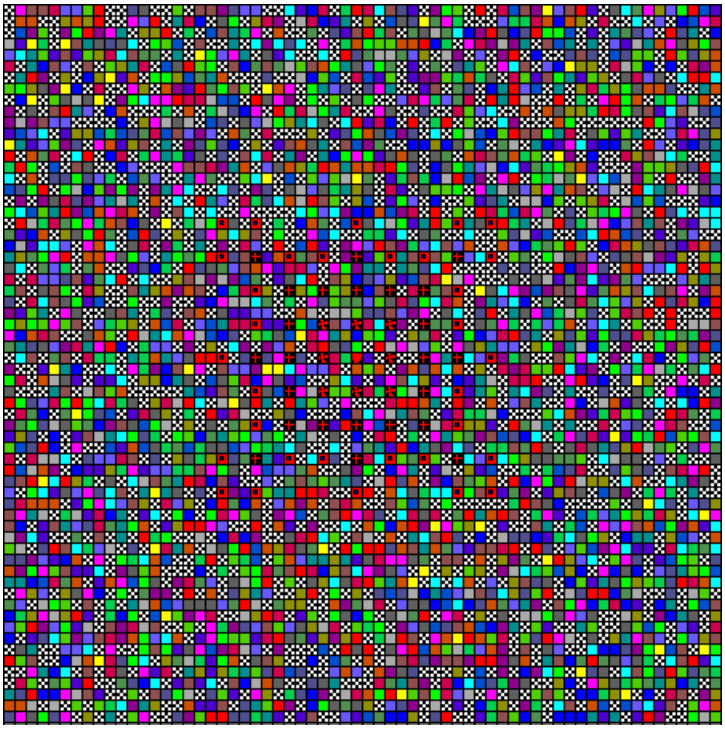

Figure 3. No Challenger present condition, t=0. Agents highlighted have challenger identity in repertoire but not the regime identity.

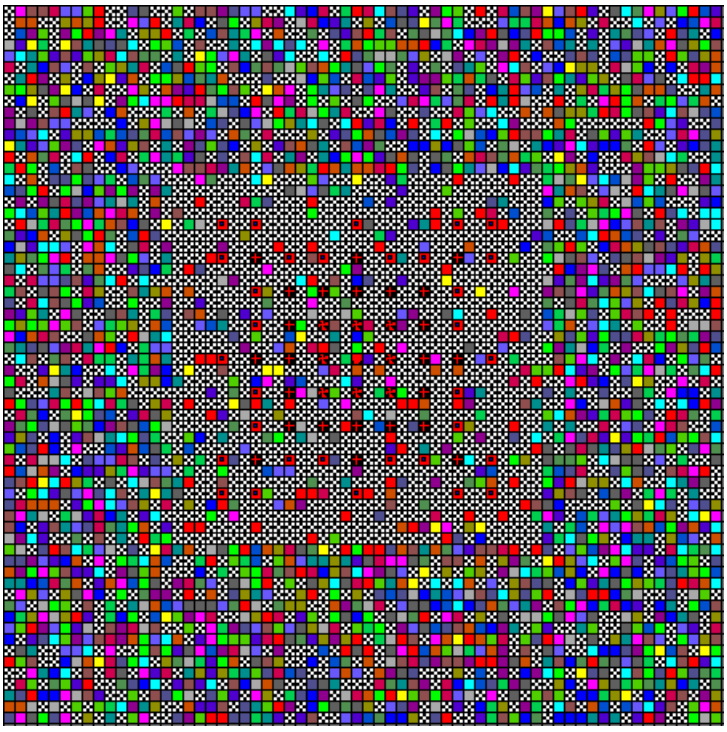

Figure 4. Challenger present condition, t=0. Agents highlighted have challenger identity in repertoire but not the regime identity.

