Chapter 13 – A HOLISTIC VIEW OF RADICALIZATION: IMPLICATIONS FOR MODELING

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Terrorism is not a new phenomenon, but the emergence of increasing numbers of violent non-state actors who employ terrorism as a mechanism to meet their social and political objectives is a growing concern for analysts and decision makers. One of the key priorities is the development of an understanding of the mechanism behind the radicalization of individuals, their characteristics, their motivations, what separates them from those who share the same grievances but do not join radical groups and choose to employ violence. Key in understanding terrorism is a better understanding of radicalization. Radicalization is the result of a complex set of interactions between individuals, groups and their environment. There are a variety of analytical methods and models that can assist in providing insight into these interactions, assessing the importance of factors, assessing the impact of uncertainty and forecasting vulnerable individuals and populations. This paper will discuss many of the factors underlying radicalization and highlight appropriate classes of models that can enable these insights. References to specific model will be made only to illustrate representative capabilities, not as an endorsement or to confer exclusiveness. Attention will be given not only to computational social science models, but also to verbal conceptual models. A basic description of the models mentioned in the paper is found in Appendix 13-1.

Numerous research efforts have identified and/or theorized about factors and mechanisms that underlie terrorism and radicalization. Title 22 of the United States Code, Section 2656f(d) defines terrorism as, "premeditated, politically motivated violence perpetrated against non-combatant targets by sub-national groups or clandestine agents, usually intended to influence an audience" and radicalization is defined alternatively as "internalization of a set of beliefs, militant mindset that embraces violent jihad" [1] or "the active pursuit of and/or support for fundamental changes in society that may endanger the continued existence of the democratic order (aim), which may involve the use of undemocratic methods (means) that may harm the function of the democratic order (effect) [2]. It is important to remember that radicalization is the process and terrorism is one of many possible results of radicalization.

A large body of research regarding radicalization and terrorism has focused on identifying various putative root causes such as: poverty, structural inequalities, political grievance and dislocations accompanying rapid modernization. It is hypothesized that the combination of a disaffected individual, a complicit community and a legitimizing ideology make for a causal "lethal cocktail" [3]. These root causes are necessary, but not sufficient, for explaining how and why individuals join, become increasingly radical and ultimately employ terrorism as a tactic, sometimes primary strategy to achieve their social and political objectives. These root causes act, along with direct or indirect experience of trauma, discrimination and alienation to create openings, psychological vulnerabilities that then resonate with key messages, leading to becoming involved in a radical group by self-recruitment or recruitment by others. Recent research has highlighted the importance of small group dynamics [4] in the process of radicalization, organic behaviors that result from the "actual and evolving cliques, cells, bridges and networks … individuals form" [5]. A frequent theme emerging from research is the importance of charismatic leaders or "spiritual sanctioners" in the mobilization of a (terrorist) social movement by transforming "widespread grievances and frustrations into a political agenda for violent struggle" [6]. Frequently, the mechanism employed by these leaders is the conscious or unconscious framing of grievances in terms of a larger narrative (e.g., the narrative of a "just war").

What is needed is a more holistic view of these, akin to understanding fire. To understand fire, on cannot focus on the flame or on the often destructive result, but on the precipitating causes, the initiating cause and the sustaining forces. Likewise, the root causes of terrorism are the environmental conditions that

predispose individuals toward radicalization, toward joining a group involved in terrorism or supporting terrorism, much like dryness and fuel/kindling. The dynamic factors, including significant events, internal/ external pressures, leaders and organization/group dynamics provide the spark and oxygen to start the fire and keep it burning. These factors interact to maintain a radical movement much like fuel and oxygen interact to maintain a fire. For example, recruitment is directly impacted by the continued presence of socio-economic and/or political grievances. Radicalization, like forest fires, is also relatively rare. There are thousands every year, but only a few are very destructive and widespread. When radicalization occurs it is because the landscape was ripe – little rain, dry woods, poor/ill-equipped fire-fighting capability [7].

There certainly is no silver bullet – a single method or model that will magically provide answers for all the related questions one would ask about radicalization or terrorism. There are, however, a number of useful methods and models that can, for answering a variety of questions related to the radicalization trajectory, stages, factors, etc., provide useful insights. Because radicalization is a process and not a single state, any method and/or model(s) of radicalization needs to be iterative, interactive and adaptive to capture the inherent dynamic complexity. One way to do that is to use several levels of models. A recent National Research Council study entitled, 'Behavior Modeling and Simulation: From Individuals to Societies" categorized "formal" (as opposed to verbal conceptual models, models that are not instantiated in algorithms or software) models as either macro (involving macro-level variables such as education, poverty, unemployment), micro (modeling cognitive or affective processes) and meso (the level between macro and micro, for example a social network) models [8]. A more holistic analysis of radicalization (related to terrorism) would consider, at a minimum, the environment, Violent Non-State Actor (VNSA)/ radical group systems and sub-systems (e.g., supporters, financing, logistics) over the life cycle of the VNSA. This analytical framework would consider not only the interactions between the system elements but also the interaction between the system and its environment [9]. The foundation for this analytical framework and the constituent models comes from across the spectrum of social (and in some cases physical) sciences.

13.1 FUEL/KINDLING: UNDERSTANDING THE ENVIRONMENT IN WHICH TERRORISM EMERGES

Previous research has established that terrorism can and does occur anywhere, but is more commonly found in developing societies. It is especially likely in societies characterized by rapid modernization and lack of political rights. Poverty contributes **indirectly** to potential for political violence in that failure to create viable economy has been asserted to be a root cause of civil war. More fundamentally, low levels of development create lots of young people with few alternatives – natural recruits for terrorist groups [10]. In the Congo, low-level income and low growth rate "reduced the cost of organizing rebellions...and the government's ability to fight a counterinsurgency" [11].

More direct contributors are structural inequities, frequently cited by militants/radicals who claim to act on behalf of repressed or marginalized population segments. "Discontent arising from the perception of relative depravation is the basic, instigating condition for participants in collective violence." [10] The relative deprivation theory of political violence posits that if people perceive they are deprived of economic and political advantages, they become resentful and motivated to act. David Wright-Neville writes, "to the extent that violence is almost always an extension of frustration, and that frustration in turn results from the failure to receive expected rewards, terrorism and the ideologies that underpin it can be viewed as a "politics of dashed expectations" [12]. Examples of groups who have been or are motivated by socioeconomic marginalization are the FARC, IRA, Hezbollah, Shi'a in Lebanon, and the Tamil Tigers [13]. Some have contended that ethnic or religious discrimination is the root cause of ethnonationalist terrorism (e.g., Tamil Tigers, PKK) [6]. The notion of inequities is based on perceptions and expectations. This is supported by research efforts that concluded that leaders of political sectarian and ethnic movements are, in general, better educated and of higher status than the general population, with personal

experiences of barriers to upward mobility [14]. A study highlighting the impact of the resentment of inequalities by results showed that the more educated Palestinians are, the more they support armed attacks against civilians inside Israel [15]. Hamas takes advantage of environments with poor governance, using its da'wa system to buy support, goodwill and grass roots level support for their agenda [16]. Neuroscience research has identified some mechanisms related to perceptions of inequality, specifically the presence of characteristic brain activity associated with the resulting feelings of humiliation and loss of honor [17].

