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Radicalization Trajectories: An Evidence-Based Computational Approach to Dynamic Risk Assessment of “Homegrown” Jihadists

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ABSTRACT
The research aimed to develop and test a new dynamic approach to preventive risk assessment of violent extremists. The well-known New York Police Department four-phase model was used as a starting point for the conceptualization of the radicalization process, and time-stamped biographical data collected from court documents and other public sources on American homegrown Salafi-jihadist terrorism offenders were used to test the model. Behavioral sequence patterns that reliably anticipate terrorist-related criminality were identified and the typical timelines for the pathways to criminal actions estimated for different demographic subgroups in the study sample. Finally, a probabilistic simulation model was used to assess the feasibility of the model to identify common high-frequency and high-risk sequential behavioral segment pairs in the offenders’ pathways to terrorist criminality.

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This article reports on an experimental study of American terrorism offenders who were inspired by Al Qaeda and its aligned organizations, including, most recently, Islamic State of Iraq and Syria (ISIS; also referred to as Islamic State of Iraq and the Levant or the Islamic State). These offenders committed criminal terrorism-related acts over a period of 16 years following the 11 September 2001 at risk attacks.

The study was designed in response to an urgent demand for reliable, evidence-based assessment protocols that could help the security services to identify individuals whose extremist views are likely to lead to actions that put the public risk. A primary objective was to empirically test the feasibility of using a dynamic four-phase model to assess the radicalization trajectories of the offenders’ pathways to terrorism-related criminality using biographical data from the profiles of the offenders. Further, the research aimed to identify specific behaviors associated with Salafi-jihadist...
radicalization and to identify common sequential segment pairs of behaviors that reliably anticipated criminality.2

Our research takes a quasi-experimental approach. The first goal was to assign specific behaviors, associated with observable cues, to each stage in the radicalization process, from the initial exploration of the extremist belief system through to the final stage, the commission of a criminal act dictated by the ideology. The conceptual and methodological framework for this study was discussed in a previously published Research Note in this journal.3 The present article reports on the empirical results.

We draw on records for 335 “homegrown” American jihadists, assembled by Klausen and her Brandeis team. From these records we have put together 135 detailed forensic biographies that detail the pathways, which led individuals to commit an act of terrorism at home or aboard. The data are available as a restricted-use dataset from the National Archive of Criminal Justice Data.4 The coauthors based at Colorado State University developed the computational model used to analyze and depict the pathways to terrorist actions.

The analytical approach builds on “process tracing,” an analytical tool used for the detection of path-dependent sequences. In social science, the process tracing methodology is typically used to analyze decision processes in policymaking or social mechanisms where path-dependent sequential mechanisms have predictive value.5 Path dependency is a special type of “soft” causality that involves a predictable pattern or processes leading to outcomes that are sufficiently uniform that they may be observed and be made subject to generalization.6 Computational graph pattern matching techniques are uniquely suited for the detection of high-frequency discrete pathways in large outcome matrices. By combining scalable real-life data with sophisticated computational modeling, the research collaboration was able to explore and test the feasibility of using a probabilistic simulation model as part of efforts to detect and prevent the development of high-risk violent extremism.

Theories of radicalization suggest a logic of deepening commitments that is both conjunctural and propositional. For example, if behaviors A and B occur together or in sequence, then the radicalizing individual is likely to progress to behavior C. In a dynamic model that is focused on individual behaviors, two key assumptions have to be made. First, radicalization is a social–psychological process that is manifested in overt behavioral changes. Second, these changes follow a somewhat predictable pattern, as the radicalizing individual is primed ideologically to take criminal action. To be clear, the dependent variable for the study is not the reasons people come to hold extremist ideas, but rather the sequence through which individuals progress from holding such beliefs to perpetrating a violent act or to supporting others committing violent acts.

The point of departure here is the New York Police Department (NYPD) model, developed by Mitchell D. Silber and Arvin Bhatt in 2007, which conceptualized radicalization as a four-phase developmental process of deepening engagements.7 Other conceptualizations have proposed that the process be visualized as a “staircase” to terrorism or a “funnel”-like process, with only the most extremist individuals coming out at the end of the chute.8 The simplicity of the NYPD model lends itself to hypothesis testing and is preferable for our purpose. Behaviors associated with each phase in the radicalization process can be specified and the frequency with which they appear tallied. The
NYPD model was modified in one important way. Silber and Bhatt took terrorist cells as their unit of analysis. Here, instead, the focus is on individual-level analysis. Cell-level dynamics are undoubtedly of great consequence as a radicalizing contagion factor for the individual radicalization trajectory, and the role played by small group dynamics was therefore conceptualized as an individual attribute, which is here referred to as “peer group immersion.”