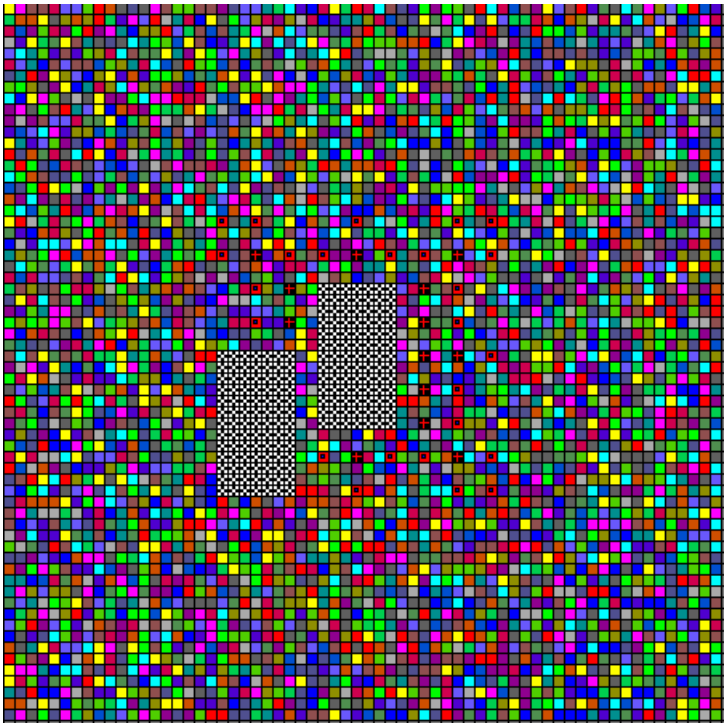

Figure 5: Regions Exposed to Violence in Southwest and Center

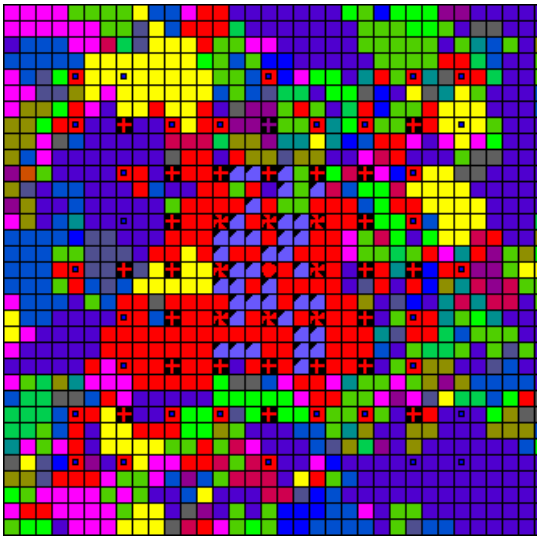

Figure 6: Auth_Shape in Typical Run (Volatility 500, Challenger Present), Time Step 51, Center Violent Strike. Light-blue cells with black triangle in upper left corner are locations struck by violence.

My expectation was that violent strikes would disrupt the regime's ability to enforce activation on red inside Auth_Shape and decrease the integrity of regime by reducing the number of influentials activated on the regime identity. I expected that under volatile conditions the regime would be more successful on each measure than under stable conditions, since rival identities would not benefit from the steadying presence of their own web of influentials. I expected that the presence of the challenger

identity would multiply the effects of violence, but was not sure what the interaction would be between volatility and the presence of the challenger. If my expectations were met, and if a plausible story could be told about the interaction between volatility and the presence of a challenger, the usefulness and appropriateness of my definition of violence and its operationalization for studying political violence would be corroborated.

Experimental Results and Discussion

The Excel file that accompanies this document as Appendix_Viol contains charts reporting data from experiments conducted under conditions explained above. Neither the charts in the Appendix nor this discussion treat all data collected. Nor do I use the data to pose decisive questions about the effects of political violence. The purpose here is narrow: to interpret patterns in the data as offering stories about the relationship between violence and political outcomes to assess the performance of the definition of violence as I have operationalized it.

As expected, under normal conditions, violence decreased the degree to which the authority structure was able to establish and consolidate a pattern of public affiliation with the regime. Figure 7 shows that in both stable and volatile conditions the average prevalence score for the regime identity within Auth_Shape was highest in the non-violence condition, next highest in the southwest violent condition and lowest in the center violence condition, where the presence of regime influentials, especially high echelon influentials, is greatest. This sequence of outcomes in which values registered in the no violence and center violence condition bracket the value registered in the southwest violence condition is regular across experiments and dependent measures. Although violence as operationalized here directly affects only basic agents and not influentials (only basics can become "violent"), what may be inferred from this pattern is that violence appears to weaken the ability of the Authority Structure to maintain influentials activated on 0, thereby allowing pockets of non-0 activation to form that include as a stabilizing and expansive force, some captured influentials.

