

The September 11 attack: A percolation of individual passive support

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Abstract. A model to terrorism is presented using the theory of percolation. Terrorism power is related to the spontaneous formation of random backbones of people who are sympathetic to terrorism but without being directly involved in it. They just don't oppose in case they could. In the past such friendly-to-terrorism backbones have been always existing but were of finite size and localized to a given geographical area. The September 11 terrorist attack on the US has revealed for the first time the existence of a world wide spread extension. It is argued to have result from a sudden world percolation of otherwise unconnected and dormant world spread backbones of passive supporters. The associated strategic question is then to determine if collecting ground information could have predict and thus avoid such a transition. Our results show the answer is no, voiding the major criticism against intelligence services. To conclude the impact of military action is discussed.

PACS. 89.75.Hc Networks and genealogical trees – 05.50.+q Lattice theory and statistics (Ising, Potts, etc.) – 87.23.Ge Dynamics of social systems

The recent September 11 terrorist attack on the US came as a total and dramatic blow to all experts on terrorism, intelligence services and military hierarchy. Here, terrorism designates the use of random violence against civilians in the purpose to kill them. While the problem is extremely complex, complicated and difficult, a different view from the physics of disorder may be useful in shedding some new light on it.

In the past years physicists have been dealing with social and political behaviors using some concepts and tools from Statistical Physics [1–6]. Here we are using the theory of percolation [7–9] to analyze the connection between terrorism activity and the surrounding population attitude. We are neither investigating the terrorist net itself nor its internal mechanisms.

Our work does not aim at an exact description of terrorism complexity. Making some crude approximations it allows exhibiting an essential characteristics of terrorism by linking its capacity of destruction to the surrounding population attitude. In particular a target is set to be reachable once it is located within an area covered by a cluster of people who are passively consenting to the terrorist cause. The September 11 terrorist attack on the US is given an explanation in terms of the first worldwide percolation of such a cluster of passively consenting people. In parallel collecting ground information has proven unable to assess the associated current world level of related terrorism threat. Military action also appears of no use against it.

Passive supporters are normal people who do not need to express explicitly their position. It is a dormant attitude that results from an individual opinion. They are unnoticeable. They just do not oppose a terrorist act in case they could. They are sharing independently an identical opinion of identifying with the terrorist cause. They do not need to communicate between them. Mainly concentrated within the terrorist home area they are randomly spread in the whole population. We analyse their distribution in terms of percolation theory.

To make our model more explicit, we assume the world is a grid within a continuum percolation picture. Sites are randomly distributed on a plane and when separated by a distance less than some maximum length, they are regarded as nearest neighbors. To move on the grid requires to go through a continuous path of neighboring sites. People are distributed randomly over all the sites. Therefore for someone to change site, it has to simultaneously exchange sites with a nearest neighbor on the grid making its agreement a prerequisite for its one site move. Accordingly for a terrorist to go from one home site to a target site requires to find a continuous path of passive supporters with whom it can switch successively. All of them do not need to cooperate collectively. The interaction is pairwise, local and restricted to the moving terrorist. Only one passive supporter is involved at a time. In contrast a non passive supporter does not allow the site exchange thus blocking the terrorist motion.

The random distribution of passive supporters produces random clusters of neighboring passive supporters.

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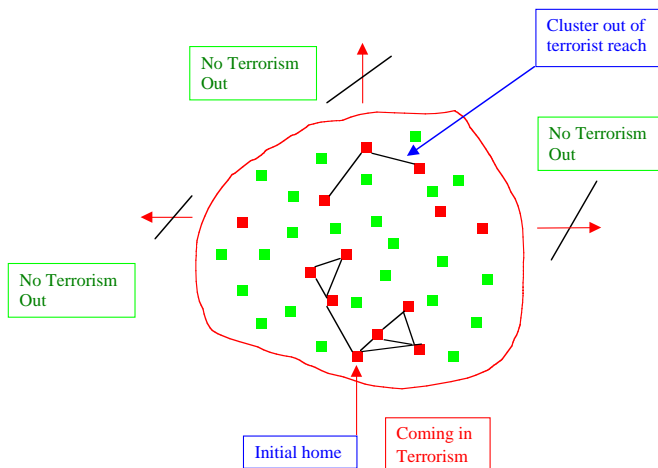


Fig. 1. Black squares are open to terrorism. Grey ones are closed to it. The connected black squares are clusters open to terrorism. The larger one below is being used by terrorists making all its sites potential targets. The smaller cluster above is of no use to terrorist since unconnected to their incoming source. Moreover the initial home incoming terrorism is trapped within the country without possibility to reach another neighboring country.

