

The Multifinality of Vulnerability Indicators in Lone-Actor Terrorism

To move beyond current aggregate and static conclusions regarding radicalisation and subsequent terrorist behaviour, empirical research should look to criminological models which are influenced by the life course perspective. Current UK government policy designed to prevent radicalisation and terrorist engagement look to outputs from criminological perspectives to inform policy and practice. However, the guidance suffers from a lack of specificity as to the major concept of 'vulnerability to radicalisation', and what this incorporates. This investigation uses sequential analyses to add to our understanding of 'vulnerability' in the specific context of lone-actor terrorism. The statistical method bridges the gap between qualitative and quantitative approaches and provides a series of empirical outputs which visualise typical lone-actor terrorist trajectories through the discrete stages of radicalisation, attack planning and attack commission.

Keywords: radicalisation; mental health; vulnerability; terrorism; sequential analysis

Introduction

A gap currently exists between quantitative approaches to understanding radicalisation and terrorist engagement on the one hand and qualitative accounts on the other. The latter can provide contextually-rich and immersive accounts of the process through which individuals progress from vulnerability to radicalisation, to the emergence of the motivation to engage in violence, attack planning, and attack commission (Böckler, Hoffman & Zick, 2015; Gartenstein-Ross, 2014; Hemmingby & Bjørge, 2015). Indeed, qualitative accounts are often the cornerstone upon which theoretical pathway models are built (Leistedt, 2013; Mullins, 2009; Shaw, 1986; Taylor & Horgan, 2006). Yet, small sample sizes mean that external validity or generalisability are an issue. Conversely, quantitative research provides prevalence rates for certain demographic attributes, behaviours, and outcomes, as well as measures of the direction and strength

of the relationships between these variables (Corner & Gill, 2015; Gill, Horgan, & Deckert, 2014; Gruenewald, Chermak, & Freilich, 2013). However, it contributes little to no insight into the sequences of behaviours which characterise individual trajectories, and struggles to speak to our causal understanding, inasmuch as the prevalence of a factor or the significance of a relationship cannot be taken as evidence of causality, nor does it speak to causal mechanisms. Given well-known methodological issues associated with the field, even prevalent factors may turn out to be completely irrelevant (Bouhana & Wikström, 2011).

Factors and indicators which have been associated with radicalisation and attack commission include poor integration into surrounding community environments (Franz, 2007; Veldhuis & Staun, 2009), poverty (Bravo & Dias, 2006), relative deprivation (Franz, 2007), the internet (AIVD, 2006; Aly, 2010), social interactions (Sageman, 2004), prisons (Silber & Bhatt, 2007; Trujillo, Jordan, Gutierrez, & Gonzalez-Cabrera, 2009), mental disorder (Trouillard, 2017), and personality characteristics (Ahmed, 2017; Post, 1998; Schwartz, Dunkel, & Waterman, 2009). In the context of risk assessment and management, the challenge is to understand when, how, for whom, and in what circumstances, these factors and indicators might be relevant to an understanding of a person's move towards, and involvement in, terrorist activities (Borum, 2014). Research feeding into prevention efforts should therefore endeavour to provide practitioners with frameworks and approaches which can contextualise these factors when assessing individual trajectories and support analysts in establishing what matters.

Within criminology, research has long brought together the rigorousness of variable-based research and the insights of qualitative approaches to the study of

individual criminal trajectories. Life course research has deepened our understanding of the importance of interacting events and factors in the emergence of offending behaviour. Such factors include childhood experiences and abuse (Monahan et al., 2001), parenting practices (Monahan et al., 2001; Schroeder, Giordano, & Cernkovich, 2010), age and employment (Uggen, 2000), marriage and spousal choice (van Schellen, Apel, & Nieuwbeerta, 2012), mental disorder and non-compliance with medication regimes (McFarland, Faulkner, Bloom, Hallaux & Bray, 1989; Swartz et al., 1998), mental disorder and homelessness (Martell, 1991), mental disorder and prior arrests (Melick, Steadman, & Coccozza, 1979; Shore et al., 1989), and neighbourhood context (Monahan et al., 2001).

In the United Kingdom, policies concerned with the prevention of radicalisation have been influenced by the life-course perspective, inasmuch as the focus of many of these policies has been to intervene in people's lives in order to prevent “vulnerable people” from being drawn into terrorism over their life-course (H.M. Government, 2011, p. 8). However, this conceptualisation suffers from a lack of specificity as to what the concept of 'vulnerability' incorporates. In Prevent Strategy guidance, those said to be ‘vulnerable’ encompass a number of groups, including “people with mental health issues or learning disabilities” (p. 83), those who religiously “convert” due to them being “initially less well-informed about their faith” (p. 87) and “young offenders and people vulnerable to offending” (p. 91). Other academic outputs have added to the ‘vulnerable’ pool, including “those suffering from identity crises” (Githens-Mazer, 2009, p. 10) and “adolescents, in particular of immigrant descent, who are socially isolated, identity-seeking and politically aggrieved” (Lindekilde, 2012, p. 337).