It is important to note what the study did not aim to do. Psychotic mass shooters, White supremacist, and domestic extremists of different persuasions often exhibit similar etiologies to the jihadists studied here. The study did not include subjects drawn from any these groups. There are practical and theoretical reasons for this omission, but a primary reason is that it was not possible to develop enough data to carry out an analysis. At present we are skeptical that our findings will apply to perpetrators of terrorist crimes who are inspired by other extremist ideologies. The mechanics of causality may be similar but the specific manifestations of dangerous extremism are assumed to be different. However, the methods used here may well be helpful in the investigation of other extremist groups.

It should be noted also that the study does not aim to yield predictions about who is likely to become a terrorist but rather to summarize and analyze what we know about how the subjects trained for the role. Further research will be needed to identify and test the list of signifying cues to dangerousness.

Re-conceptualizing extremist radicalization

Ideology provides the framing structure, a meta script, for everything the radicalized individual does and how he or she does it. We assumed that while the factors that lead to individuals becoming homegrown terrorists are complex, the process is, very generally, steered by knowable mechanisms. Criminal extremism is not an inherent psychological trait or part of a person’s nature. It is acquired through self-invention and peer immersion. As they prepare their actions, terrorists follow an ideologically sanctioned playbook. The playbook is preached by the public intellectuals of violent jihad and pushed out by recruiters, in meeting houses and online.

The conceptualization of terrorist extremism as a reconstruction of the self finds support from Howard S. Becker’s classic work on deviance. Becker argued that criminal behavior is learned in the same way that other types of “work” are learned. Becoming a criminal involves acculturation to the expectations of the “profession.” The extremist ideology imparts cultural values and norms, spells out moral boundaries, and sets up an adversarial dichotomy between believers and nonbelievers. The teachers and role models exercise more and more control, and the radicalizing individual is cut off from former friends and family members.

Salafi-jihadists sometimes literally follow a script. In 1999, police found a 180-page mimeographed handwritten instruction booklet during a raid on a house in Manchester, England. This became known as the “Manchester Manual,” but its is undoubtedly Egyptian. It provided instructions on the proper understanding of jihad, how to conduct clandestine operations, how to kill with a knife and how to make a bomb, and what to say in case of arrest. Similar types of instruction manuals are now
found online. In 2010, Al Qaeda in the Arabian Peninsula started to publish the online Inspire magazine, which included an “Open Source Handbook” for the mujahidin featuring, among other recipes for action, instructions on “how to make a bomb in your mom’s kitchen.”

In the first phase, described as pre-radicalization, the individual experiences a cognitive opening to extremism and explores the ideology. Family members, neighbors, and others may be concerned, but these are not behaviors that government agencies under U.S. law have reasons to track. The exploration of a political and religious belief system, even if the beliefs include advocacy of violence, is legal in the United States. However, since these behaviors do in some case lead to increasing extremism, they may serve as a benchmark risk factor. The other phases identified in the model (Figure 1) are referred to as stages 1, 2, and 3. The last and final stage involves preparation for acts leading to terminal criminal action.

Ideally, risk assessment protocols should be evidence based, fine-tuned to the behaviors and to the different stages in the cycle of radicalization and pathways to violence. Our model differs from other risk assessment approaches in important ways. VERA 2 and ERG22+ are the best known. The protocols are similar in that they are comprised of lists of risk factors that have been used by professionals working in mental health, criminal justice, and psychology to assess the dangerousness of inmates in custody and the post-incarceration risks that they may pose. The use of protocols that are used in other contexts to assess terrorists neutralizes criticism that “Muslims” are singled out. (This criticism ignores that many suspects are converts to Islam who have little or no connection to Muslim faith communities.) These are in important ways flawed tools. Following the VERA2 schema, marriage was until recently considered a deterrent, thought to reduce the risk of violence. In the action script pushed out by the Salafi-jihadist recruiters, however, marriage is tied to status and martyrdom, and it is a frequent precursor to violent action. Indeed, it looms large as an anticipatory risk cue. Another problem is that the guidelines are constructed as a
structured nominal list, essentially check-off menus. The more factors checked, the more serious the case. This is not necessarily true. Certain factors (e.g., online surfing of jihadist sites) are so ubiquitous that they provide little guidance as to the likelihood of imminent action.