Another putative root cause highlighted in previous research is rapid socioeconomic change. This is bolstered by the fact that terrorism is most common in countries in mid-range of economic development. The explanation is that economic change creates conditions for instability and the emergence of a militant movement. Based on the work of sociologists Scheuch and Kingemann [18], the theory postulates that people in fast growing modernizing countries cannot cope with rapid economic and cultural developments and react to the pressures with rigidity and "closed-mindedness" which some radical movements can mobilize [19]. If one group gains faster than another and inequalities are along pre-existing lines of class or cleavage, incentives for revolutionary or separatist movements increase [13]. Other relevant factors are the social trauma accompanying rapid change. The disruption due to rapid modernization increases the potential for political violence and terrorism by making traditional norms and social patterns irrelevant and increasing susceptibility to radical ideologies, especially those that provide an encompassing explanation and prescription for all aspects of life (e.g., Islam shar'ia). Blocked or distorted modernization manifests in terrorism. This is due to traditional societies coping with both external stresses and internal stresses (e.g., urbanization, literacy, social mobility). This pluralizes societies to various degrees and strains established ways of thinking and behaving. Endogamous social organizations, in which greater loyalty is given to a family/tribe versus an ideology, respond to threats to their collective identity (e.g., importing of western materialism) by returning to convention (e.g., becoming more religious) and sometimes with "chiliastic" violence [20].

Political grievances have also been identified as root causes of terrorism. The dynamics between individuals and groups and the government are key – good governance, in terms of services provided and policies, can substantially serve to mitigate grievances, but "bad" governance can exacerbate them. Repression and torture are two catalysts for conflict and violence. Oscillations between reform and repression may actually be greater contributors to political conflicts in that the prospect of reform increases incentives for action, while the repressive actions of the government reduce the opportunity costs of violence, including terrorism. Government inconsistency is often interpreted as regime weakness [14], [21]. This is consistent with the "J Curve" hypothesis of rebellions and revolutions in which "revolutions occur when a prolonged period of objective economic and social development is followed by a short period of sharp reversal" [22]. A reinforcing loop (Figure 13-1) has been identified in which an increase in terror tactics increases the repressive tactics employed by the government, which then decreases public support for the government and shifts it to the terrorist cause (resulting, in part, in increased recruitment). An example of this was the "Bloody Sunday Massacre" in Londonderry in 1972 [13].

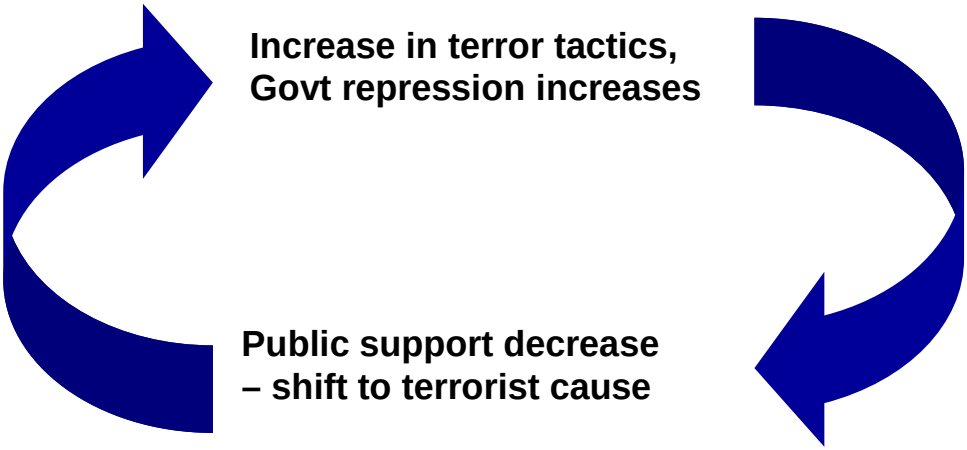

Figure 13-1: Repression Reinforcing Loop (Stohl, 2006).

Diaspora populations, with large, unassimilated and often marginalized immigrant populations, are exceptionally vulnerable to radical ideas and terrorism. The juxtaposition of the environmental predisposing factors discussed previously and psychological susceptibility to radical ideas and sub-cultures is real and dangerous. Diaspora communities exacerbate the tendency for emergent enclaves of radical thought due to feelings of isolation and tolerance for extremist sub-cultures. Within these areas individuals seeking an identity, looking for approval, searching for cause that can be religiously and culturally justified, and a clear call for action are vulnerable to radical ideas. This is the case with many European communities with marginalized Muslim populations [23].

13.2 FUEL/KINDLING: IMPLICATIONS FOR METHODS AND MODELS

The entities, factors, relationships and processes related as root causes of radicalization and terrorism in the narrative above are verbal conceptual models stemming from seminal research in the area of socio-cultural-political factors related to conflict, terrorism and instability. Verbal conceptual models are quite useful for understanding the factors, and their importance, that underpin psychological vulnerabilities – particularly in expressing critical differences between the vulnerabilities and associated motivations of individuals (e.g., between individuals in conflict zones versus non-conflict zones) [23]. In addition, other models can provide important insights. For example, system dynamic modeling and econometric modeling, macro-structural models designed to forecast instability and conflict (e.g., ACTOR) can provide insight about the environment and its impact on the susceptibility of individuals and/or groups to become radicalized and pursue terrorist tactics. System dynamic models (macro-level non-linear feedback models) are helpful for looking at the impact of environmental factors on behaviors (group(s), government) and identifying tipping points. This is hugely useful since many of these outcomes are non-intuitive and do not fit with extrapolative thinking [24]. Agent-based models, since agents can be defined as macro level entities (e.g., government, military, Non-Governmental Organizations (NGOs), can also be used to assess the probability of state failure. Rules can be written describing the behaviors, goals and characteristics of agents (e.g., tension and social comparison and social pressure) and then simulations can be conducted to assess the probability of various outcomes (e.g., inter-group conflict) [25]. Agent-based models could also be employed to provide insight about the both the cause and impact of reinforcing loops in System Dynamic Models or serve as cognitive models for individuals and groups, highlighting psychological vulnerabilities and susceptibility for recruiting by a terrorist group.

Modeling based on identifying risk-taking behaviors on the basis of relative depravation (using sigmoid-utility theory) can potentially predict vulnerability to recruitment, provide insights on the evolution of radicalization and risk-taking preferences and the effects of “small world network” group dynamics. [21]

Grievances need to be considered in terms of how they're interpreted by the group [26]. Statistical models (e.g., regression analysis), which explore the relationship between environmental variables and behaviors using empirical data, are also quite useful. For example, this approach can be used to explore the relationship between government features or policies and group behaviors (e.g., violent actions) [27] or to explore the relationship between economic and political capacity variables and nation-state instability [25]. Other variants of statistical modeling (Bayesian Networks and Hidden Markov Models) are useful for tracking and fusing indicators of instability [25], with the notion that instability creates the perfect breeding ground for radicalization and terrorism [28].

13.3 SPARKS: FACTORS THAT TRIGGER RADICALIZATION AND TERRORISM

While environmental conditions can create the right conditions and impact individuals so as to increase susceptibility for recruitment and group mobilization, there must be a transformation for mobilization to take place (see Figure 13-2). The system elements interact with one another in a causative and highly dynamic fashion to form and support VNSAs [9]. Terrorism and radicalization is a process (or some would say a continuum) "inculcated through social processes and internalized over time" [12]. Radicalization can take months to years. The trigger or catalyst is often a cognitive event or crisis that causes the questioning of beliefs. These events or crises could take a variety of forms, for example economic (losing a job or blocked mobility), social (alienation, discrimination, racism, either real or perceived), political (international or local conflicts) or personal (death of a friend or family member) [29]. The process often starts with incitement, a message that commands and legitimizes a cause and provokes outrage, leading to the decision that political activity is the solution.