This lack of clarity permeates further. Prevent guidance not only mentions vulnerability in terms of people who are 'vulnerable' due to personal and/or social circumstances, but also a 'vulnerability to radicalisation'. This distinction is important. 'People vulnerable to radicalisation' may include 'vulnerable people', but it remains to be demonstrated that 'vulnerable people' are of necessity 'vulnerable to radicalisation.' This conflation, nevertheless, is pervasive. In reporting the findings of a series of interviews with Prevent practitioners, Peddell, Eyre, McManus, and Bonworth (2016) illustrate the lack of conceptual clarity surrounding the notion of 'vulnerability':

"Broadly, individuals were characterised as vulnerable because of a personal characteristic that rendered them unable to resist radical discourse, or the influence of the social context in which they lived, or both. All participants viewed mental health issues as a significant factor in personal vulnerability" (p. 68). Peddell et al. conclude that "participants strived to explain vulnerability by making various causal attributions. Discussions clustered around folk-psychological explanations and an implicit diathesis-stress model was used... Overall, very little reference was made to evidence-based research" (p.70). Assessing 'vulnerability' is a key element of the Prevent Duty and of the Channel Programme, yet an understanding of what exactly constitutes vulnerability to radicalisation, and how much this overlaps, in the perception of the individuals carrying out this assessment, with medical and social perceptions of vulnerability, remains ambiguous (Thornton & Bouhana, 2017).

To address this ambiguity, Bouhana and Wikström (2011; Wikström and Bouhana, 2016) set out a causal model of radicalisation founded on Situational Action Theory (SAT; Wikström, 2010), an integrative theory of crime causation, which views

crime essentially as an act of moral rule-breaking. SAT has been proposed as a useful framework for the explanation of individual involvement in terrorist and political violence, moving beyond a mere "risk factor approach" (Schils & Pauwels, 2014; 2016) and deepening understanding of the role of person-environment interactions (Bouhana & Wikström, 2010; 2011; Wikström, Mann & Hardie, 2018).

Bouhana and Wikström (2011) disaggregate vulnerability to radicalisation into two dimensions: susceptibility to moral change and susceptibility to exposure to radicalising settings. This distinction recognises that to be, at some point in time (and space), susceptible to changing one's perception of what constitutes a legitimate alternative for action, is not, in itself, enough to be considered vulnerable to radicalisation. One also needs to be susceptible to exposure to environments where radicalising socialisation takes place. Susceptibility to moral change is rooted in individual differences in cognitive capabilities (i.e. executive functioning; the psychosocial 'machinery' of judgement and decision-making; Wikström & Treiber, 2016) and commitment (or lack thereof) to value-based rules of conduct (i.e. morality; the psychosocial 'content'; Wikström & Treiber, 2016). Susceptibility to exposure is underpinned by mechanisms of social and self-selection. Social selection refers to rules and social forces that encourage or compel, or discourage or bar, particular kinds of people from taking part in particular kinds of time- and place-based activities. At the individual level, social selection is a matter of the groups to which an individual belongs (e.g. ethnic, social, religious, and so on), which broadly constrain the kinds of settings an individual is likely to find themselves in. Self-selection refers to the preference-based choices people make to attend particular time- and place-based activities, within the constraints of the forces of social selection. At the individual level, self-selection

operates on the basis of the preferences (likes and dislikes) a person has acquired through life experience (Wikström & Bouhana, 2016).

In other words, to be vulnerable to radicalisation is to be cognitively (through deficits in executive functioning) and/or morally (through lack of or weak commitment to prosocial moral rules) susceptible to moral change, while, at the same time belonging to groups and holding personal preferences that make one more likely to elect to spend time or come into contact with settings where terrorism-supportive ideas are promoted (Pauwels & Schils, 2016). This suggests that vulnerability to radicalisation is likely to be highly context-specific, as radicalisation may take place in different settings in different environments; hence, the specific personal preferences and social selection factors associated with susceptibility would themselves change across environments¹. Consequently, indicators, are expected to be ontologically unstable, in that the same marker (e.g. symptoms of a mental disorder, anger, arrest) can play different roles in different actors, or within the same actors across different phases of development (e.g. the same indicator can be a marker of vulnerability to moral change and/or an indicator of susceptibility to social selection).

This article aims to add to our understanding of 'vulnerability' in the specific context of lone-actor terrorism. First, it explores the prevalence of indicators which are hypothesised to act as markers of the different aspects of 'vulnerability' set out by Bouhana and Wikström (2011). Second, it introduces a novel statistical method that

¹ This is likely to be key in the explanation of why there are no stable, general terrorist profiles (Wikström & Bouhana, 2016).

bridges the gap between qualitative and quantitative approaches and provides a series of sequential analyses which quantify and visualise typical lone-actor terrorist trajectories through the discrete stages of radicalisation, attack planning and attack commission. In other words, this paper aims to improve our understanding of lone-actor terrorism by nuancing our understanding of what constitutes ‘vulnerability’ in this context, and by moving beyond static empirical analyses to explore when vulnerability indicators emerge across the sequence of lone-actor terrorist events, and how they interact with other personal and situational indicators.