Two key assumptions should be made in a dynamic model focused on individual behaviors. First, radicalization is a social–psychological process that is manifested in overt behavioral changes. Second, these changes follow a somewhat predictable pattern, as the radicalizing individual is primed ideologically to take criminal action. To be clear, the dependent variable for the study is not the reason people come to hold extremist ideas, but rather the sequence through which most progress from holding such beliefs to perpetrating a violent act or to supporting others committing violent acts.

**Data collection methodology**

No official lists exist for how many jihadism-related indictments and prosecutions have been undertaken by the U.S. Department of Justice, and the list of possible subjects was compiled from press releases made by the Department. The bulk of these cases involved international terrorists who were apprehended abroad and therefore not eligible to be included in the study. The “homegrown” cases comprise half of the total number of cases related to Al Qaeda–inspired indictments, of which there have been more than 800 since 2001.22

Individuals were considered eligible to be included in the study if three conditions were met: (1) He or she must have spent some or all of their formative years in the United States; (2) the radicalization process must have taken place primarily within the United States; (3) the first instance of verifiable illicit activity took place in 2001 or thereafter. Americans who became “foreign fighters” are also classed as “homegrown” terrorists, as long as they are known to have radicalized in the United States.23 Offenders who did not radicalize while living in the United States were excluded from the study on the assumption that no reliable documentation would be available for charting their biographies. In order to diversify the study group as much as possible, an effort was made to include individuals who died abroad while fighting for a terrorist organization operating under the Al Qaeda umbrella. These included individuals who had been publicly identified and verified as having acted on behalf of a terrorist organization. A few subjects died while carrying out attacks in the United States.

Three hundred and thirty-one individuals met the above three criteria. From this group, individuals were randomly selected for more detailed study. One hundred and thirty-five subjects were included in the detailed study. They are referred to as Study Group B in what follows.

The dataset is unique in its provision of comprehensive real-world data (as opposed to theoretical data) about known criminal jihadist extremists and their behavioral indicators. It includes time-stamped data that make possible a dynamic trajectory analysis of the radicalization processes by means of stochastic dynamical system modeling. (See Table 1 for a list of time-stamped variables.) Legal documents were accessed through Bloomberg Law, a subscription-based service for online legal research. The U.S. Department of Justice also increasingly makes
relevant documents available online. Occasionally, defense lawyers make their submissions available online or they are made public by the court. Data were also gathered from a range of other sources, for example, congressional reports and media sources, as well as the offenders’ self-publications online and on social media.

Coders were trained to follow a detailed codebook, which enumerated specific cues to the various behaviors. The behavioral indicators used to assess progressive radicalization were linked to the different phases hypothesized by the model. Issued a detailed codebook, the coders were trained to look for specific cues to a particular behavior, including, for instance, such behavioral indicators as adapting ways of dress in order to conform to the dictates of the Islamic State.

Study subjects were randomly assigned to the coders. In some cases, the compilation of a forensic biography required only a couple of hours while others took several days to complete. On average, a coder spent about 8 hours of uninterrupted research on a case. A total of about 1,200 person-hours were used for the data collection. To assess agreement between the coders, every coder working on the project coded the same nine subjects and the coding compared for consistency. The inter-coder agreement was 88 percent with calculations based on all possible cells from the records used in the coding exercise. Coders generally agreed when no evidence could be found. Inter-coder reliability dropped to 80 percent once the empty cells were removed from the calculation. This indicates that when evidence was available, the coders agreed on how to infer data points for four out of five variables. It is easier to agree on the absence of data than on how to infer data from text when it is available. Overall, the inter-coder reliability score indicates reasonable consistency between the coders.