No one is aware it belongs to a definite cluster. Such a cluster existence comes to life only *via* the moving of a terrorist on it. Otherwise it is totally virtual. However it is both the size and the localization of such virtual clusters which determine the global level of terrorist threat as well as its reach potential targets. Up to now the passive supporters of a terrorist cause have been always mainly concentrated with the geographical area of the terrorist home. It usually give rise to one major home cluster with sometimes few additional clusters further away but unconnected to the home one (see Fig. 1). It explains why all known terrorism has been always geographically anchored to finite size areas like for instance recently in Ireland, Corsica or Euskadi.

However one of the characteristics of current terrorism has been its capacity in creating many passive supporters spread all over the world. It also succeeded in producing one huge home cluster covering in part Afghanistan (see Fig. 2). Nevertheless for years other existing world backbones stayed out of reach to its activity making them invisible and unused. Accordingly the past years of continuing dynamics of converting more and more people to the terrorism cause went unnoticeable. At least, it did not rise any concern. After all it was just a question of opinion spreading. And indeed, since all new and enlarged backbone of passive supporters were staying unconnected to the home one, they were of no practical significance on terrorism activity. Their size increase went without any consequence.

However at some density coverage of passive supporters a drastic geometric phenomenon occurs. All of a sudden and at once many existing spread backbones got connected to merge into one unique huge world wide cluster. It must have been the first passive social percolation phenomenon in terrorism history. Passive means the phe-

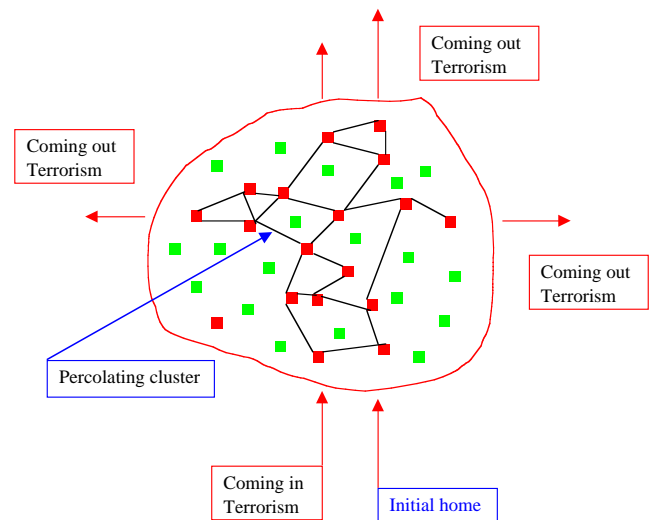


Fig. 2. Black connected squares are a percolating cluster. Incoming terrorism can get out towards any other neighboring country.

nomenon occurs without any particular organized social behavior. It is a geometrical result that does not require interactions among its ingredients. The associated level of threat became automatically infinite. We argue the September 11 terrorist attack on the US is the immediate result of that percolating cluster. It is worth to stress at this stage that the few previous long-ranged terrorist attacks, like the one by the Japanese Red Army Group at Tel Aviv airport three decade ago, are associated to a dangling path rather than a percolating cluster.

Such an explanation rises the question on whether it was possible to predict this world wide percolation. To answer such a strategic question and keep the presentation simple we set black a site open to terrorism move and grey a blocking one. To illustrate the demonstration the percolation threshold is supposed to be at fifty percent of the whole grid sites. The qualitative results do not depend on this choice. Moreover within the qualitative level of the present paper it may be sufficient to state that approximately a structure is connected if the majority of its substructures are connected. Accordingly as long as less than fifty percent of the world sites are black there exists no world percolating cluster and therefore no world level to terrorism threat.

Now, at this stage we are aiming at measuring a world state which result from individuals attitudes. Therefore to find the distribution of world passive supporters requires getting ground information about individual attitudes. One natural approach to achieve such a goal is to use ground people to report on what they see. Indeed let us examine such a scheme.

In principle each person sees things which it could report on. However these reports would score up to billions making it impossible to collect all of them, even with very large resources. The construction of a representative sample of such an infinite ensemble is then a prerequisite. Let us assume it exists. Along with, every person of the sample reports on the black or grey occupation of the various sites it can see. The associated grid coverage thus defines an

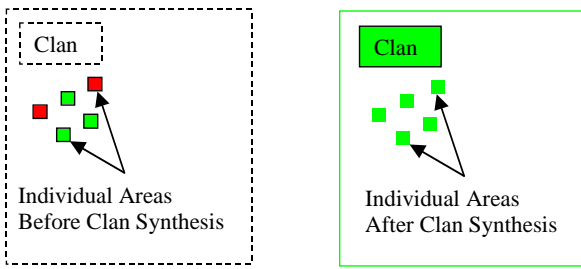


Fig. 3. Synthesizing process. (i) On the left side 5 individual areas before the clan level synthesis with 2 black and 3 grey areas. On the right side after the clan level synthesis which makes the clan grey. Now all inside 5 areas are looked upon as grey areas.

individual area. The goal is then to state if it is an area open to terrorist move or not. To do so requires to aggregate and synthesize the resulting color of several sites which are respectively either black or grey. Being concerned with the percolation of the whole world grid, a natural way to proceed is to apply the same above hypothesis of fifty percent at the level of individual areas. A given area with more than fifty percent of black sites is black, otherwise it is grey.