Data

The data used in this investigation draws from Gill’s (2015) dataset of 111 lone-actor terrorists. This dataset was expanded to include more recent cases covering lone-actor terrorist attacks from the beginning of 2014 to the end of 2015. The present sample includes 125 individuals who engaged in or planned to engage in, lone-actor terrorist attacks within the United States and Europe and were convicted for their actions or died in the commission of their offence.

The codebook for the sample was originally developed by Gill et al. (2014). Variables covered sociodemographic information, aspects of the individual’s behaviour within their daily routines, event-specific behaviours- including targeting and attack methods, and post-event behaviours and experiences. To expand the dataset for the present study, a risk analysis framework was developed (Bouhana et al., 2016; Schuurman, Bakker, Gill & Bouhana, 2017).² The framework articulates key factors and

² An in-depth discussion of the framework and its development is beyond the scope of this study, but is available elsewhere (Bouhana et al., 2016).

processes involved at each phase of a terrorist event. Forty novel variables related to vulnerability (as theorised by Wikström & Bouhana, 2016) were added to the Gill et al (2014) codebook to act as markers and indicators of these processes.

Indicators related to cognitive susceptibility to moral change include; thrill seeking, impulsive, inflexible, and obsessive tendencies, as well as experiences such as receiving special attention for difficulties whilst at school, psychological distress³, substance abuse, over-confidence, anger and problems controlling anger and exhibiting escalating anger, and a diagnosed mental disorder. Indicators relating to the moral component of susceptibility to moral change include; religious and ideological conversion, exhibiting behaviour contradictory to an espoused ideology, denouncing others who share espoused ideology, a history of violent behaviour, perpetrating familial abuse, expressing a desire to hurt other people, a history of criminal convictions, and espousing a change in religious and/or ideological beliefs following their attack.

With regard to susceptibility to exposure to radicalising settings, indicators of interest in examining self-selection were; being a victim of abuse, assault, and or bullying, an impending upcoming life change, experiencing a psychological and/or social crisis, experiencing a situation which appears to have pushed an individual towards their attack, evidence of chronic and/or recent stressors generally, and more specifically, experiencing losing a job, the death of a family member, dropping out of

³ In this instance, psychological distress is defined as ‘signs of mental health problems short of a formal diagnosis of mental disorder’. Examples of psychological distress include; suicidal ideation and attempts, self-harm behaviours, and descriptions of symptoms of disorders.

education, being degraded, disrespected, ignored, and/or not cared for by others, and experiencing problems with personal relationships. Analytically, each of these experiences could lead to a change or reinforcement in preference and a move towards particular environments, some of which may have contained radicalising settings.

When examining social selection, variables include; changing address, moving out to live alone, living away from home during exposure to radicalising agent and/or setting, imprisonment, exposure to radicalising agent and/or setting whilst incarcerated, withdrawal from previous social environments, exposure to radicalising agent and/or setting online, using online settings for legitimisation of beliefs and/or attack preparation, using virtual and physical settings for interactions with like-minded individuals, seeking out religious or epistemological figures for legitimisation of beliefs, engaging in fundraising for groups related to the individual's ideology, joining a group or network who espouse similar ideological sentiments, having family members or friends who are within a group or network, and having a spouse or significant other who is involved in a group or network.

Data was drawn through thorough examination and coding of information contained in open-source news reports, trial documents, sworn affidavits, and openly available first-hand accounts. Relevant documents across online public record depositories such as documentcloud.org, biographies, and scholarly articles, were also analysed. Each variable was coded by three independent coders. After an observation of a variable was coded, the results were reconciled in two stages (coder A with coder B, and then coders AB with C). In cases when three coders could not agree on particular variables, a researcher resolved differences based on an examination of the original sources that the coders relied upon to make their assessments. Such decisions factored in the comparative reliability and quality of the sources (e.g., reports that cover trial

proceedings vs. reports issued in the immediate aftermath of the event) and the sources cited in the report.

Method

Sequential Analyses

Within criminology, research has long shifted from examining the presence (or absence) of static variables, to examining the causes and outcomes of events (Hagan & Palloni, 1988). Because of this shift, criminal behaviour is now recognised as an occurrence within a wider sequence. Unfortunately, to date, there have been few attempts to empirically measure life-courses in examinations of terrorist behaviour.

Traditional inferential statistical techniques typically focus on the relationship between immediate events with no consideration for the importance of the ordering of these events. However, human behaviour is more complex than such context-free interactions imply. Within a behavioural sequence, immediate experiences and behaviours are often highly related. However, experiences and behaviours earlier in the sequence also have an effect on the final outcome. It is therefore imperative to capture the indirect experiences and behaviours and examine how they impact the development of the sequence (Taylor & Donald, 2007), whilst also retaining the complex individual direct inter-relationships. Behavioural sequencing has been performed across a wide range of situations, including marital interactions (Gottman, Markman, & Notarius, 1977), traffic accidents (Clarke, Forsyth, & Wright, 1999), alcohol-related violence (Taylor, Keatley, & Clarke, 2017), rape (Fossi, Clarke, & Lawrence, 2005), and terrorist mobilisation (Jacques & Taylor, 2007). The visual outputs allow for simple interpretation of the ways in which experiences come together over time (Taylor et al., 2008).