One concern is that evidence presented in the course of prosecution may not paint a full picture of the radicalization process. Arguably, by using legal documents to study terrorists, we allowed the government to tell its story, perhaps exaggerating the danger posed by individuals who were brought to trial in domestic courts. These are relevant concerns but they have to be weighed against the practical constraints related to the study of terrorist extremists. The normal means by which social scientists collect data—surveys, sampling procedures, and so on—are not available. The use of sampling techniques requires that you know the population from which the sample should be draw but, in the case of our subjects, no clearly delineated population at risk for developing

<table>
<thead>
<tr>
<th>Table 1. Data-stamped features in the dataset.</th>
</tr>
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<tbody>
<tr>
<td>Date of Birth</td>
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<tr>
<td>Religious Conversion Date</td>
</tr>
<tr>
<td>Disillusionment Date</td>
</tr>
<tr>
<td>Trauma Date</td>
</tr>
<tr>
<td>Personal Crisis Date</td>
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<tr>
<td>Information Seeking Date</td>
</tr>
<tr>
<td>New Religious Authority Date</td>
</tr>
<tr>
<td>Ideological Rebellion Date</td>
</tr>
<tr>
<td>Lifestyle Changes Date</td>
</tr>
<tr>
<td>Occupational/Educational Disengagement Date</td>
</tr>
<tr>
<td>School Dropout Date</td>
</tr>
<tr>
<td>Underemployment Date</td>
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<tr>
<td>Da’wah—Virtual Date</td>
</tr>
<tr>
<td>Da’wah—Real Life Date</td>
</tr>
</tbody>
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violent extremism can be identified and, consequently, no practical means exist for establishing parameters for random sampling procedures.\(^{25}\)

In principle, it would be desirable to include “failed” terrorists, individuals who have shown signs of extremist radicalization but have not (yet) committed such acts or been arrested and charged. In practice, the use of private information about human subjects is restricted by Institutional Review Board and privacy rules and the data available for research involving subjects who are suspected of being in the process of becoming terrorist extremists severely limited, which makes the use of available public sources preferable. Diversity of subjects was sought in other ways. We were able to include some individuals who died in insurgencies abroad or are known to be at-large fighting or living with a foreign terrorist group, but overall practical restrictions related to the availability of reliable data meant that we had to focus mainly on individuals who were prosecuted in U.S. courts.

**The demographics of “homegrown” jihadism**

Demographic information was collected about all the offenders. This allowed us to assess the general picture of the subjects as a group and also to test if the subjects selected for the detailed study of their radicalization pathways differed in any significant ways from the general population of Americans who have radicalized while living in the United States.

The results confirmed that there is no reliable demographic profile for who becomes a *jihadist*. One third or more of American *jihadists* are converts to Islam and did not grow up as Muslims. In most cases, they embraced Islam as they radicalized. To be clear, even those offenders, going straight from being nonbelievers to becoming extremist *Salafi-jihadis*. Converts comprised one third of the subjects in the large data set, but 41.5 percent (fifty-six individuals) in the smaller study, and so were overrepresented in the detailed biographical profiles. We cannot assess the impact of this overrepresentation, which may be explained by the attention paid to converts and therefore more public information was available to us about their radicalization histories.

In the United States, converts have been relatively more likely to commit terrorist crimes inspired by *jihadism* than is the case for converts in other Western countries. A common but inaccurate assumption is that the converts are racially Black. White converts are well-represented in the pool of convert-*jihadists*. Some American Hispanic converts have also radicalized to become *jihadist* extremists. Some Black and White offenders were the children of parents who were converts to Islam.\(^{26}\)

Education levels among the subjects selected for the small study were in the same range as those of the larger sample of offenders. When it comes to both education and social background, American *jihadists* are similar to the general American population. Of the full study group, 27 percent had graduated with high school degrees, and 35 percent had attended or graduated from college. Only 16.5 percent were high school dropouts. The rest held vocational degrees or, in a few cases, advanced degrees (Figure 2).

Prior criminal convictions for nonpolitical offenses are increasingly observed among the American *jihadists*. In all, thirty-five subjects had prior criminal convictions unrelated to terrorist activity.
Increasing ethno-national diversity is another key trait. Before the 9/11 attacks, and in the immediate aftermath, immigrant-origin offenders dominated the arrest statics. A previous study by the Brandeis team identified sixteen different ethnic populations among the offenders. That number rose to twenty-four between 2002 and 2007 and to over forty different ethnic and racial identities in the years after 2008. Hyphenated identities complicate the counting of ethnic and racial backgrounds, and slight changes in the definitions of ethnic identity will produce different results.27

Kinship and, in particular, the prevalence of brothers and cousins in small cells is often commented on. The Minneapolis-based Somali-American recruitment network supporting Al Shabaab, the Somali Al Qaeda affiliate, included both White and Black converts who were not of Somali origin. However, the majority of the participants were of Somali origin. In many cases they were born in the United States or had arrived as young children. Siblings and cousins featured and yet many more siblings disavowed their brothers’ decision to join or attempt to join the Al Qaeda affiliate. Sometimes ethnic ties appear to have been a conduit for recruitment but more often they played no role.