Once this area step is completed, the next one is to collect and treat all available world spread colored areas to determine the world status with respect to its passivity to terrorism. But here come a genuine difficulty. Real information is not just a black or grey color. Indeed, the more from the ground an information is, the more specific to the ground it is. Cultural biases, religion, poverty, military pressure and many other local characteristics dress heavily any ground information. In term of information theory the signals are very noisy. Accordingly all area informations cannot be just added together. They must be grouped by families such that their respective dispersions are not too large to be understandable by one unique person which has to make a clear synthesis report. For individual areas, a clan can be such a natural frame to a synthesis.

Then, keeping our fifty percent criterium, a color clan is determined using a simple majority rule among the various colors of its associated individual areas. A grey clan is hostile to terrorism while a black clan don't oppose it. Along the same aggregating-synthesizing process, clans have to be grouped by ethnies, ethnies by provinces, provinces by states, states by countries, countries by continent and continents gives the world. At each iterative step, colors are respectively determined using the same local majority rule [10]. It means, at each step we are increasing the size of territories for which we are setting the color. For instance starting from individual areas black and grey we go to each associated clan area which becomes either black or gray. In other words a posteriori we are turning all individual areas to the same and unique color of its corresponding clan (see Fig. 3). And so forth going up to higher levels.

To proceed with a quantitative scheme, we note $n = 0$ the ground site level of aggregation, $n = 1$ the individual areas, $n = 2$ the clans, $n = 3$ the ethnies, $n = 4$ the

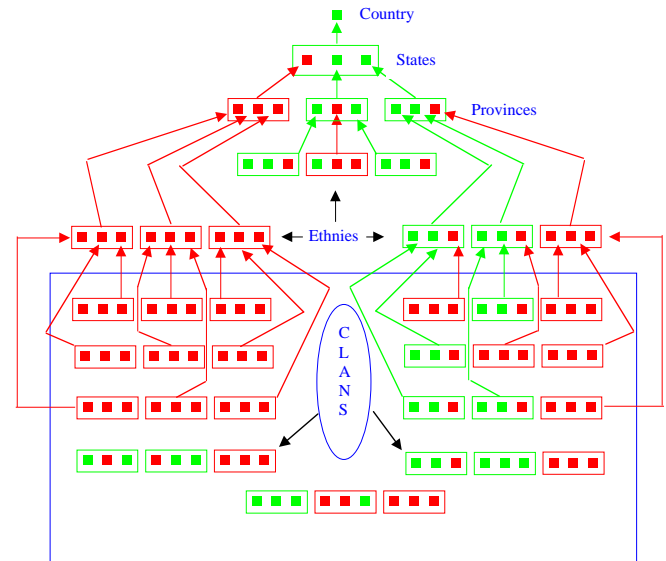


Fig. 4. A particular illustration for one country with 3 states, 9 provinces, 27 ethnies and 72 clans. Although 48 clans are black against 24 grey, the intelligence machine yields a grey country due to the peculiar distribution of the grey clans. Below 27 clans without outgoing arrows are connected to the above 9 ethnies without incoming arrows.

provinces, $n = 5$ the states, $n = 6$ the countries, $n = 7$ the continents and $n = 8$ the World. At each level a black color means the level allows terrorist activity on the corresponding territory. Gray means it forbids it (see Fig. 4). For instance one black country surrounded by grey ones confines possible terrorism activities within this country. Such a possibility gives light to the fact that several countries stated that prior to September the 11 they did warn the US about the possibility of some terrorist action. But such a warning could not be credited since the US would have to be sure the world was percolating to engage a preventive military action. Otherwise any military move would have been rejected by the whole world as arbitrary aggressive.

Let us now illustrate the quantitative mechanism at work in the model by the repeated color rescaling from site colors to the world color. To solve simple equations we choose arbitrary numbers for each grouping step. Exact numbers could be used but it would only make the equations more fastidious without changing the main qualitative result. We take 5 sites per individual area, 5 individual areas per clan, 5 clans per ethny, 5 ethnies per province, 5 provinces per state, 5 states per country, 5 countries per continent and 5 continents to the world. It implies $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 = 78\,125$ human personals on the ground. Each one of them reports on 5 different sites.