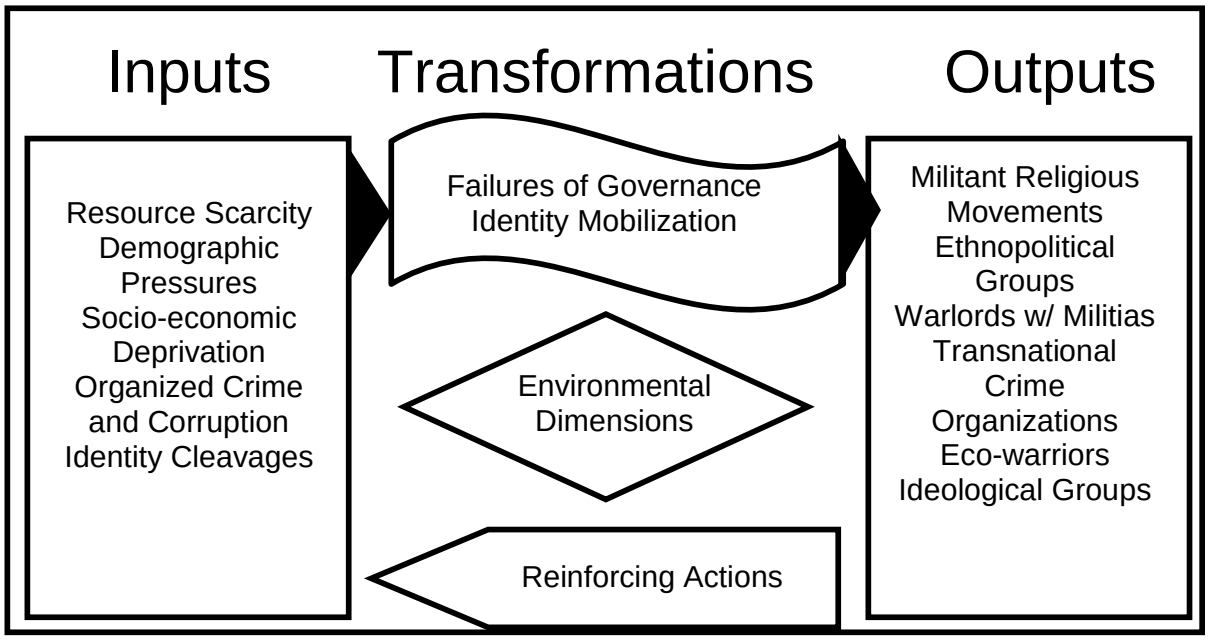

Figure 13-2: Systems View of Violence (Thomas, 2004).

Quintan Wiktorowicz suggested that activists emerge through a personal crisis, experienced discrimination or chance encounters with a charismatic recruiter who creates a "cognitive opening", followed by a search for new ideas, followed by a frame alignment in which a movement's message increasingly "rings true". Once the key tenets of a movement's message are accepted, intensive socialization takes place in study groups and one-on-one interaction. Emotive appeals are underpinned by ideological teachings, leading the

individual to the conclusion that he or she is personally responsible and obligated to join and become active. Peer pressure and group bonding reinforce the commitment of the member [30]. This is consistent with the concept of "moral shocks" as the frequent first step in participation in a social movement [31]. Affective dimensions are pervasive in social networks, often causing individuals to participate in activism [32].

Radicalization is a process with distinct phases working at the individual, group and social psychological levels (which are symbiotic). The individual interpretation of and response to socio-political conditions is influenced by personal psychology as well as group dynamics (family, peer group) [33]. One assumption that needs to be questioned is that of the rational actor, in which it is presumed that a well-ordered and transitive utility function exists that enables rational decisions based on full/perfect information with no time limits. Some radical actors may take cognitive "shortcuts", a tendency identified through research on heuristics and biases [34] or use "fast and frugal heuristics" like "take the best" (mechanisms of inference developed under time constraints) [35]. Individuals may filter and interpret information based on storytelling narratives they've created and/or been exposed to (e.g., Jihad versus McWorld) [36]. Neurobiologists postulated that emotional and affective considerations operate subconsciously and affect reasoning more than explicit arguments/premises.

The "hot mind" may be critical in explaining deviations from rational decision making. Both emotion and identity have been identified as critical resources in and provide different motives for initial and continued participation in crowds and social movements [37]. Emotion is the basis for commitment processes to bind actors into social systems and sustain activism over the long haul. When mixed with a positive evaluation of an ideology, this sense of commitment is strengthened ("moral commitment") [38]. Also, dynamic approaches to reasoning have highlighted the importance of diachronic cognition (time dependent reasoning, e.g., using historical events to filter/interpret current events) [39]. Work by Scott Atran has reinforced the notion that radical groups/VNSA's employ non-instrumental reasoning in which "sacred values" trump rational thinking; for example, greater support for an apology versus financial incentives [40]. Not falling prey to inappropriate (rational actor assumptions), and considering organizational and cultural narratives, diachronic cognition and emotional and affective considerations are all important.

Existing research does not support the hypothesis of a specific terrorist personality or mental pathology, but identifies group dynamics to explain behaviors. Small dense networks promote the confluence of in-group love and out-group hate and enable the transformation of self-interest to self-sacrifice for a cause. "Small world" networks enable the rapid diffusion of terrorist innovation through social hubs and flexible communication in all directions, often in contrast to the doctrine espoused in terrorist manuals [41].

Individuals are both self-selected and recruited either directly or indirectly by a charismatic leader. In some countries (e.g., Philippines, Indonesia, Pakistan, Chechnya), recruits are members of locally dominant culture, involved in on-going conflict. In this case, membership and participation in the conflict is part of tradition with a sympathetic local population and families often having a history of resistance. In these conflict zones, the motivation for recruitment and radicalization is revenge in reaction to pain over personal loss/trauma, to gain a feeling of control over negative events [23]. There are often economic incentives to join as well, since the families of "martyrs" are compensated.

In non-conflict zones (including areas with diaspora populations), ideology is broadcast (in the internet, TV, radio and in sermons) to foster resonance. These messages are, in many cases, a tonic for disillusionment and spread via contagion. Friends or relatives affected by a death (e.g., a suicide) are motivated to act similarly [23]. Alternatively, the motivation can be a sense of collective grievance (e.g., genocide in Bosnia or the invasion of Iraq as a collective grievance of the Muslim community). A study of Italian and German terrorist groups resulted in the observation that radicalization is "encouraged less by direct experiences of violence than by the sense of being violently rejected by mainstream society." [42] The resulting promise of a sense of belonging and adventure, positive identity and empowerment are compelling reasons to join and actively participate in radical groups [23]. New converts to an ideology are more susceptible to radical ideas (political

or religious) and, once recruited, are "overachievers … overcompensating for the fact that they did not see the light before." [43]

Another trigger and reinforcer of radicalization that needs mention is that of being detained or imprisoned. Incarceration creates grievances against the government and an opportunity for key physical contacts [16]. Prisons are an isolated environment with a "captive" audience, a large population of disaffected young men. Several examples of individuals who became significantly more radical in prison include Ahmidan (leader of Madrid bombing group) and Hamman (leader of the militant wing of Islamic Group, responsible for the murders of Egyptians and foreigners). Ayman Zawahiri, second in command to Osama bin Laden, was jailed after the Sadat assassination and said, "after Sadat's assassination the torture started again … was brutal this time." A radical English version of the Qur'ān (containing an appendix entitled, "The Call to Jihad") is widely available in prisons. Prisoners are vulnerable to recruitment into radical organizations after parole due to their financial and social vulnerability. Providing for prisoners after their release can engender their loyalty [44]. The use of torture, and other forms of individual rights violations, is linked to increased radicalization [16].