This research uses proximity coefficients to perform quantitative behavioural sequencing (Beune, Giebels, & Taylor, 2010; Taylor, 2006). Proximity coefficients have the potential to quantitatively identify key risk and mediating factors that affect an individual's behaviour on their trajectory towards a terrorist attack, enhancing qualitative understanding.

The proximity coefficient output highlights how indicators (nodes) within the same area of a sequence have more in common when they are temporally closer than when they occur further apart. Within the matrix output, if the coefficient is 0.00, the nodes of interest occur at opposite ends of the sequence. However, if one node immediately precedes the next, the coefficient is 1.00. Within the matrix output, values between 0.00 and 1.00 reflect the different levels of closeness between the two nodes being examined. These values are independent of sequence length and node occurrence frequency.

To generate the proximity coefficients, indicators are each assigned a code. These codes are then arranged chronologically, starting with the earliest recorded experience. Each sequence is then analysed and a matrix is computed. Table 1 provides an example of a behavioural sequence and accompanying computed matrix. For example, within the sequence, C only occurs once, and is directly preceded by A. Therefore, within the matrix the proximity coefficient for C, when followed by A is 1. C is not preceded by any other letter, so the rest of the column for C is empty, but because C precedes eight other letters, the row for C highlights numerous coefficients, which decrease in value as the sequence develops.

[INSERT TABLE 1 HERE]

State transition diagrams can be used to provide a clear visual representation of proximity coefficients, and the relationships between nodes. In these diagrams, the nodes are connected by arrows. The arrows represent contingencies between experiences. An arrow is drawn between two nodes when the experiences the nodes represent occur next to each other in the behavioural sequence. The direction of the arrow highlights the temporal ordering of the experiences. These diagrams resemble flow chart diagrams, which allow for an efficient interpretation of the complex coefficient matrices.

The state transition diagrams are employed to determine whether behaviours significantly associated with each other in the earlier analyses occur close together in time, or whether their association has little impact due to the occurrence of other behaviours.

Results⁴

Descriptive Statistics

[INSERT FIGURE 1 HERE]

The descriptive results explore the prevalence of indicators associated with susceptibility to moral change, many of which are common to other behavioural problems, as would be expected if such susceptibility were shared with other instances of criminal development (Bouhana & Wikström, 2011; Wikström & Bouhana, 2016).

⁴ Colours denoting vulnerability indicators within the descriptive analyses match the colours of nodes in the State Transition Diagrams.

Notably, excessive thrill seeking, impulsivity, and inflexibility have been linked to numerous high-risk behaviours (Robbins & Bryan, 2004; Steinberg et al., 2008; Windle, 1991) and these indicators are present in roughly a third of the sample. Also linked to high risk behaviour is anger. Over half of the actors were described as angry, with 37.6% and 35.2% of these individuals having problems controlling anger and exhibiting escalating anger respectively. Within the cohort, only 6.4% presented with significant issues that caused concerns during their early childhood education. This may suggest that the psychological distress (47.2%) and diagnosed mental disorder (40.8%) manifested at a later point in their lifespan, but it could also be due to the fact that, given the age range of individuals examined within the dataset (53.8% over the age of 30, and 2.6% under 18), the media reporting of school concerns would be minimal by the time of the index offence. It may also be explained by reporting bias: since the individual was not arrested until adulthood, investigative protocol may not deem school concerns as relevant to the attack behaviour. Alongside overall diagnosed mental disorder prevalence, the prevalence of substance abuse is also significantly higher than that within the general population (for example, Kessler et al., 2008, estimate that worldwide average prevalence of any substance use disorder is 7.6%).

With regards to morality-related indicators of susceptibility, the cohort of actors did not show high levels relative to indicators of ideological development and maintenance (18.4% underwent a religious conversion and 19.2% underwent an ideological conversion prior to their attack planning, 12.8% exhibited behaviour contradictory to their espoused ideology, and 7.2% changed their beliefs following their attack and/or apprehension). Conversely, a significant proportion of actors (41.6%) had some history of violent behaviour, supporting the findings of Schuurman, Bakker, Gill,

& Bouhana (2017). History of violent behaviour is often considered an important risk factor for subsequent violent behaviour and is a primary indicator in many violence-related risk assessment tools (HCR-20v3, Douglas et al., 2014; MLG, Cook, Hart, & Kropp, 2013; PCL-R, Hare, 1980). Extremism based risk assessment tools also acknowledge the importance of prior violence (ERG-22+, Lloyd & Dean, 2015; VERA 2, Pressman & Flockton, 2012; TRAP-18, Meloy & Gill, 2016). Further examination of 'violent behaviour' found that 10.4% of actors had been a perpetrator of familial abuse, 64% expressed a desire to hurt others, and 48.8% had a history of criminal convictions. Given the high prevalence of violent behaviour within the sample and following the work of Lloyd and Dean (2015), Pressman and Flockton (2012), and Meloy and Gill (2016), it may be justified to expect that, in combination with other factors, previous violence may be an important element for threat assessment, above and beyond indicators of ideological change.