This interpretation is strengthened by the data in Figure 8, "Effect of Volatility and Violence on Regime Integrity." We see that violence and the strategic direction of it (i.e. center as opposed to southwest) each decrease the number of influentials activated on 0 at t=300. Since the violent strike in the center targets a region more heavily populated by more influential agents (the Great Leader, Lords, Vassals) than the strike in the southwest, the higher echelons of the Authority Structure suffer more damage, on average, from center than from southwest violence.

Because of the nature of agent-based modeling experiments it is relatively easy to probe more deeply into the data by studying the shapes of distributions of batches of outcomes rather than simply comparing averages. Consider that in the no violence condition the two variables determining outcomes are the particulars of the random initialization of repertoire complexion and activation distribution and the randomly generated sequence of bias assignments. Across the three experimental conditions in any particular experiment these factors are held constant, permitting us to consider the data in

any particular set of three runs as 100 triplets data point triplets. The procedure followed to compare heuristically the shapes of outcome distributions is to first order by increasing magnitude the data points measured at t=300 in the no violence condition. The corresponding values for the violent conditions are then plotted alongside the run numbers as determined by the rising curve of outcomes in the no violence condition. In this way it can be seen whether the difference in average outcome is due to especially large discrepancies in some portion of the rising curve of outcomes in the no violence condition.

Indeed we see in Figures 9 and 10 that violence in both the southwest and the center produces frequent reductions of regime identity prevalence under both stable and volatile conditions. The reductions are relatively small in the southwest violence condition but robust in the center violence condition, especially in the portion of the data displayed on the extreme left sides of these figures, when exogenously determined conditions appear to have been relatively unfavorable for the regime. Very similar patterns, for both stable and volatile conditions, appear in the data displayed in Figures 11 and 12 regarding the frequency, robustness, and distribution of effects of violence on regime integrity. [9] It is also clear that in the portion of the data displayed on the extreme right side of these figures, when exogenously determined conditions appear to have been extremely favorable for the regime, violence, whether in the southwest or in the center, only occasionally and relatively moderately reduced values for regime identity prevalence or regime integrity. In the central portion of the distributions displayed in these charts, when general conditions were neither distinctly favorable nor unfavorable, violence, especially center violence, impacted regime identity prevalence and integrity more strongly and more often and tends to be stronger in volatile than in stable conditions. Under distinctly unfavorable conditions, in the data displayed on the extreme left side of these figures, we see how powerfully violence, especially violence in the center, tended to reduce levels of regime identity prevalence and regime integrity that were already weakened by the conditions then exploited by whomever we might imagine the wielders of violence to be.

A key mechanism involved in the relationships traced above is that streams of perturbations or particular initializations that may be unfavorable for the regime may be distinctly favorable for some other identity, producing regional cascades of activation on that identity accelerated or consolidated by the capture of influentials unable to remain activated on 0. To probe the operation of this mechanism a follow-on set of experiments was conducted. A “Challenger” identity was implemented, as explained above, as a particular identity (16) that in the “Challenger present” condition would be present in the identity repertoire of each agent in Auth_shape that did *not* have identity 0 in its repertoire (whether basic or influential). It is important to remember that this manipulation involved no additional *activation* of identity 16, only a substantial increase in the availability of the identity within the repertoires (or “subscriptions”) of the Auth-Shape agents not allied with the regime by virtue of the presence in their repertoires of identity 0.