A picture has emerged of today’s jihadists as delusional youths who have fallen prey to online recruitment tactics. In fact, overall, terrorism is an adult, not a teen, crime.28 We were able to assess with reasonable accuracy the age at which the offenders in our study were radicalized by subtracting the year of birth from the year of the first indication of behaviors consistent with militancy (Figure 3). The results corroborated what other researchers have found: about two thirds of homegrown offenders were between the ages of 19 and 29 when they first exhibited signs of extremism.29 The median age at radicalization was 22 within the larger study, compared to 21 in the smaller study group. But the terrorist age–crime curve drops off sharply by the age of 33. The larger study included eighty-seven individuals who began radicalizing as teenagers (19 or under), 175 who were between 20 and 29 years old (53 percent), and fifty-one who were over the age of 30. Study Group B had forty-nine jihadists who began radicalizing as

Figure 2. Educational status of American homegrown terrorists. Note: The outer ring shows Study Group A (n = 289, 46 missing values). The inner circle shows Study Group B (n = 129, 6 missing subjects) included in the smaller subset.
teenagers (younger than 20), seventy-four in their twenties (55 percent), and twelve above 30 years old.

The average age at which the offenders typically radicalize has dropped in recent years. The shift to social media recruitment tactics coincided with a noticeable uptick in the number of teenagers who became involved with terrorism-related crimes. Sometimes, but not always, online social media prompted the process. Social media sometimes fueled codependent radicalization of a peer group or of close relatives. In one case, three siblings from Chicago radicalized together. Only one of them was tried as an adult.30

But older offenders also tended to get involved first through Internet contacts. A few of the women fell into the category of older offenders. Colleen LaRose, who is known as “Jihad Jane,” the online persona she chose for herself, was 46 years old when she was arrested in 2009.31 Terry Lee Loewen, 58, was arrested in December 2013.32 He was charged with planning to commit a suicide attack against an airport in Wichita, Kansas. In some ways, Loewen was no different from the recently radicalized youths. He was a fan of Anwar al-Awlaki and the American-run website RevolutionMuslim.com. He too was in possession of Inspire, the online magazine produced by Al Qaeda in the Arabian Peninsula. In one respect, however, the older offenders do stand out: None of them succeeded in their endeavors.

Around 2010, terrorist recruitment was dramatically transformed by the development of new online communication tools, generally referred to as the Web 2.0 environment of laterally integrated social media file sharing. The notorious Inspire magazine was first published in June of that year. The “e-zine”—glossy online magazines that are distributed through social media—magazine transformed jihadist proselytizing. The brainchild of Anwar al-Awlaki and Samir Khan, who grew up in Queens, New York and moved to Yemen in 2009, Inspire is published in English and preaches the gospel of “Do-It-Yourself” terrorism. Inspire featured in most of the biographies of Americans linked to jihadist crimes in recent years. This has raised questions about the importance of online radicalization.

The coders were asked to assess each of the subjects in the study to see whether their initial contact with extremism, and the early stages of their radicalization, occurred online or rather through the influence of a friend or a family member. Among the

![Figure 3](image.png)

**Figure 3.** Estimated age of the offenders at the first indication of radicalization. Note: Breaks in the line indicate that no subjects were included in the study from the particular age.
eighty offenders who had been radicalized before 2010, most (sixty-one) were assessed to have radicalized initially though personal contacts. Fifty-five were radicalized in 2010 or in the following years. Of these offenders, twenty-six were initially radicalized though online communications. There was therefore a near 50-50 split between individuals who had initially been radicalized through their contact with friends or family and those who had been initially influenced by online sources. In ten of these cases, the person in question was arrested after making contact with an undercover agent.

The findings would seem to suggest that the terrorist groups’ shift to pervasive online proselytizing in and around 2010 resulted in a significant change in the speed of radicalization and the methods by which individuals were radicalized after file-sharing platforms such as YouTube and social media sites became available, but the change was perhaps not as consequential as the initial picture suggests. Individuals who we judged to have initially radicalized online often quickly took the initiative to meet in real-life with a person they had met online. Moreover, Internet-based recruitment and activism were important throughout all years and in all cases we studied.