Social Movement Theory (SMT) can provide a mechanism to understand the mobilization of radical groups, the relationship between resonance and recruiting and the impact of societal mechanisms (government policies, countermeasures, coverage of media) on the radicalization process. The focus is not just on small group dynamics but a holistic look at larger groups and the relationships between individuals, group and society. SMT provides a framework to link structural factors, group processes and individual motivation including the feedback from the surrounding environment to the movement.

Three major SMT approaches include Strain Theory, Resource Mobilization Theory and Framing Theory. Strain theory focuses on the external strains on society that degrade institutional efficacy and lead to instability and mass mobilization. Strain, a common factor stated as causative of conflict, is the "existence of ambiguities, deprivations, tensions, conflicts and discrepancies in the social order." [45] The strain can be economic (relative deprivation), but also strains in values [46]. However, strain may be necessary but not sufficient and movements are purposeful, not just coping mechanisms. Resource Mobilization Theory focuses on how movements engage in garnering support and enlarging their constituency and how social networks, churches, schools and charities define and disseminate grievances, seeking to exploit openings or closures in the political space and calculate the action based on the greatest chance of success. However, the extent to which a movement's cause resonates with a constituency often matters more than resource availability and political opportunity. Framing Theory focuses on how individuals come to conceptualize themselves as a collectivity by the social production and dissemination of meaning.

A "frame" refers to an individual's worldview and includes values, beliefs, attributes and mechanisms of causation as an organizing construct for experience and guide for action [47]. According to framing theory, social mobilization depends on whether a movement's version of "reality" resonates with its potential constituency (known as "frame alignment", congruence between the interests, values and beliefs of an individual and an organization). This can be facile, with "sentiment pools" of individuals sharing a grievance with the organization, or the result of value, belief manipulation by a movement entrepreneur. Key factors include the degree of compatibility between the movement's message and a broader cultural context, risk and cost associated with movement membership, the extent of internal coherence of messages, the existence or absence of competing frames/movements and the status and reputation of key messengers [48].

Framing Theory explains violent radicalization and terrorism in terms of the distinct constructed reality shared by group members who frame problems as injustices, attribute responsibility for injustices and construct an argument for the moral justification and efficacy of using violence against civilians to right the perceived wrong. In contrast to psychological approaches, Framing Theory focuses on relational position rather than innate characteristics. Frames aid in mobilization by identifying a grievance, calling for corrective action and attributing blame. They offer reasonable, attainable solutions for ameliorating grievance and

provide the motivation for collective action by aligning individual values and orientations with movement goals, providing a rationale for participation and a vocabulary for accounting for actions [49]. The resonance between the objectives of a radical group and a potential recruit occurs on multiple levels. The ideology is spread by word of mouth, sermons, films/videos, songs. Inside conflict zones the framing emphasizes trauma, hardship and humiliation resulting from occupation, loss of homes and struggle over territory, ethnicity, and independence. In non-conflict zones, the framing focuses on fostering collective grievance (e.g., claims about Islam under attack illustrated, often graphically, with images from conflict zones) [23].

Representative frames used to recruit new members by militant jihadi radicals are: the Islamic community faces assault, military attack from infidels, the potential for cultural corruption and/or social disintegration, and glorification of jihad as an adventure, noble cause which provides a sense of direction and meaning and jihad as not only a spiritual quest, but also armed defence [29].

In Indonesia, Laskar Jihad, a militant Salafi organization, used a series of frames to mobilize fighters during the Moluccan conflict, which began as a clash between two youth groups and evolved into a collective conflict between Muslims and Christians. The first was a statement of grievance that stated in sweeping terms of the thousands of Muslims killed and hundreds of others expelled in the Moluccan conflict during Wahid's presidency. The second frame was about Muslim "cleansing", conjuring imaging of a Muslim genocide at the hands of Moluccan Christians. The third was an accusation that Moluccan Christians were Zionists – essentially a "guilt by association" frame. By emphasizing a "spiral of conflict" and linking it to other key issues for Indonesian Muslims, they effectively used "frame bridging" which combines elements of separate public opinion sectors, merging them in the process. They also employed "frame amplification", a dichotomized articulation of the world in stark "us" and "them" terms, and "frame extension", in which the issue was extended from the Moluccan conflict to a more general conflict involving Muslims [50].

13.4 SPARKS: IMPLICATIONS FOR METHODS AND MODELS

Models can help provide an understanding of where conditions exist that would foster and resonate with psychological vulnerabilities (the existence of ethnic fissures, socio-economic grievance, discrimination, alienation, opportunities for recruitment (either direct or indirect via Internet, etc.)). Appropriate models, in addition to the verbal conceptual models developed by Speckhard and others include rule-based models (another form of expert models) or Bayesian Belief Networks, discourse analysis and agent-based models. For example, Tom Pyszczynski [51] found that mortality primes (e.g., images related to mortality) resulted in an increase an individuals' support for terrorism. These relationships could be expressed by rules in a model or by probabilities in a Bayesian Belief Network.

Understanding the frames a group uses, how they reflect and foster group identity and alignment with frames in the environment is important. Group identity is crucial for recruitment into a radical group and continued participation in the social movement by fostering identities that resonate within a larger culture [52]. Frames inspire and legitimate collective action by identifying grievance, highlighting a solution and rationale for participation. Discourse analysis, an analytical method enabling the formation of a verbal conceptual model, can provide a window into the hidden agenda of the speaker, providing cues about resonance with ideology, expressions of grievances and, through discursive mechanisms related to in-group/out-group polarization, a sense of the salience of social characterization which is a correlate of inter-group violence or conflict [53]. Critical discourse analysis can be used to analyze the frames used by a group [54]. Agent-based models can enable an examination of social movement mobilization, the impact of messages, etc. Agent-based models can also serve as cognitive models for key individuals and groups, providing insights into psychological vulnerabilities, and susceptibility to recruitment, as well as forecasting plausible behaviors. One particular form of agent-based models, Cellular Automata, can be useful for looking at the spread of a message and movement. Finally, Social Network Analysis can

identify influential individuals and enable an understanding of the network structure and dynamics. Social Network Analysis is a useful tool for assessing organizational structure and information flow.

13.5 OXYGEN AND WIND: FANNING THE FLAMES OF RADICALIZATION AND TERRORISM

As an individual becomes more radicalized, they often begin a process of gradual alienation from society at large based on feelings of rejection/lack of acceptance, concomitant with a growing sense of disempowerment (ability to change the circumstances). One characterization of terrorists stated that 84% were cut off from their culture and social origins..." they were marginalized, underemployed and generally excluded from the highest status …." Dirk Laabs, a documentary filmmaker and reporter, said the Hamburg (9/11) cell was "not integration into the community but withdrew from it to live in a parallel universe of Jihad." [5]

As the level of radicalization increases, the detachment increases. This is evident in the behavior of the 9/11 hijackers, the London and Madrid bombers and others. The withdrawal is accompanied by increasing polarization in the way the events of the world and "others" or out-groups are viewed. For example, in the case of the London bombers the external events in Kashmir, Afghanistan and Iraq "encroached into … perceptions and … fomented a steady disengagement with the world" [12]. This is exacerbated by tendencies for individuals in small cohesive groups to find it difficult to voice dissent when a majority of the members agree on something, even when it is objectively false [23]. As the level of radicalization increases, the detachment increases. This is evident in the behavior of the 9/11 hijackers, the London and Madrid bombers and others.