The data exhibited in Figures 13 are drawn from experiments run with the Challenger identity present, i.e., from an activation point of view, there is a high latent presence of identity 16 in Auth_Shape. As the above explication of the mechanism involved would lead us to expect, the prevalence of the regime identity, under both stable and unstable conditions, decreases with the introduction of violence and its focus on the center of the Authority Structure. Comparison of Figures 13 and 7 show, again as expected, that across all conditions of violence and no violence, the prevalence of the regime identity in Auth_Shape is reduced by the presence of the Challenger identity. Comparison of Figures 13 and 14 shows that while violence decreases the prevalence of regime identity, it increases, as expected, the prevalence of the Challenger identity, by opening up more opportunities under otherwise less favorable conditions for identity 16 to establish itself as activated in compact and sizeable enough regions to capture influentials and consolidate its presence. Evidence for the importance of this specific sequence (focused on the decisiveness of capture of high echelon regime influentials) is found in the fact that the average prevalence of the Challenger identity jumps considerably more moving from southwest violence to center violence than from no violence to southwest violence.

The data in Figure 15 reinforce this finding in an interesting way. Under stable conditions the Challenger identity has, across no violence, southwest violence, and center violence, substantially less success capturing regime influentials than under generally volatile conditions. However, although violence produces very moderate *increases* in Challenger control of influentials under stable conditions, volatility reduces the contribution of violence to the success of the Challenger. One possible (though unconfirmed) interpretation is that under volatile conditions challenger-captured influentials are themselves increasingly likely, especially in the center violence condition, to be recaptured by the regime identity or captured by some other rival whose potential for activation has been unleashed with the breakdown in the coherence of the regime's authority structure.

Figure 16 presents data on Challenger control of influentials across six conditions. The three closely aligned curves that begin at 0 on the Y axis and turn sharply higher in the extreme right side of the figure compare Challenger influentials under stable conditions (no violence, southwest violence, and center violence). The other three curves, anchored on challenger control of the regime with no violence under volatile conditions that begins at 10 on the Y axis, display a much more robust effect for violence, especially center violence. We can infer from the raggedness and substantial separation between the light blue "x" marked curve and the brown "circle" marked curve that center violence under was a potent determinant of challenger control of the regime under volatile conditions, as long as those conditions were not (as in the extreme right side of the figure) extremely favorable for the Challenger. By contrast, center violence, when it did make a difference under stable conditions, increased the success of the challenger identity in capturing influentials (note the number of yellow "diamond" (center violence) and even pink "squares" (southwest violence) that register more challenger influentials than their no violence counterparts. The story reflected in the data in this figure seems to be that when conditions are stable challengers must have very favorable conditions to

succeed in gaining control of substantial portions of the regime, and that violence does not add or subtract appreciably from their prospects, though if some success of this sort is to be registered when general conditions are not extremely favorable, violence, especially violence directed strategically at the center of the regime, will be necessary. On the other hand, under generally volatile conditions, a challenger with widespread latent support can register substantial gains in a struggle to gain control of the regime. Indeed, when conditions are volatile it appears that violence will tend to hurt rather than help such efforts, and that violence toward the center will have a rather high likelihood of hurting rather than bolstering challenger success. In other words, we may say that political violence acts as a kind of shock to a stabilized system. When shocks are in short supply, i.e. under stable conditions, challengers do less well and violence can help them. When shocks are not in short supply, as under volatile conditions, challengers can do better in a wider array of circumstances but are likely to suffer, and to suffer perhaps greatly, from the use of violence that then creates so much instability as to advantage either the network of regime influentials or other identities able to exploit the high levels of instability to capture portions of the regime.

Conclusion

My expectation, as stated earlier, was that violent strikes would disrupt the regime's ability to enforce activation on red inside Auth_Shape and decrease the integrity of regime by reducing the number of influentials activated on the regime identity. This hypothesis was borne out by the data. I also expected that under volatile conditions the regime would be more successful on each measure than under stable conditions, since rival identities would not benefit from the steadying presence of their own web of influentials. The data in Figure 7 do show that volatility does increase average regime identity prevalence in every condition. However, as indicated in Figure 8, contrary to my expectation, volatility resulted in somewhat fewer influentials activated, on average, on the regime identity than under stable conditions. I expected that the presence of the challenger identity would multiply the effects of violence, but was not sure what the interaction would be between volatility and the presence of the challenger. Evidence in support of this hypothesis was presented in Figure 16, which suggested, at least preliminarily, that the relationship between volatility of general conditions and violence would be significantly context dependent.