Among the twenty-six people who were assessed to have been radicalized exclusively or primarily through online contacts after 2010, seventeen were converts and appeared to have been converted to Islam through their online self-study (although it is hard to say for sure). Generalization from base-numbers as low as these is not advisable; our findings suggest that converts are more likely to become radicalized online rather than through real-world contacts. In no instance was the Internet the sole or even the primary source of influence. The main driver was close connection to someone who had radicalized earlier, such as a husband (and in one case, girlfriend), a cousin, or a friend. Five of these seventeen converts were women, some of whom treated jihadist sites as specialized dating sites. In fact, online radicalization is the most common way for women to become engaged in jihadism. Perhaps unexpectedly, women proved to be very quick to move on to action, typically taking just four months. A plausible explanation is that women often engage in “low threshold” activities, such as, posting threats online or attempting to travel abroad to “marry” a terrorist operative.

It is also not obvious that Internet-based radicalization should be blamed for fast-tracking individuals to terrorism-related action. Social media played a role in all of these cases, both as a tool for communicating with recruiters, and as the source of information about “what to do,” but in the majority of cases rapid progression to illegal action was driven primarily by interaction with peers. We identified five instances of individuals who radicalized in six months or less. Four of the five did so in 2014 or 2015. But these individuals were all attracted by the Islamic State’s promise of a new caliphate. It may therefore be presumed that we should blame the Islamic State’s open door recruitment tactic in this period rather than the Internet for causing the speedup of radicalization.

Unexpectedly, we found that converts and individuals who have previously been convicted of crimes unrelated to jihadism took twice as long as other offenders to reach the point of taking steps to action. The two groups partially overlap—one third of the converts in our study group also had previous criminal records—but all individuals with criminal records are comparatively slow to engage in criminal terrorist conduct.

Overall, social media recruitment and the lure of the Islamic State’s dystopia played a role in the changing demographics of offenders by making it possible for recruiters to
reach out to a broader population of susceptible individuals than in the past and diversified recruitment. Surprisingly, this brought in both younger and older adherents.

From null to boom

How long does it generally take for an individual to move from initial radicalization to criminal terrorist action? We find that radicalization trajectories became shorter in recent years. This validates law enforcement concerns that the window of opportunity for intervention narrowed significantly once recruitment moved onto social media.

Once dates were assigned to signature behaviors associated with the different stages in the model, the durations of the study subjects’ radicalization trajectories were calculated by working backward from the time of criminal terrorist action or the arrest. Standardized measures for the radicalization trajectory of the offenders—or a particular demographic subset of offenders—are calculated as the mean times it took the subjects to complete the arc of radicalization. By correlating the timeline data with other biographical information (e.g., age, gender, and whether a particular individual grew up Muslim or converted to Islam), profiles of the typical radicalization trajectory of different demographic groups were constructed. A standardized radicalization trajectory rate for terrorism offenders may be expressed as the mean time offenders took to progress from evidence of the initial attraction to extremist ideas to criminal action following the ideology. From this, we estimate the median length of time was just over four years (fifty months) for all the subjects studied.

All the same, it is difficult to speak of a “typical” length of time for radicalization. A handful of individuals took well over a decade to take action. Once these outliers were removed from the calculation, however, the average trajectory was reduced to three years. Individuals in the upper 25 percent of the age frequency distribution, the +30-year-old cohort, took more than seven years on average to reach the culmination of their careers as extremists. These individuals often spent a great deal of time searching to realize their ambition of becoming a mujahidin. At the other end of the spectrum, the lower quartile, study subjects typically took just one to two years to complete the arc of radicalization. Many youths, particularly teenagers who grew up in Muslim households, made the transition in a matter of months. Since 2010, and the shift to online recruitment tactics, the typical length of the radicalization trajectory has contracted significantly.

Notwithstanding variation in how quickly individuals radicalized, some regularities stood out once the data were broken down to focus on sub-strata within the population of offenders. Contextual factors ranging from accessibility of jihadist ideas to the opportunity structures for waging jihad are difficult to parse out in a small N study. Figure 4 compares the median time for the radicalization trajectory of different demographic subgroups in the offender dataset. The starting point here is the moment when there is clear evidence of a commitment to extremism. The endpoint comes when the offenders formulate practical plans to “do something” criminal in support of the extremist beliefs. The average duration for going from one point to the next was calculated for different demographic subgroups. Again, setting aside the few outliers who take very long to make up their minds to embark on a criminal act, radicalized individuals have
in the last five years taken from between four to sixteen months to go from embracing extremist ideology to making plans to commit an act of terrorism.