Once the "Alienation Threshold" is crossed (see Figure 13-3), radical group members have an increasing need to be with like-minded individuals who affirm their sense of alienation and anger and collectively replace feelings with confidence and the inclination to act against those responsible for past injustices and slights. Irrelevance and helplessness is replaced by a sense of control and importance at being part of a collective effort against an adversary. The "bunch of guys" dynamic transforms resentment into hatred and rejection of society [41]. The polarization is echoed in the group's discourse, with increased euphemism expressed about the in-group and increased derogation (e.g., hostile, corrupt) expression of the out-group. This is a standard psychological tactic, dehumanization of the "other" in order to justify conflict/violent action. Studies have shown that individuals act more cruelly if the responsibility is collective versus individual [55]. This effectively rationalizes future behavior, shifting the group/sub-culture norm. An example of this is a parable shared by an imam from one of the mosques attended by the 9/11 in which there are two rams, one with horns and one without. In the next world "Allah switched the horns from one ram to the other, so justice could prevail." [5] At this point, a "Violence Threshold" is crossed by some or all of the members of the group.

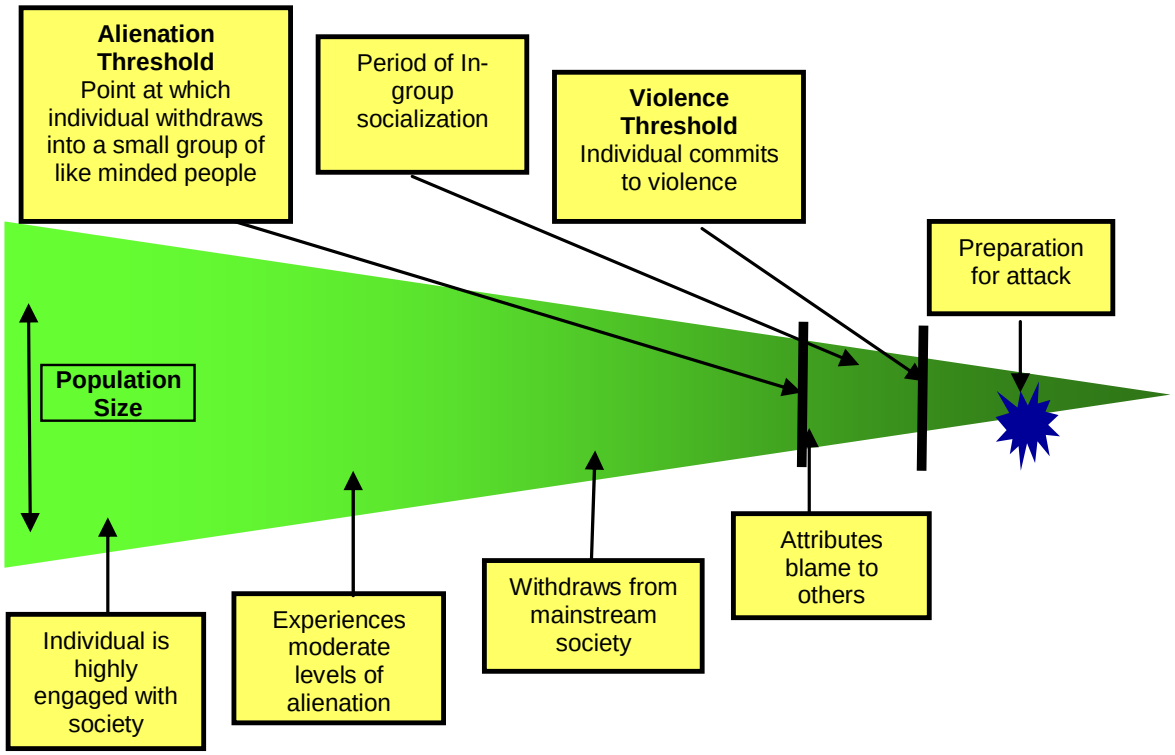

Figure 13-3: Evolution of a Terrorist (Wright-Neville, 2006).

Social contagion, networks and mechanisms of information cascades provide important clues about some of the mechanisms underlying this transitional phase related to increasing radicalization between the "Alienation Threshold" and the "Violence Threshold". Social contagion is defined as the "social transmission by contact, of sociocultural artifacts or states" [56] or as a process and form of collective excitement "in which emotions and behavioral patterns spread rapidly and are accepted uncritically by the members of a collective" [57]. Research has focused on two major types: emotional (spread of mood and affect) contagion and behavioural (spread of behaviours) contagion. Examples are waves of suicides, rule breaking behavior (e.g., teenage smoking, speeding) and contagions of aggression (e.g., angry crowds).

Two types of theories have emerged to explain social contagion. Emergent Norm theory [58] and Social Learning Theory [53],[59] posit that behaviors spread not by contagion/contact, but due to deliberate attempts to adhere to collective norms or deliberate imitation resulting as a strategy to deal with uncertainty, respectively. Alternatively, Convergence Theory [60], Disinhibition Theory [61] and Deindividuation Theory [62] posit that homogeneity and clustering are not due to contagion, but are due to emergent collectives due to prior shared motivations, imitation mediated by restraint release "due to observing another perform an action that the individual is in conflict about performing himself" [63] and restraint reduction due to the anonymous nature of collectivities, respectively. Environmental macro-social factors that affect social contagion and information transfer are population density, ethnic heterogeneity and the concentration of social interactions. This, in turn, impacts the temporal change or spatial spread of crime [64]. Contagion is evidenced in the behaviors of friends or family members of a suicide bomber who are affected by the act and decide to act similarly.

There are some critical lessons from studying social contagion and information cascades that are important here. The nature of a network that fosters global cascades of social influence is one that is connected, but not too connected (exhibiting two phase transitions). Below a certain level of connections, a network will not experience cascades and above a certain level of connections the impact of any single person is too small to trigger a cascade. Information cascades leverage "small world networks", networks with high

connectedness (high degree of clustering) and a low average path length between one person and any other enabled by "weak" or "bridge" links to otherwise remote parts of the network [65].

Early in the radicalization process, prior to the gradual alienation, individuals are connected in a network. Cascades are more often triggered by an individual with an average amount of connections or neighbors, not necessarily a "hub" (highly connected "influentials"); thus, the key is the connectivity of the vulnerable ("early adopter") cluster to which the initial innovator/instigator (e.g., charismatic leader or "spiritual sanctioner") is connected. Early adopters are the individuals who seize upon an idea, including apostles and followers of revolutionaries. They are the first to be influenced by an external stimulus. The larger the cluster of early adopters, the farther an idea will spread [65]. Said another way, the success of a trend (e.g. radicalization based on some ideology) depends on how susceptible overall society is to the trend, not on the person who starts it. This is not to say that some people aren't more instrumental than others, but they aren't simply the ones that are more connected [7]. So, for recruitment into a radical group, a large cluster of individuals vulnerable to a particular idea is a gold mine.