However, the static nature of the above analyses does not allow for further inference, in the absence of information about when the violent behaviour occurred, how it relates to other indicators, or what part it plays, if any, in subsequent terrorist behaviour.

[INSERT FIGURE 2 HERE]

When examining prevalence rates of indicators of self-selection, a range of experiences could influence an individual's preferences and, therefore, their preference (or lack thereof) for particular of environments and settings. Although early childhood abuse has been consistently linked to later onset of violent, delinquent, and criminal

behaviours (Haapasalo & Pokela, 1999; Lansford et al., 2007), the sample did not yield high prevalence of any history of abuse. The recorded prevalence also sits below what has been found across general population studies (Cawson, Wattam, Brooker, & Kelly, 2000; May-Chahal & Cawson, 2005). Over 53% of individuals suffered some form of psychological crisis prior to their radicalisation, and 59.2% of individuals experienced an identifiable tipping point, which propelled them towards planning and conducting an attack. In order to disaggregate these indicators further, the prevalence rates for multiple stressors were also identified. Individuals were almost equally likely to experience chronic and recent stress, which included unemployment (29.6%), the death of a family member (7.2%), educational drop-out (12.8%), being degraded (16.8%) and disrespected (21.6%), being ignored (9.6%) and not cared for (10.4%) by someone close to them, and experiencing problems with personal relationships (27.2%). These wide range of stressors highlight the complexity of indicators of self-selection. Without further inferential analyses, it is not possible to determine when these indicators occur, and if, as suggested by Bouhana and Wikström (2011), such experiences could alter an individual's preferences in such a way as to lead to their exposure to radicalising settings or agents supportive of terrorism.

[INSERT FIGURE 3 HERE]

Although high prevalence of social withdrawal (51.7%) and living alone (38.5%) may at first seem counter-intuitive indicators of social selection, it may be indicative that an individual withdraws from their previous social environment and moves toward a social environment with a radicalising influence. The high levels of online indicators (46.4% virtual learning, 31.2% virtual interaction) suggest that this

withdrawal is accompanied by a move towards online settings. At the same time, prevalence of face-to-face interaction with individuals is higher than virtual interaction (39.2%). These results imply that isolation often reported in open source information may be skewed by reporting from individuals in other, non-radical social environments. Further empirical analyses are necessary to make more sense of these indicators and investigate how and when the isolation of the individual from a longstanding support network may have become a factor in their susceptibility to exposure to radicalising settings.

With further regards to social interactions, 31.2% of actors were part of a wider extremist or terrorist network, 25.6% had family and/or friends who were part of a wider network, and 5.6% had a spouse or partner who was a member of a wider network, which may account for the radicalisation of individuals who did not experience social isolation; or it may be that social isolation occurred at a later time in the process.

While these results provide a general picture of indicators or factors of vulnerability, which may have played a part in, or signalled, an individual's acquisition of a terrorist propensity, further analyses need to be conducted to establish the temporal ordering of these indicators and gain a better understanding of how and when different factors and mechanisms interact in the process of lone-actor radicalisation, and subsequent attack planning and attack commission.

State Transition Diagrams

The sequence analyses reported below focus on three phases of a lone-actor terrorist event as identified in Bouhana et al.'s (2016) risk analysis framework: radicalisation, attack preparation, and attack. The problem of inter-relatedness is a concern which needs to be acknowledged, as each phase is linked to the preceding phase and variables are likely to overlap and occur at different points in time (for example, 'arrest' features in each Diagram, and appears to influence each phase differently, which is, in fact, the kind of outcome this approach seeks to highlight, given the implication for risk assessment and management). Therefore, each of the following State Transition Diagrams begins with the last behaviour in the sequence of the previous Diagram. Due to the complexity of human behaviour, and given the distinction between developmental and behavioural processes, one overarching Stage Transition Diagram would present highly convoluted pathways and would only serve to confuse; therefore, it is not included.

Radicalisation Phase

The diagram for the radicalisation phase (Figure 4) is a visual representation of the complexity involved in mapping the sequencing and interaction of key markers of vulnerability to moral change.

[INSERT FIGURE 4 HERE]

With regards to social selection, the earlier hypothesis stating that individuals move from their initial social setting to a radical network appears not to hold weight. Joining a wider network and physical interaction with this wider network appear to play a minor role in influencing the transition between radicalisation and attack planning, as the indicator appears at the start of the radicalisation streams. Physical movement from

existing social settings occurs further down the sequence. For those individuals who have some experience of working within a legitimate military entity, following their discharge these actors are more likely to quickly move towards marriage and children. The birth of a child and unemployment appears significant to selection (exposure) and moral change. Individuals are highly likely to noticeably intensify their religious beliefs following the birth of a child, which in turn moves them towards espousing a radical ideology. However, the birth of a child also appears connected to the breakdown in personal relationships. Following a child's birth, individuals are also likely to move house, which is almost always followed by the individual living on their own. This living alone moves an individual to isolate themselves from previous social relationships, and occurs prior to unemployment. Following unemployment, individuals intensify their ideology. Self-isolation also seems critically linked to increased susceptibility to moral change and exposure through social selection (both following arrest and prior to psychological distress and following treatment for mental health problems).