The acceleration of radicalization was particularly apparent when we compared the pre and post-2010 cohorts. Eighty subjects began to radicalize before 2010 and 55 after 2010. Offenders in the post-2010 cohort were much quicker to reach the point of taking action than were members of the pre-2010 cohort. Of the many jihadists arrested in 2015, most were radicalized in less than five years, often in less than two years. Time elapsed between the first overt sign of committed extremism (start of stage 1 behaviors) and taking steps to terrorist action (end of stage 2) was typically fifteen months for the pre-2010 cohort, compared to 6.25 months for the later cohort. By 2015, the average length of the radicalization trajectory of the cohort radicalized that year had decreased to just over one year.

The findings have implications for efforts to develop intervention programs intended to steer people away from full-blown violent extremism. Ideally, to be effective, such interventions should be timed to take place after a person has become radicalized but before he or she has been drawn into criminal plots. Finding the sweet spot turns out to be difficult. The window of opportunity may be available only for a brief moment, if policies are designed to be highly targeted and sensitive to concerns about interfering with people’s civil liberties. It is apparent that preventive intervention has a wider window before the radicalizing individual moves on to engage in the manifest behavioral changes associated with stage 1 behaviors, typically lifestyle changes, making aggressive complaints about how family and neighbors lack of proper piety, and so on. The dilemma is that often these behaviors are interpreted as mere rebelliousness and no legal grounds exist for seeking to reeducate people because they start to hold unpopular and potentially dangerous beliefs.

**Assessing the behavioral model**

We now turn to the question of sequence and the utility of behavioral cues for assessing radicalization. A list was developed of specific behaviors that were thought to

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**Figure 4.** Time from start of stage 1 radicalization to conclusion of stage 2. *Note: N = 123. Calculated in median values. 10 percent outliers removed from upper end of distribution.*

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Time (months)</th>
</tr>
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<tbody>
<tr>
<td>Radicalized Post-2010</td>
<td>6.25</td>
</tr>
<tr>
<td>Radicalized Pre-2010</td>
<td>15</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
</tr>
<tr>
<td>No Prior Criminality</td>
<td>8</td>
</tr>
<tr>
<td>Prior Criminality</td>
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<tr>
<td>Raised Muslim</td>
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</tr>
<tr>
<td>Converted to Islam</td>
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</tbody>
</table>
correspond to the different phases in the radicalization process. For the purpose of an empirical assessment of the offenders’ biographies, specific cues of each type of a behavior were developed for use by the coders. Optimally, a behavioral indicator used to assess a risk profile should be distinctive, occur frequently, and reliably at the point in the radicalization trajectory that the model anticipated. The model was developed based on informed speculation about common overt manifestations of increasing extremism. A poor fit between the data and the model may be the result of incorrect assumptions. A specific behavior assigned to one stage may be more commonly associated with another stage. Or a specific behavior may be prevalent overall but not in a proximate way to other behaviors and would therefore not be a useful warning sign of growing extremism. Obviously, an indicator that occurs rarely or randomly in the radicalization trajectory is not particularly helpful for our purposes.

A tracking algorithm was used to assess the sequencing of the behavioral indicators of the different steps in the radicalization process. When the expected behavioral indicators were observed in the order stipulated by the four-phase model, the counter increased by a value of one. If it did not, the counter was unchanged. If the next chronological cue also conformed to expectations set out in the model, the value increased to two. In this way we were able to calculate how often, out of all possible scores, the biographical data conformed to the expectations of the model. The algorithm provided a tool both for estimation the “fit” of the behavioral indicators within the model and for assessing the chronological sequencing of individual trajectories. The fit analysis of the behavioral cues to the behaviors associated, in the model, with the different phases of radicalization is summarized in Table 2.