Small dense networks promote the confluence of in-group love and out-group hate and enable the transformation of self-interest to self-sacrifice for a cause. "Small world" networks enable the rapid diffusion of terrorist innovation through social hubs and flexible, informal communication in all directions, often in contrast to the doctrine espoused in terrorist manuals [41]. It is interesting to note that while "hubs" are less important at this stage, accident and circumstance can play a role here. For example, in the case of the Madrid bombing the two main cells merged after a chance meeting in prison and marriage. Researchers designing a viral marketing scheme married two concepts: small network effects (using dense connectivity to connect locally through word-of-mouth and "weak links" to spread to other parts of a network), along with aiming the ad at as broad a market as possible since the person who triggers it is virtually impossible to predict [7].

However, as individuals (and groups) become increasingly radicalized, the process for influence/information cascades becomes that for sparsely or poorly connected networks (reflecting the extreme alienation from society). Below a certain threshold (the other tipping point or phase transition), cascades can't spread because the network is too poorly connected and fragmented into "islands". As groups become more radicalized (associated with greater risk preference) they become progressively insular and pressure increases to conform with the in-group [66]. With less exposure to different influences/ideas, in a poorly connected/insular group certain individuals can be highly influential (e.g., charismatic leaders). This explains how the Branch Davidians, a religious cult, could maintain implausible beliefs because of their isolation, continual reinforcement of each other and lack of interaction with the outside world [64]. A network analysis of the links in the "global Salafi jihad" reflects dense clusters with few links spanning the clusters [41]. This is consistent with observed behaviors of increasingly radicalized individuals prior to a violent action/ event who engage both in person and through the internet in "self-imposed brainwashing" forming, in part, a "virtual network of like-minded individuals that serves to reinforce beliefs, commitment and further legitimize them." [29]

13.6 SUSTAINMENT OF RADICALIZATION

The ability to sustain a radical/terrorist group is related to the level of organizational maturity and complexity. Organizational maturity can be assessed by examining the inputs, transformations and outputs of the organization. In the initial radicalization stages, a VNSA is focused primarily on scanning the environment, determining the state's response to environmental grievances and the prospects for violent action to address the unspecified goals of the organization (e.g., survival, profit, vengeance, power). As it grows, it is heavily focused on recruitment and developing resources, specifies its goals, takes initial form (including potentially a formal military organization and infrastructure) and manifest basic functions (e.g., develop leadership, recruit). A more mature organization will exhibit progressive differentiation (e.g., intelligence and military logistics divisions, special combat teams, multiple town chapters) and

clarified goals (e.g., the Al Aqsa Martyr Brigades goal of creating a sovereign Palestinian state and ending Israeli occupation) [9].

Another measure of the ability of a radicalized organization to sustain itself is organizational congruence, the relationship between internal system components and between organizations and their environment. A VNSA with good congruence has its sub-systems functioning in a reinforcing manner and optimizing coordination and information exchanges to reduce uncertainty and increase efficiency. These sub-systems can be categorized as support (which includes recruiting, resource acquisition, stakeholder associations, competitive learning and operational employment), maintenance (preserving equilibrium and maintaining stability through socialization, as well as rewards/sanctions), authority/leadership (fostering learning, developing strategy and providing organizational control) and conversion (conversion of inputs to product, for example non-violent (e.g., reconnaissance)/violent operations, training, production (conversion of resources into materials, for example drugs/weapons, social services and messaging (e.g., ideology, fatwas)). The importance of these sub-systems varies with organizational maturity; for example, during initial stages support (e.g., recruiting, resource acquisition and stakeholder associations) is at the forefront, whereas maintenance and conversion functions become more important as the organization grows and matures. Congruence is also manifested by a good match between environmental opportunities/constraints and system functions. Al Qaeda's adaptive strategy of shifting from hardened targets in the US to soft targets in Africa is an example. Conversely, poor congruence can lead to organizational failure (e.g., ETA recruitment of undisciplined youth to execute complex attacks) [9]. Resources (e.g., capital and people) are very important for sustainment of terrorist organizations [67]. In the case of the Madrid bombers, there was a financial pipeline for operations in Iraq and elsewhere originating in Tetuan, Morocco, fed by reputable businessmen who give zakat (charity) to local groups. The cost of funding a Tetuan suicide bomber bound for Iraq was estimated to be 6,000 Euros [5].

Interestingly, the level of events/casualties can allow us to infer the level of fragmentation in the organization and thus make some inferences about the organizational structure and maturity.

A study of the current wars in Iraq, Afghanistan, global terrorism in non-G7 countries and guerrilla warfare in Columbia resulted in the conclusion that the dynamic evolution of asymmetric conflict is correlated less with the geography, ideology, ethnicity of religion and more to the day-to-day mechanics of insurgency. The assertion is that the same mechanism of continual coalescence and fragmentation of "attack units" underlies modern insurgent wars. The number of casualties per terrorist attack (for non-G7 countries) and the number of casualties within a given war exhibit the power law distribution with $\alpha = 2.5$. Since the frequency of events on all scales is produced by the same exponent, the network is called "scale free". In Columbia and Iraq (insurgencies) α is evolving toward 2.5, in conventional conflicts $\alpha \sim 1.7$; thus, the value of α may actually be useful for characterizing conflicts. A model was developed to explain this behavior, representing an insurgent force as an evolving population of relatively self-contained loosely organized units which coalesce to pool resources and increase capability and fragment when the threat of capture increases. This process of coalescence (with associated greater destructive power) and fragmentation reaches a dynamic steady-state with a fixed distribution of groups of different sizes and a power law distribution with $\alpha = 2.5$ [68].

Charismatic leaders or "spiritual sanctioners" [29] play a role in maintenance of commitment and increasing radicalization. For example, in the case of Mohammed Nasir Abas, formerly of Jemaah Islamiyah, was encouraged to attend an Afghanistan training camp by a charismatic mentor and become an arms instructor and religious teacher and Abu Bakar Bashir's (the "emir of JI") anointing of him as one of JI's regional leaders [69]. Leaders are responsible for developing "Us-versus-Them / War on Islam" group worldview, with global events perceived through the extremist ideological lens and providing moral justification for jihad. Key behavior indicators at this stage are withdrawal from mosque and politicization of new beliefs. Other mechanisms to foster continued commitment and affirm the acceptance of one's "duty" include "bonding" experiences and tests, including training camps, Outward Bound-like activities,

religious retreats, websites and blogs to reinforce beliefs and rationale for action, and making a last will and testament [29].

13.7 OXYGEN AND WIND: IMPLICATIONS FOR METHODS AND MODELS

The role of models for understanding the spread and maintenance/sustainment of a radical organization that engages in terrorism includes enabling an understanding of the impact of a variety of factors on the behaviors of a terrorist group, including relationship/competition with other groups, government reactions/ counterterrorism policies, perceived legitimacy of the salient groups (including the government). Models can provide insights on triggers for a group to employ terrorism tactics or change tactics, targets and/or the intensity of attacks. Models are also useful for assessing changes in organizational structures, since organizational structures are related to capability. Models can also help track and identify changes in behaviors, goals and motivations of VNSAs, providing insights in changes in a terrorist group over time – increasing or decreasing radicalization, fissures in the group, likelihood of fragmentation, changes in political grievance or socio-economic grievance.

