THE ADDED VALUE OF NETWORK SCIENCE IN UNDERSTANDING RADICALISATION: *HOW TO LOOK*

This paper focuses on how network theory and technology can help improve the understanding of the processes of radicalisation so enhance description and understanding of principles of effective interventions. Ultimately, this can be used to prevent, halt or reverse processes of violent radicalisation in Europe

Dr. A.J. van Vliet.,
TNO, the Netherlands
September 2013

THE ADDED VALUE OF NETWORK SCIENCE IN UNDERSTANDING RADICALISATION: *HOW TO LOOK*

INTRODUCTION

The objective of the project SAFIRE is to improve the understanding of the process of radicalisation, and to use this knowledge to describe and understand the principles of effective interventions to prevent, halt or reverse the process of radicalisation in Europe. The present approach focuses on understanding radicalisation through the use of network science.

What is known from the literature suggests that **it is not possible to identify a uniform terrorist profile or pathway**. We cannot not meaningfully aggregate individuals from a range of groups when trying to understand the factors associated with radicalisation. Further, one of the most striking elements of radicalisation is that it is a gradual process – not a one-time decision – and that the process is not identical for any individual or group. The phenomenon of radicalisation is contingent upon the past and current state of the world, the persons involved, and their interactions with the world. Hence, there is an unlimited number of routes into violent extremism and terrorism, with a limited number of commonalities, that is factors in common. Thus, up to now there is no all-encompassing theory explaining everything about radicalisation.

To have a fuller understanding of how to effectively handle the challenge of radicalisation, and more specifically how to design a valuable intervention, it is imperative to understand how and why people are drawn to radicalism in the first place, even if commonalities are few and far between. Rather than pinpointing single causal chains leading to radicalisation, our approach is to identify, on the basis of a body of highly diverse literature on actual violent radicalisation open source cases (e.g., anecdotal, scientific, biographical), as many relationships as possible between variables. We use the *upstream* approach, which involves only those cases in which violent acts were, we presume, preceded by a actor-specific process of radicalisation. These sets of ordered relationships, also called 'edges', may then be analysed by sophisticated techniques to provide more understanding of the process of radicalisation leading to violence. In other words, the path to radical extremism can follow different routes, each route consists of several legs (edges); what we try to accomplish is to collect and represent known legs (edges). This approach can be seen as an alternative to a meta-analysis of scientific studies, which is not particularly suitable as the phenomenon may be too complex to be reduced to single causal chains, as indicated by the literature. We therefore require a different approach, tools and metrics to better understand the phenomenon of radicalisation. One possible set of tools is derived from Network Science.

THE APPROACH

NETWORK SCIENCE

Network science, as defined by Wikipedia, is "a new and emerging scientific discipline that examines the interconnections among diverse physical or engineered networks, information networks, biological networks, cognitive and semantic networks, and social networks. This field of science seeks to discover common principles, algorithms and tools that govern network behaviour." The National Research Council defines Network Science as "the study of network representations of physical, biological, and social phenomena leading to predictive models of these phenomena."

What is a network? In any data, there are relations among things, such as two people being cousins or a network of amino acids in a protein. These networks might be psychological or cultural, as when two people share the same belief. They might be physical, as in two resources being in the same location or two computers being connected by a line, or they might be social, as in people being related. Networks are omnipresent and there are many reasons why networks exist. Everyone and everything is constrained and enabled by the networks in which they are embedded. Everyone and everything is embedded in multiple networks; for instance, you are connected to some people due to work, others due to school, others due to your neighbourhood, and so on.

Community plays a role in both the process of radicalisation and de-radicalisation. Just as any person, someone who has been drawn towards radicalism relies day-in and day-out on a network of people with whom they relate on some level. One promising approach to study the networks of people drawn to radicalism is Social Network Analysis (SNA). SNA typically probes the patterns of relationships among people or organisations. SNA can help visualise the connections between and among individuals, groups, or organisations, as well as provide metrics to clarify the

communication patterns and communication-related roles in groups.

Besides social networks at the group level, other networks can be identified. One type of social network, called an Actor Network, represents a social structure made up of individuals (nodes), who are connected by one or more specific types of interdependency, such as friendship, common interests, or relationships of beliefs.

Network representations can be made of any factor for which relationships between nodes matter. This presents further opportunities: instead of a network in which people are represented as nodes, a network (or networks) of nodes representing factors leading to violent radicalisation can be created. This type of network can be called a Content Network. Both Actor and Content Networks can also be extended to Dynamic Network Analysis (DNA). DNA treats individuals as actively involved in communication, storing information, and learning. Both networks and individuals change dynamically and can learn.

Compared to a more traditional approach of identifying factors that predict violent acts related to radicalisation, the building of a (social) network has the advantage of including and visualising variables and their relationships. Visualisations have two advantages.