Among markers of cognitive susceptibility, the most critical appear to be overarching mental health problems and anger. Anger appears to be an important precipitating factor in both subsequent cyclical violent and criminal behaviours, and religious conversion, while mental health problems appear to be a precursor to, and consequence of, criminal behaviours, which are themselves markers of lack of commitment to prosocial moral rules (moral susceptibility) and/or markers of selection into criminogenic settings, some of which may be radicalising (including prison).

Attack Preparation Phase

Figure 5 presents the State Transition Diagram for the attack preparation phase. This diagram presents less convoluted sequences, with many cyclical patterns in planning behaviours. That the expression of radical ideology precedes only the arrest of an individual indicates that it may be of more use for prevention initiatives to take greater account of other behaviours which move individuals towards planning and preparing a terrorist act.

[INSERT FIGURE 5 HERE]

Although interaction with a wider network did not appear critical in the radicalisation phase, during the attack preparation phase, individuals appear to gain much from these interactions, which is worth noting given we are dealing with a sample of lone-actors. The results show that interacting with a wider network provides individuals with access to propaganda (the results also highlight that individuals who suffer from psychological distress appear to use other, as effective means to access group propaganda), which leads them to either immediate attack planning, and towards stockpiling weapons, conducting further research, arrest, and either attack planning or an attack, or towards a secondary stream. In the secondary stream, access to a network and propaganda moves an individual towards a cycle of proclaiming their ideology and preparations in both written and verbal statements (punctuated by arrests), or towards a more direct route of written statements just prior to the implementation of their attack. These two streams illustrate the depth of planning carried out by some individuals, whereas others may be more vocal in their opinions, but plan less sophisticated attacks.

While indicators of vulnerability to moral change are less directly impactful during this phase, as is expected, psychological distress and in particular its treatment

appear to mark a significant step in the planning and preparation of an attack. As highlighted in the radicalisation State Transition Diagram, individuals who receive treatment for mental health problems isolate themselves socially. What the attack preparation phase shows is that this social isolation does not extend to online behaviours. Much like those who join a wider network, individuals who suffer from psychological distress move to seek propaganda from group entities, whereas those who receive treatment move towards using online social settings for their planning and preparatory activities. In the online space, individuals encounter propaganda from groups and bomb manuals (the downloading of such manuals also leads the individuals to seek more information online), before moving towards stockpiling weapons. Alongside this, the use of online social settings moves individuals to verbalise their grievance and planning to family members, and towards stockpiling weapons.

Attack Phase

Within the attack phase (Figure 6), two distinct behavioural sequences were identified: individuals who were apprehended during their attack planning and individuals who successfully implemented an attack. What appears to distinguish these sequences is target choice. Individuals who were apprehended prior to an attack targeted government targets, whereas individuals who carried out an attack would target, lower value, private citizens. The weapon's sophistication did not appear to affect target choice or apprehension. Individuals who used vehicles for their attack appear to be most lethal, as all of their victims were killed, whereas those who implemented bombings or shootings would injure a proportion of victims. Within the less lethal attacks, this cohort of individuals was more likely to be killed during the execution of, or following their

attack. Across the cohort, individuals were more likely to make a successful getaway from the scene before apprehension.

[INSERT FIGURE 6 HERE]

Also evident within Figure 6, and of particular interest to our deepening understanding of vulnerability factors, the indicators for mental disorder, psychological distress, and treatment, which are present in previous phases, here follow the arrest of an individual after their attack. These results are congruent with Corner and Gill (2017), Ferracuti (1982), Horgan (2003) and Weatherston and Moran (2003) which show that the experience of 'being' a terrorist may lead to psychological suffering, as well as being implicated in radicalisation and engagement. It is this kind of complexity (the many 'roles' or 'meanings' indicators – here, indicators of vulnerability – can take across the whole terrorist process) which this analytical approach highlights and which we go on to discuss further.

Discussion

The State Transition Diagrams presented here support the assertion that static inferential analyses only scratch the surface with regards to vulnerability to radicalisation. In particular, our findings suggest that factors associated with psychopathology interact in complex and changing ways across the different phases of the terrorism process, and interact with other factors in the progression from propensity change (radicalisation) to involvement in violence (terrorist action). Crucially for risk assessment, and as implied by Bouhana and Wikström (2011)'s radicalisation model and the associated risk analysis framework (Bouhana et al, 2016), the diagrams would indicate that the same markers – specifically, indicators of undiagnosed symptoms of

mental disorders – play different roles within each phase (radicalisation, attack planning, and attack)