As stated previously, understanding the group identity is crucial for explaining continued participation in the social movement and key to gaining that understanding is analyzing the frames used to inspire and legitimate action. Discourse analysis is certainly one method that can be used to develop verbal conceptual models of the salient frames. In addition to Discourse Analysis, Self Organizing Maps, a variant of Artificial Neural Networks, can be used to characterize communications and identify discursive patterns characteristic of a significant shift in behaviors or attitudes toward behaviors. Statistical modeling is useful for providing insights into ongoing dynamics between Violent Non-State Actors (VNSA) and other competing groups and the government, critical for forecasting the propensity to continue to pursue collective violence/terrorism as a tactic or change tactics (e.g., this method has been used to forecast changes in tactics from overt to covert in response to government policies [70]. System Dynamic Modeling can also provide useful insights on the spread or maintenance of terrorist groups based on their ability to represent a complex system-of-systems (VNSA, supporters, logistics, the environment) as well as highlight environmental changes that relate to political or socio-economic grievance (e.g., quality of life, infant mortality, security). Agent-based models are useful for understanding the potential for social contagion and information cascades [65], modeling fragmentation and defragmentation of groups [71] and forecasting changes in behaviors (including identifying emergent behaviors). Social Network Analysis can provide information on organizational structures and capability.

13.8 MODELING AND THE NEED FOR DYNAMIC ADAPTATION

Complex phenomena, like radicalization and terrorism, and complex systems, like VNSAs, embody "a network of relations that are spatial, temporal and causal. The new complex is sustained – i.e., stabilized – because the energetic bonds within it have established a particular equilibrium, one that will sustain this thing's integrity until some greater energy is used to destroy it, or until energy within the system dissipates" [72]. The energetic bonds are the organizational connectivity (both internal and to the environment), the energy in the system is related to the resources, including new recruits. The energy to destroy it could be government interventions/policies, as well as threats from other organizations. Any analytic methods and models used need to continually assess the inputs and outputs of the organization, as well as the state/health of its constituent sub-systems, its connectivity. Interactions between the environment and the organization need to be periodically assessed since "… every dynamic relation to things outside a system is mediated by its material properties and architecture, or by that interpretation of the outside created by this agent's synthesis of the available information" [72]. For example, perception of grievance drives recruitment, so government policies/behaviors can modulate this sub-system. All of this needs to be done with an informed psychological lens which takes into account "fast and frugal" decision-making heuristics, diachronic cognition, organizationally and culturally appropriate narratives and emotional and affective considerations.

A single model will not suffice to represent such a complex system. Any model of radicalization should consider, at a minimum, the group, the individual actors and their motivations and goals, the sympathizers and the environmental factors that impact their support and the group/individuals and the ideology that ties these together. A variety of types of models exist that can provide useful insights on various aspects of radicalization. It is important to understand what question is being addressed by a model, what type of data is available to determine the appropriate level and type of model.

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Appendix 13-1

13A.1 AGENT-BASED MODELS (ABM)

ABM is a class of models (containing elements of game theory, computational sociology, complex systems, emergence) useful for simulation of actions and interactions among autonomous agents or entities for the purpose of assessing system level effects, recreating and forecasting complex phenomena. These entities can be at multiple levels; that is, they can represent an individual, a group, a country, an institution, physical systems (e.g., weather) etc. Characteristics of the entities and the way they interact are defined (by theory, by rules from experts, by relationships derived from data, etc.) and then typically multiple simulations are run to identify plausible futures. Agent-based modeling is a general purpose technology because of the inherent malleability in the definition of agents and their interactions. A modeler can make certain assumptions which may or may not be based strongly on data. Simulation with Agent-based models can generate data suitable for analysis by induction and can enable testing and refinement of theories as well as a deeper understanding of causal mechanisms. Agent-based models are very appropriate for answering "what if" questions and are powerful in that they can help identify unexpected consequences (through the generation of emergent behavior(s) from the micro-level systems level to the macro-level). Monte Carlo methods and evolutionary programming are incorporated to introduce randomness into the model(s).

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13A.2 BAYESIAN NETWORKS

Bayesian Networks are probabilistic graphical models that represent a set of random variables (or "nodes") and their conditional interdependencies. Formally, Bayesian networks are directed ("parent to child") graphs whose nodes represent random variables in the Bayesian sense; that is, observed or inferred or unknown variables, or hypotheses. Graph edges represent conditional dependencies; nodes which are not connected represent variables which are conditionally independent of each other. Each node has an associated function that transforms input (values from a "parent" node) into a variable probability of the "child" node.

However, many implementations do not use Bayesian mathematics in the strictest sense but rather estimates, but are called "Bayesian" because they use Bayes rule for probabilistic inference. **Bayesian Belief Nets** are networks of connected nodes (e.g., groups, organizations, institutions) with each connection having an associated probability (commonly one assigned by one or more Subject Matter Experts). They are compact networks of probabilities (or causal graphs) that capture the probabilistic relationship between variables, as well as historical information about their relationships. Bayesian belief networks are very effective for modeling situations where some information is already known and incoming data is uncertain or partially unavailable (unlike rule-based or "expert" systems, where uncertain or unavailable data results in ineffective or inaccurate reasoning). In this form, it is more an **Expert System** than a Statistical Model in the purest sense. Bayesian Belief Networks are useful for managing

uncertainty; that is, understanding the impact of what is unknown. By changing the connection probabilities, one can ascertain the relationship with outcomes, essentially a sensitivity analysis. This model is very useful for supporting "what if" questions as well for assessing influence ("influence diagrams").

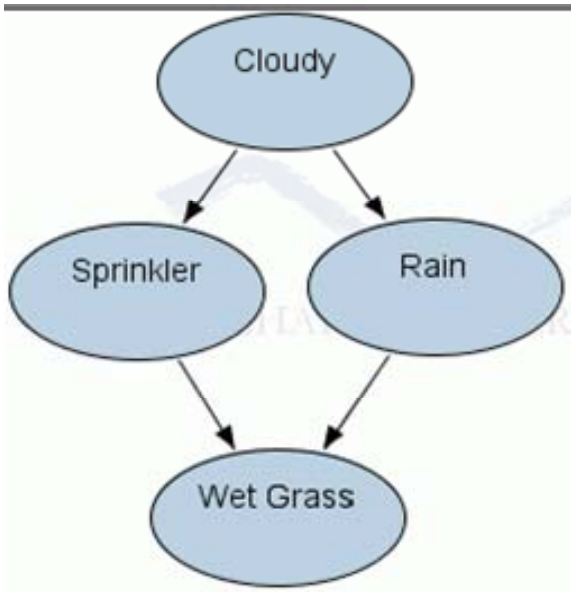

Figure 13A-1: Bayesian Networks.

This is a simple example of a Bayesian Belief Network. The "wet grass" child node has two parent nodes: "sprinkler" and "rain", both of which can cause "wet grass" (Charles River Analytics, 2005).

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13A.3 CELLULAR AUTOMATA

A Cellular Automaton (plural cellular automata (CA)) is a model that has been applied in a variety of fields including mathematics, computational theory, epidemiology, biology and physics. The model consists of a grid of cells. Each cell is in one of a finite number of states ("on" or "off", "yellow", "infected", etc.). The neighborhood of a cell is defined (e.g., the set of cells a distance of 2 or less from the cell). At each time increment, the values of a cell are compared the state values of its neighbor and the state is changed (or kept the same) based on a transition rule. For example, the rule might be that the cell is "On" in the next generation if exactly two of the cells in the neighborhood are "On" in the current

generation, otherwise the cell is "Off" in the next generation. Typically, the rule for updating the state of cells is the same for each cell and does not change over time, and is applied to the whole grid simultaneously, though exceptions are known.