First, they can give a sophisticated overview of the many factors related to radicalisation, and thereby aid in hypothesising about relationships.
Second, different forms of examination emerge from network analysis, because the structure of the relationship between entities can be incorporated. Network analysis can be used to increase understanding of the process of radicalisation. For example, information about the relative importance of factors and relationships in a graph can be obtained. Examples of questions that can be asked are: Which factors immediately precede violent acts? Are these factors related? Are they directly related or indirectly (through another factor)? How central or peripheral is a factor in a network? Which factors serve as bridges between other variables?

Several tools are available for the analysis and visualisation of networks. One such tool, Organizational Risk Analyser (ORA), was designed to identify individuals or groups that are potential risks to the organisation. ORA is designed to help the user evaluate one or more networks. It can be used to assess the nature of, features of, change in, and determinants of complex networks. A large variety of networks can be assessed including, but not limited to, social networks, activity networks, task networks, knowledge networks, supply chains, and communication networks. Using ORA, we can address questions such as: what is critical, are there groups of interest, are there patterns of interest, how might interventions impact the network, who is critical, are there emerging groups, how is the network changing? ORA can assess any data that can be represented as nodes and relations regardless of what the nodes are or what the relations are. Hence, ORA can assist in the analysis of relationships between any two factors. A network analysis tool such as ORA is highly suitable for our purposes for the following reasons:

- *Size of the dataset.* We have identified several hundred relationships between factors involved in radicalisation. Such a complex system of interrelationships can be regarded as a large dynamic network that is analysed more easily with network tools.
- *Dynamic possibilities.* Network tools allow for the exploration of dynamic changes in the network over time. Radicalisation is a process that evolves over time.
- *Evolving dataset*. Our database with relationships identified from the literature will grow over time. Network tools allow for easy data incorporation from external data sources, and hence support adding edges.
- *Intuitive representations.* Network tools have excellent visualisation capabilities that are highly suitable for exploring multiple relationships among factors, thus increasing our understanding of the process of radicalisation.
- *Options.* Network tools currently have many options to analyse and visualise the data (e.g., ORA has currently in excess of 80 metrics), allowing for multiple perspectives on the same data set.

BUILDING A DATABASE WITH RELATIONSHIPS

In order to apply network analysis to a dataset, we first gathered relationships between factors that are relevant for radicalisation. These relationships were then stored systematically in a database.

Relationships between factors pertaining to radicalisation were selected from the following research areas: cultural-economic, social psychological, political-demographic, and intervention studies, consistent with topics covered in the SAFIRE Work Packages. The origin of the identified relationship was included in the database, varying from repeatedly demonstrated empirical research findings to third-hand anecdotal information.

The relationships in the database were categorised on the basis of a number of other characteristics. This way, factors belonging to a sub-group could be selected to be further scrutinised in a (sub)-visualisation. For example, the coded characteristic 'Ideology' allows for a visualisation containing only left-wing or only right-wing individuals and groups.

Our database contains hundreds of relationships between factors. Relationships were taken from the work performed in previous and parallel Work Packages

in SAFIRE. Examples of these factors are: use of drugs, antisocial behaviour, marital status, socioeconomic status, education level, GDP, multiculturalism, happiness, interpersonal trust, religious factionalism, and terrorist activity. Relationships between any two of these factors are expressed in terms of strength, for instance: the relationship between being married and terrorist activity might be -0.17 on a scale of -1 to +1 (if a quantitative measure is available) or 'weak' (if only a qualitative measure is available). Examples of relationships uncovered are:

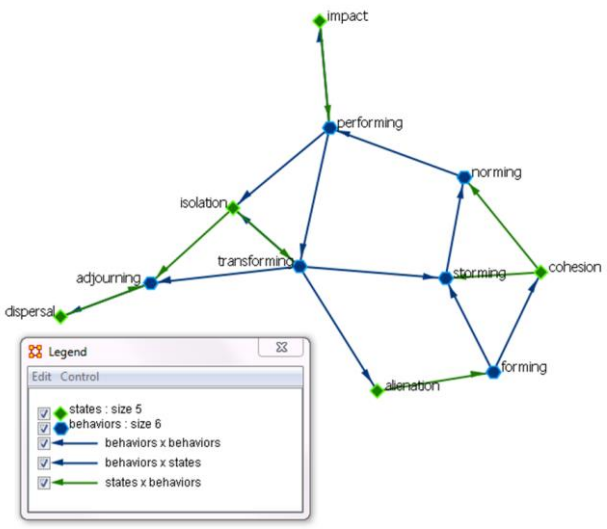
- At the country level, more satisfaction with the system is associated with less political mindedness.
- The global indication of terrorism (measured using death indexes) was negatively associated with GDP indexes in 2009.
- At the country level, more interpersonal trust is positively associated with the desire to have different groups as neighbours.
- Economic globalisation positively affects Islamist terrorism.
- More generous social welfare provisions tend to reduce terrorism and also have fewer of their citizens perpetrate terrorism.