Overall, these simple findings suggest that the definition and operationalization of violence presented here do not produce drastically unfamiliar or bizarre patterns of outcomes. This is a fundamentally unsurprising result. When conducting substantive research this usually registers as uninteresting. However at this point in the research program, when definitions and operationalizations are being developed and tested, the absence of surprise may be reasonably interpreted as corroborative of the potential value of the conceptual apparatus, the analytic utility of the definition of violence here advanced, and the specific technique for its operationalization I have employed.

On a conceptual level we may ask why this way of thinking about violence, as a sudden and drastic increase in the scale of negative values at stake in an encounter,

should work to capture what we want to study as political violence. One line of argument might be that the essence of what distinguishes unpleasant or unfortunate encounters that are not violent from those that are is the sense, on the part of the observer (whether victim or not) that enormous uncertainty about what might about to be lost is compressed into a small space of time. When the fist is heading to the face neither the puncher nor the punched can know with any certainty just what scale to use to evaluate the stakes of this encounter. This unsettling shock, that will pass quickly in time, while leaving traces of the existence of severe and compressed uncertainty and threat in a particular space or population, is what on the macro level the operationalization explicated and deployed in this paper has been designed to realize.

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[1] American Political Science Association Annual Meeting, Chicago, Panel in the Comparative Politics Section, "Civil Wars and Violence." Panel participants included Macartan Humphreys, Robert Bates, Ethan Buena de Mesquita, Jeremy Weinstein, and Eric Dickson. Similar answers to this author's same query were received at interdisciplinary conferences on political violence and civil wars held at the Santa Fe Institute, January 16-18, 2003; and at a workshop on "Civil War and Peace-making in Colombia" at the University of Chicago, November 13, 2004.

[2] Mary R. Jackman, "Violence in Social Life," Annual Review of Sociology, Vol. 28 (August 2002) pp. 387-415. Accessed on line at http://arjournals.annualreviews.org/doi/full/10.1146/annrev.soc…Quotation from p. 2 of downloaded version.

[3] Jackman page ??

[4] Ibid., p. 20.

[5]Ian S. Lustick, Simulating the Effects of Israeli-Palestinian Violence, Fundamentalist Mobilization, and Regional Disruption on Regime Stability and USA-Friendly Outcomes in Middle East Polity, January 2003, http://discuss.santafe.edu/files/politicalviolence/lusticksantafe.pdf

[6] Each agent class in this simulation updates on even time steps only, so a two time step punctuation is equivalent to a single update cycle.

[7] Updating routines require each agent to count the number of agents in its Moore neighborhood activated on different identities. Each identity receives one identity weight "point" for each agent, including self, activated on it, multiplied by the respective influence level of each agent. To the sum of these products is added the exogenously and randomly changing "bias," which varies between –3 and +3 for all identities except for identity 20 (which as explained is permanently assigned a bias of –10). The resulting sums for each identity are compared by each agent to determine which update, if any, to implement.

[8] Stability vs. volatility of general conditions is operationalized by changing the probability that at any even time step (when updating occurs in this model), any one particular identity will be eligible for a random change in its bias assignment. When eligible, a fresh bias assignment is made via a random draw from available values. In this series of experiments the bias range was set at –3,+3, so available values were –3, –2,-1, 0, +1, and +2,+3. Volatility settings are expressed as fractions of 10,000. Thus a "stable" setting was implemented as 250, meaning that each identity at every update had a .025 probability of being eligible for a fresh bias assignment, while a "volatile" setting, implemented at 500, means that each identity at every update had a .050 probability of being eligible for a fresh bias assignment. Note that with seven available values in the pool, each fresh assignment of a bias entailed a probability of approximately .14 that there would actually be no change in the identity's assigned bias.

[9] It is worth noting that in each of these Figures the occasional presence of yellow or violet markers above the blue circle markers of the no violence condition indicates that under some circumstances violence can actually increase the prevalence of the regime identity or the integrity of the regime. This pattern indicates that there is nothing determinative at the macro level about the operationalization of violence that insures it is damaging to the regime.