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13A.4 DISCOURSE ANALYSIS

Discourse Analysis is a variant of a **Verbal Conceptual Model** can be characterized as a way of approaching and thinking about a problem and question basic assumptions of various research methods. Since a person's discourse choices are never neutral, but based on the way they see the world and the way they want others to see the world, discourse Analysis can help reveal the hidden motivations behind a text or the hidden agenda of the speaker or writer. Critical Discourse Analysis is a methodology that enables studying and analyzing discourse (both text and spoken words) to attempt to identify discursive sources of power, dominance inequality and bias and how these sources are initiated and maintained or changed within various social, political or historical contexts. The objective is to uncover ideological assumptions hidden in the text or speech and understand inherent relationships between discursive practices and cultural or social structures and processes.

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13A.5 EXPERT SYSTEMS

Some models are what are called expert systems. Expert systems attempt to provide answers or clarify uncertainties in situations typically calling for one or more human experts to be consulted. The model can represent the performance of the expert, or some aspect of their expertise, in a variety of ways (e.g., a knowledge base, a rule-based system, a Bayesian Belief Network). Expert systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real-world problem solving situation as the human Subject Matter Expert (SME), typically as an aid to human workers or a supplement to some information system.

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13A.6 HIDDEN MARKOV MODELS

Hidden Markov Models model a sequence as a discrete Markov chain in which the probability of a current state is only reliant on the previous state (hence the name "hidden"). The model is developed by calculating the observation probabilities of each state and the transition probabilities between each state. Typically the Viterbi algorithm is used to compute the optimum (most probable) state sequence for a given input sequence. So for example, if a person is outside a room and only sees the result of the coin tosses of three coins, those are the "observation sequence". The bias of the coins and the order in which they are tossed is unknown (or "hidden"). The challenge is to find the state sequence (e.g., THHTTHHT), with T representing "tails" and H representing "heads", for which the probability of the observation/input sequence is greatest. This model can be applied for forecasting an event such as a rebellion or coup or the probability of nation-state instability.

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13A.7 SELF ORGANIZING MAP MODELS

A Self-Organizing Map (SOM) or Self-Organizing Feature Map (SOFM) is a type of Artificial Neural Network that is trained using unsupervised learning (that is, it "learns" the pattern based on the data). It produces a low-dimensional representation or "map" of the training samples. This map is useful for elucidating patterns (e.g., voting patterns in Congress). The procedure for placing a vector from data space onto the map is to find the node with the closest weight vector to the vector taken from data space and to assign the map coordinates of this node to our vector. After creating the map in training, the "test" or new data is classified based on its closeness or similarity to regions on the training "map".

Reference

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13A.8 SOCIAL NETWORK MODELING

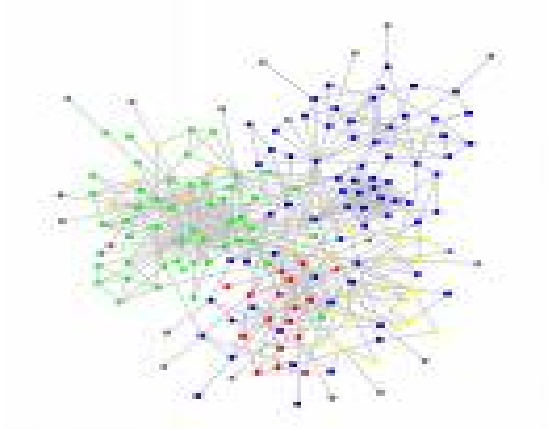

Figure 13A-2: Social Network Modeling.

A **social network** model represents social structures (based on network theory) made of individuals or organizations (called "nodes") in order to explore individual, social, organizational, political or cultural issues. The nodes are connected or tied. The ties can represent the type of relationship (e.g., kinship, friendship, knowledge, relationships of beliefs or knowledge or influence), the flow of information or resources, etc. The resulting graph structures can be very complex. Social networks operate on many levels, from small groups (e.g., families) up to the level of nations and their analysis provides key insights on problem solving, decision making, organizational performance, etc. The position of a node in the network (e.g., central, highly connected) is related to opportunities or constraints on its actions. Likewise, the network structure is related to group performance, capabilities or outcomes.

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13A.9 STATISTICAL MODELS

Statistical modeling involves the application of various statistical analysis techniques. To choose the appropriate technique, a useful first step is to evaluate the data, identifying possible outliers and assumption violations and forming preliminary hypotheses on variable relationships based on an examination of descriptive statistics, graphs, and relational plots of the data.

One class of statistical techniques is **Regression Analysis**. Regression analysis, often used for forecasting or prediction, includes techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. Regression analysis enables an understanding of how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. Often regression analysis estimates the conditional expectation, or the average value, of the dependent variable given the independent variables (i.e., the independent variables are held fixed). Regression analysis is also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships, including inference of causal relationships between the independent and dependent variables.

Logistic regression (sometimes called the **logistic model** or **logit model**) is used for prediction by computing the probability of occurrence of an event by fitting data to a logistic curve. It is used with either numerical or categorical predictor variables. For example, the probability that a rebellion will occur might be predicted from a variety of variables representing group behaviors (e.g., attacks, riots) and government behaviors (e.g., policies, strategies).

References

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13A.10 SYSTEM DYNAMIC MODELS (SDM)

System Dynamic Model represent the dynamic behavior of complex systems. The model elements (called "stocks") are connected (with "flows") unidirectionally (the output of A is an input to B) or bidirectionally (including feedback), as appropriate. Each element is defined by associated variables and the dynamics of the relationship between two elements is represented by a differential equation related to those variables.

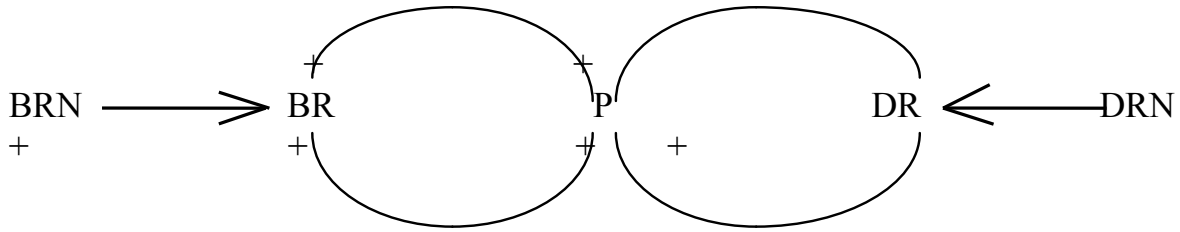

Figure 13A-3: Causal Diagram for a Simple Population Model (Burns, 2003).

The model above is a causal model for Population (P). The "flows" can indicate increases in the Birth Rate (BR) and Death Rate (DR) based on the Birth Rate Normal (BRN) and Death Rate Normal (DRN) (Burns, 2003).

System dynamic models can represent non-linear behavior, including tipping points. This is quite useful as humans are not terribly adept at forecasting tipping points. SDMs enable the representation of complex system behaviors over time, including connectivity and feedback – thus enabling emergent behavior. The elements or stocks can, themselves, represent other sub-elements or stocks and so the model can be multi-resolution.

References

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