Assuming everything is randomly distributed in our collecting system we can write one equation giving the probability p_n to have a black entity at level n as function of the probability p_{n-1} to have one at the level below $n - 1$,

$$p_n = p_{n-1}^5 + 5p_{n-1}^4(1 - p_{n-1}) + 10p_{n-1}^3(1 - p_{n-1})^2, \quad (1)$$

where n runs from 1 for individual areas to 8 for the world. The value p_0 gives the density of reported black ground sites. Suppose $p_0 = 0.47$, the percolation transition is about to happen. We can then make our intelligence collecting ground information system at work to check its validity.

Iterating equation (1) from $p_0 = 0.20$ gives $p_1 = 0.06$ with $p_2 = p_3 = p_4 = p_5 = p_6 = p_7 = p_8 = 0.00$ where 0.00 symbolizes fractions below half a percent. The collecting process makes 20% of black sites a small ground noise not to worry about. An increase of black support to 30% results in the series $p_1 = 0.16$, $p_2 = 0.03$ and $p_3 = p_4 = p_5 = p_6 = p_7 = p_8 = 0.00$. Reaching 40% leads to $p_1 = 0.32$, $p_2 = 0.19$, $p_3 = 0.05$ and again $p_4 = p_5 = p_6 = p_7 = p_8 = 0.00$. Getting close to the transition point at $p_0 = 0.47$ gives $p_1 = 0.44$, $p_2 = 0.40$, $p_3 = 0.31$, $p_4 = 0.18$, $p_5 = 0.04$, $p_6 = 0.00$, $p_7 = 0.00$ and $p_8 = 0.00$. If some indication is emerging about something going on within countries with $p_5 = 0.04$, at the country level none is a threat. The aggregation process has dropped out the existing 47% of ground black sites. It would lead to a total disaster in term of any forecast. At the same time from $p_0 = 0.55$ the aggregation process yields $p_1 = 0.59$, $p_2 = 0.67$, $p_3 = 0.80$, $p_4 = 0.94$ and now $p_5 = p_6 = p_7 = p_8 = 1$. The conclusion would be a total hysterical view of the whole world in the terrorist camp.

From above numbers, the intelligence machine has proven its ability to determine exactly the current world color but it misses totally the corresponding ponderation of the leading color. Moreover the vicinity of a possible global shift is completely missed. When the shift to black occurs it is too late to react. At this stage the world appears either “good” or “bad”. And indeed the performance is even worse. In many real life situations, it may happen a synthesis cannot provide a clear characterization on whether an area is black or grey. In that case to avoid a dramatic mistake a doubting synthesis is associated to a grey signal. No one would decide military action unless the evidences are unquestionable.

To implement this zero mistake requirement within our model we introduce some even size collecting groups which may exhibit equal number of black and grey sites. In this case the color is grey. To illustrate this possibility let us go from 5 to 6 in above intelligence machine with $6 \times 6 \times 6 \times 6 \times 6 \times 6 = 279\,936$. Equation (1) becomes,

$$p_n = p_{n-1}^6 + 6p_{n-1}^5(1 - p_{n-1}) + 15p_{n-1}^4(1 - p_{n-1})^2. \quad (2)$$

Again iterating equation (2) from $p_0 = 0.47$ gives respectively $p_1 = 0.29$, $p_2 = 0.06$, and $p_3 = p_4 = p_5 = p_6 = p_7 = p_8 = 0.00$. Although there exist 47% of black sites the machine gives every level grey already at the clan one. Checking on an initial $p_0 = 0.60$ leads to $p_1 = 0.54$, $p_2 = 0.43$, $p_3 = 0.22$, $p_4 = 0.02$, and $p_5 = p_6 = p_7 = p_8 = 0.00$. The result is dramatic with a total failure in determining even the current state of the world which is much above the percolation threshold. Changing above numbers does not modify the qualitative result.

To conclude the use of ground information can at best determine the current dominant ground state but cannot

assess the associated level of potential threat, in particular the vicinity of a phase transition. And most likely, since a large-scale military action cannot be undertaken with any doubt, it even misses totally a ground shift to a state of maximum world danger. On this basis our results make void the major criticism against intelligence services that would have failed in opposing current terrorism due to its neglecting of human ground personal. The hint to a better efficiency of intelligence services should to be looked upon other direction than coming back to old ground intelligence practice.

Last but not least our finding demonstrate that the use of military power cannot reduce the level of threat attached to the existence of the percolating backbone of passive supporters. Indeed to suppress a percolating cluster requires getting down the number of passive supporters below the percolation threshold. Imagine there exist 54 percent of passive supporters within a population of 100 millions. A military action would aim at neutralizing say 10 percent of them. To achieve such a goal would require the neutralization of more than 20 percent of the whole population (20 millions) whose moreover half are innocents since passive supporters are randomly distributed and unnoticeable. It is morally unacceptable though achievable with currently available weapons of mass destruction. Accordingly new non-destructive tools are urgently needed to suppress the current terrorism world threat. This conclusion does not exclude the use of military action against the terrorism group itself.

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