The proximity coefficients within the State Transition Diagrams suggest that psychopathology may be both a catalyst and an inhibitor in the movement towards committing a terrorist attack. Within the radicalisation phase, following psychological distress, it is the move towards substance abuse (possibly for self-medication) which appears to contribute to an individual's vulnerability, leading to a move towards violence. This replicates findings from the wider field of mental disorder in crime and violence (Arsenault, Moffitt, Caspi, Taylor, & Silva, 2000; Cuffel, Shumway, Chouljian, & Macdonald, 1994; Fazel, Gulati, Linsell, Geddes, & Grann, 2009; Hodgins, Cree, Alderton, & Mak, 2008; Monahan et al., 2001; Swanson, Holzer, Ganju, & Jono, 1990; Swartz et al., 1998; Tiihonen, Isohanni, Räsänen, Koiranen, & Moring, 1997; Wallace et al., 1998). This violence then leads to an arrest, which places the individual in a situation which may result in an individual moving towards a religious conversion and the expression of a radical ideology. Given the pervasive concern espoused within public discourse, academic interest in radicalisation within prison settings has been growing (Acheson, 2015; Bouhana & Wikström, 2011; ICSR, 2010; Penal Reform International, 2015; RAN, n.d.; Syal, August 2016), but, as with research concerning online radicalisation, due to the lack of systematic empirical evidence, there is little consensus of the actual scope of the risk. The results of this investigation would suggest that the actual prevalence may be much lower than currently believed in lone-actors who turn to violence (5.6%); the probability of espousing a radical ideology is higher within individuals who are arrested but not imprisoned and within those who do

not enter the criminal justice system, though the mechanisms involved require further study.

A higher probability sequence suggests psychopathology may also play an inhibitory role in the radicalisation process. It is only following treatment for both mental disorder and psychological distress that an individual experiences impactful changes in their social setting. Following treatment, individuals isolate themselves from previous social networks. This isolation either follows a direct route to expression of a radical ideology, or the expression follows unemployment and an outward intensification of ideology and religion. The results again show that within the radicalisation phase, psychopathology may play a convoluted role, and that taking into account indicators such self-isolation and its consequences, as well as the birth of a child, may be worthwhile when assessing the risk of radicalisation.

Examination of the attack preparation diagram adds to an understanding of the protective role of psychopathology. Within this phase, following treatment for psychological distress, some individuals move to an online space where they gather information pertinent to their attack (propaganda, bomb manuals). This use of an online environment may help contribute to the reported self-isolation demonstrated within the radicalisation phase. In some cases, individuals trade their social environment from physical to virtual settings. The use of an online space by individuals suffering from psychological distress may also be indicative of a lack of physical access to like-minded individuals, which would suggest that psychological distress could be both a marker of susceptibility to moral change (which it is often considered to be) and an indicator of susceptibility to selection. Individuals who join a wider network appear to have access

to group propaganda and weapons for their attack planning. This distinction may highlight that individuals suffering from psychological distress do not benefit from the same physical resources that a wider group offers. However, it is not possible to tell from the diagram why there is a difference in resources. Despite over-riding opinion that terrorist groups reject the mentally ill (Horgan, 2005; Jackson, 2009; Spaaij, 2010; Weenink, 2015), the difference is not due to those with psychological distress being rejected from a wider group. Bivariate analyses found no significant difference between psychological distress ($\chi^2(0.609)$, $p=0.435$) or diagnosed mental disorder (Fisher's Exact test, $p=0.755$) and rejection from a wider group or network, supporting Corner and Gill (Forthcoming).

With regards to the attack phase, vulnerability indicators follow attack-related behaviours. As with the radicalisation phase, the results within the attack State Transition Diagram suggest that psychopathology is a consequence of being arrested. That mental disorder occurs prior to imprisonment may be indicative of the judicial system and undergoing psychiatric evaluation prior to conviction. However, it is not possible to concretely determine whether psychopathology is a consequence of perpetrating an attack or being disrupted whilst planning an attack. The results may simply reflect that underlying psychopathology is noted as a consequence of contact with authorities. With open source information, much of the time, reporting puts a greater focus on pre-attack experiences, with less consideration of how individuals cope following their apprehension. Further investigations should work to disentangle the post-attack space to establish sequences of indicators and behaviours, which may help inform handling and treatment of terrorist offenders.

Alongside the findings regarding psychological distress and mental disorder, the initial descriptive analyses also included multiple variables related to susceptibility to moral change, and self and social selection. These results also highlight the need to disaggregate our understanding of 'vulnerability'; the figures show that there are a range of indicators which should be considered in practice. That many of these indicators were not found to be definitively related within the State Transition Diagrams may indicate an issue with the chosen data. The data used for this investigation was from open source outlets. Despite the demonstrated usefulness of open source data in the study of lone-actor terrorism, the reporting within open source outlets may not be fine grained enough for valid examination and sequencing of personality factors, stressors, and exposure to radicalising settings. For example, although 36% of actors were classified as having demonstrated impulsive personality traits, it was often not possible to determine when an individual showed such traits within a behaviour sequence. This limitation could be addressed by using experimental methods to investigate the role of personality traits in selection into different kinds of radicalising settings and susceptibility to radicalising moral contexts in these settings.

Interestingly, the results of the State Transition Diagrams would suggest that self-selection may not be of critical importance in an individual's progression towards engaging in a terrorist attack, which is a significant finding given the prominence of 'grievance explanations' in accounts of radicalisation. However, this may be also skewed by the data. The use of open source data can cause issues when researching sensitive subjects, particularly if the actor made no disclosure, but it was reported by secondary or even tertiary sources. Alongside this, because of stigma and shame, topics such as abuse are often under reported. Dhaliwal, Gauzas, Antonowicz, and Ross (1996)

drew attention to the inherent difficulties in collecting accurate abuse reports, explaining that study type (and therefore methodology) can drastically alter the reporting levels (reporting between 2.5% and 36.9%).