VISUALISING

Conceptual images of networks can be built to illustrate real world events or entities such as violent acts, training recruits or criminal groups. (Psychological) states, such as interpersonal trust and need to affiliate, can also be represented as nodes.

Links connect nodes that share a direct relationship. Indirect links are relationships between variables that are connected through other nodes. Furthermore, one can zoom, select, isolate, add and remove nodes, and much more. For example, a selection can be made of all variables directly linked to violent acts.

An example of a network visualisation is provided below. This example, based on Tuckman's stages of group development, and the states a group might achieve is only for demonstration purposes.



There is a large variety of options for how information can be represented: different colouring or node shape can be used to represent labels, and mouse-over options can be used to provide additional details. The location of the node in the network often gives information about how many connections a node has, with a more central location representing more connections ('centrality'). Other common visualisation characteristics include the size of the node to indicate the strength of the combined connections and the thickness of the lines to indicate the strength of a connection.

RESULTS AND CONCLUSIONS

Neither the process of entering nor the process of leaving radicalisation is precise. Many interconnected components influence the process of radicalisation, and so the concept of being removed from radicalism (for example by intervention programmes) also cannot be strictly defined or delineated. The varying sources of radicalisation and goals of extremist groups lead to interventions that have assorted goals of their own, and differing methods of achieving those goals.

In an effort to keep radicalisation from further infiltrating societies around the world, public and private entities have developed various types of intervention programmes with differing—though sometimes overlapping—goals. It is important to treat participants of de-radicalisation programmes as the people they are—and not just as statistics on a page—because they, too, have their rationale and their reasons, and social and psychological needs. As such, knowledge and understanding of the large variety of factors related to radicalisation (e.g., the culture from which radicalising individuals come) is imperative for effectively addressing radicalisation. We have argued and illustrated that this knowledge and understanding can partly be made accessible using a Network Analysis approach.

Our preliminary sample visualisations give important preliminary directions, both for interventions and further research.

One conclusion we can draw from the data we have incorporated, is that the notion of one overarching theory of how radicalisation proceeds is not to be expected. Depending on the level of analysis, the actors involved, the characteristics of the situation, the state of the actor, and the unwanted and extreme behaviour, different determinants play a role. Consistently, our data did not yield a linear causal deterministic chain of behaviours.

In the SAFIRE project we only included data from actual cases in which we assume that non-violent radicalisation must have preceded violent extremism, that is, 'the upstream approach'. This, by definition excludes a 'downstream approach'. In a downstream approach we would have had to start at birth for the whole population of Europe, and identify which combination factors (concurrent and historical, situational and personal) leads to violent radicalisation of individuals. Clearly, these data are not available, and if they were it would certainly not comply with civil rights and privacy regulations. For this ethical and methodological reason we only made use of open source upstream data.

The consequence of using upstream data is that we lack data in the period that substantially precedes the actual violent behaviour. This leads to sparse connections. If we take into account that the average age for actual violent behaviour lies in the mid-twenties, we must assume that the process of extreme radicalisation has to have preceded that. We also know that, often a period of 'training', has preceded the actual violent behaviour. Thus the process of radicalisation would fall between puberty and the early twenties. Within some psychological developmental theories, this is the phase of 'more complex' moral development. Let it be clear that we have not found open source upstream evidence, from a developmental point of view. This would be a worthwhile endeavour for future research.

We have tried to make clear that radicalisation is not a certain state of an actor but a process. For each behaviour of a specific actor different factors need to be considered, a network approach allows for retaining the richness and dynamisms of the process, while at the same time allowing one to make sense of specific observed radical behaviour.

What we also demonstrate is that a multidisciplinary approach to radicalisation is a necessary requirement. More important, what we can conclude from our approach is that –, and this may not come as a surprise – the various scientific and operational points of view need some sort of common ground to connect these insights. The network approach does exactly that. It is able to represent 'collective knowledge' on radicalisation and systematise present and future knowledge acquisition. We need to fill in the gaps, make new connections which make sense and have empirical evidence, preferably – though not necessarily – quantitative. In addition, temporal data per actor (individual, group) are required in order to have some appreciation of causality.

Temporal sequencing of individuals' radical behaviours, which is only possible after the fact (up-stream), needs to be reported on, systematically and always in conjunction with the then prevailing relevant cognitive and emotional states of the actor and the state of their environment. By knowing the temporal relationships that influence the radicalisation process at different times, a causal chain of increasingly radical behaviours becomes possible.

This, in turn, helps focus interventions aimed at inhibiting violent and extreme behaviour, thus increasing the probability of effectiveness. In short, it would allow for interventions targeting key factors at different stages in the radicalisation process.

The present focus paper does not answer the question 'What is radicalisation?', but does answer the question how radicalisation can be understood and dealt with. We have provided an alternative approach for making sense of radicalisation; our preliminary results suggest that these are not merely academic notions but have practical implications.