Also, worth noting is that the high prevalence rates of specific variables, such as anger⁵, expressing a desire to hurt others, experiencing a crisis or tipping point, changing address, and face to face interactions did not translate to the State Transition Diagrams. This may indicate that reporting of such indicators occurs within a contextual vacuum. In other words, while many sources may report that individuals exhibited these indicators, during sequencing there was very little information to determine *when* they actually occurred.

Finally, public discourse, government bodies, and the media all reinforce the perception of the danger posed by online environments, which are presumed to be ripe for exploitation by radicalising agents. Current government advice emphasises the risks of online settings for radicalisation (Department of Education, 2015; Australian Government, 2016); however, to date, there has been little supporting empirical evidence. Gill, Corner, Thornton, and Conway (2015) argued that conceptual issues and a lack of empirical data (only 6.5% of 200 investigations utilised some form of data) have led to a large gap in the knowledge base of the true risk of online settings. While our descriptive findings tentatively support Gill, et al. (2017), who observed that online interaction is relevant to both radicalisation and aspects related to attack planning.

⁵ The high levels of anger mirror other perpetrators who are motivated to act violently due to their grievance (James et al, 2006; McCauley, Moskaleiko & Van Son, 2013).

Analysis of the present dataset finds that only 16% of actors were first exposed to a radicalising influence online. This may be lower than expected given current discourse. Nevertheless, we note that the cohort studied here stretches over an extended period of time (lone-actor events since 1990); therefore, some of these individuals will have been active pre-internet

Conclusion

The results of this investigation are limited by the data used. Although open source data has been shown to be of much use in understanding the behaviour of lone-actor terrorists (Corner & Gill, 2015; Freilich, Chermak, Belli, Gruenewald, & Parkin, 2014; Gill, 2015; Gruenewald et al., 2013; Horgan, Gill, Bouhana, Silver, & Corner, 2016), to date, investigations have largely relied on traditional static analyses, comparing prevalence rates of behaviours, and examining associations between them. The prevalence rates presented within this investigation revealed multiple indicators which may be of use in determining vulnerability; however, once incorporated into the sequence analyses, many of these indicators were lost. To investigate whether the loss of such indicators reflects meaningful sequential dynamics (prevalence does not indicate relevance), or whether the loss is due to insufficient data granularity, future investigations should draw from other data sources to examine developmental and behavioural trajectories. One potentially fruitful source might be autobiographical information. Though it may suffer from its own biases, the fact that this data originates directly from the actor may address some of the weaknesses of the current dataset

Despite the limitations, this study has introduced an analytical approach and a set of results that practitioners may find useful in both the preventive and reactive space.

The State Transition Diagrams are clear, user-friendly outputs which are easily translatable into practice. They provide an overlay map of which indicators may be important across cases and suggest direction for the allocation of investigative resources. This diagrammatic approach, combined with the guidance of a risk analysis framework motivating the selection of indicators (Bouhana et al, 2016), could, if further operationalised, allow practitioners to focus efforts on unknown indicators, given what is known during a given investigation. Given their ontological instability, indicators should be expected to be idiosyncratic across cases (hence the limits of the 'risk factor-based' approach to risk assessment), and the diagrams can serve as a tool, focusing the analyst's attention to what matters in the case under scrutiny, and systematically guiding the inference process. Replication of this analytical technique across datasets would be a further test of the validity of the diagrams, and, consequentially, their practical potential.

In order to improve the study of psychopathology in terrorism, and to move away from potentially unfounded assumptions of causal relations, researchers should strive to go beyond static analyses. The role of psychopathology in the development and behaviour of a terrorist is highly complex. The results of this investigation have shown that it is one of several factors implicated in the move towards radicalisation and conducting an attack. Depending on circumstance, it is a catalyst, an inhibitory factor, and even a consequence. Psychopathology seems to play a significant role across the process of becoming a terrorist, and is both a precursor to, and a consequence of changes in social settings.

This versatility once again drives home the need to recognise the dimensions of 'vulnerability' and the need to disaggregate this fuzzy analytical construct into clear constituent parts, if only to assist risk analysts in making sense of the (potentially multiple) role(s) played by any given indicator. Current guidelines must evolve to make a clearer distinction between general indicators of 'vulnerability' and indicators of vulnerability to radicalisation and involvement in terrorist violence, starting with recognising that indicators of vulnerability manifest across the spectrum of 'being' a lone-actor terrorist.

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Table 1. Behavioural Sequence and Resulting Proximity Coefficient Matrix

Figure 1. Prevalence of indicators of susceptibility to moral change

Figure 2. Prevalence of indicators of susceptibility to self-selection

Figure 3. Prevalence Indicators of Susceptibility to Social Selection

Figure 4. State Transition Diagram for Radicalisation Indicators

Figure 5. State Transition Diagram for Attack Preparation Indicators

Figure 6. State Transition Diagram for Attack Indicators