Overall, the conceptual framework accurately captured the sequential placement of the behaviors attributed to the radicalization process. In more than three quarters of cases, fourteen of the behavioral indicators occurred at the predicted point in the radicalization process. Five indicators appeared as predicted in more than half of the trajectories analyzed. Other behavioral indicators did not seem to be consistently associated with a specific step in the radicalization process or did not appear to be relevant in the way that was originally hypothesized. In what follows the term indicators refers to the variables used in analysis of the radicalization process. When discussed, the indicators are indicated in italicized boldface. Cues are the specific behaviors the coders were instructed in the codebook to look for as examples of these indicators.

**Pre-radicalization: Cognitive opening**

The pre-radicalization stage is the period before an individual takes decisive steps to put new convictions into action. Legal and moral issues must arise when attempts are made to change the minds of people who are playing with undesirable ideas. Yet this may be the best opportunity for intervention: before the radicalizing individual closes his or her mind to other views, and before a crime has been committed. The significance of the behaviors associated with the cognitive opening to jihadist extremism may often seem significant only in retrospect, when other, more serious, behaviors become apparent.
<table>
<thead>
<tr>
<th>Indicator and cues</th>
<th>Frequency (135 cases)</th>
<th>“Fit” with model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P-R: Seeking New Religious Authority:</strong> Attending a new place of worship or communication with a radical cleric.</td>
<td>57% (77)</td>
<td>74% (57)</td>
</tr>
<tr>
<td><strong>P-R: Information Seeking:</strong> Downloading or procuring jihadist literature, or other information indicating the earliest known date on which an individual began actively seeking out sources of jihadist information.</td>
<td>55.6% (75)</td>
<td>84% (63)</td>
</tr>
<tr>
<td><strong>P-R: Disillusionment:</strong> Public expressions online or to friends or family of disillusionment with world affairs, religion, or Western society.</td>
<td>42.2% (57)</td>
<td>80.7% (46)</td>
</tr>
<tr>
<td><strong>P-R: Personal Crisis:</strong> Adverse personal circumstances leading to dissatisfaction with self or introspection, catalyzed by continuous, prolonged problems (e.g., incarceration, drug addiction, unemployment, homelessness).</td>
<td>27.4% (37)</td>
<td>75.7% (28)</td>
</tr>
<tr>
<td><strong>P-R: Trauma:</strong> An event causing a shock or injury (e.g., death of a loved one, personal injury or illness, an accident).</td>
<td>19.3% (26)</td>
<td>84.6% (22)</td>
</tr>
<tr>
<td><strong>S-1: Lifestyle Changes:</strong> Overt changes indicative of new religious piety following the prescriptions of jihadism; e.g., changes styles or grows a beard.</td>
<td>54.1% (73)</td>
<td>79.5% (58)</td>
</tr>
<tr>
<td><strong>S-1: Da’wah (Virtual):</strong> Active circulation of extremist material in an online setting (e.g., publishing or recirculating material on social media, public postings of such material, encouraging others to extremism on the Internet).</td>
<td>34.1% (46)</td>
<td>56.5% (26)</td>
</tr>
<tr>
<td><strong>S-1: School Dropout:</strong> Voluntary withdrawal from classes or educational program or by dismissal from program. Applies only to students.</td>
<td>31.9% (43)</td>
<td>48.8% (21)</td>
</tr>
<tr>
<td><strong>S-1: Da’wah (Real-Life):</strong> Actively taking part in the dissemination of extremist material or encouraging others to adopt orthodox beliefs, handing out literature in public places.</td>
<td>23.7% (32)</td>
<td>56.3% (18)</td>
</tr>
<tr>
<td><strong>S-1: Educational/Occupational Disengagement:</strong> Includes, but is not limited to, suddenly falling grades or seeking jobs involving little supervision.</td>
<td>18.5% (25)</td>
<td>48.0% (12)</td>
</tr>
<tr>
<td><strong>S-1: Underemployment:</strong> Pursuing a job on the premise that such work would not interfere with religious beliefs or obligations, or seeking manual labor to earn money in order to travel abroad or to provide support to an extremist organization.</td>
<td>17% (23)</td>
<td>65.2% (15)</td>
</tr>
<tr>
<td><strong>Rebellion:</strong> Acts out against formerly central life figures on an ideological basis or starts haranguing individuals at place of worship, defacing property.</td>
<td>11.9% (16)</td>
<td>No specific stage</td>
</tr>
<tr>
<td><strong>S-2: Desire for Action:</strong> Specific, verbalized desire to fight abroad or take part in domestic plot.</td>
<td>85.2% (115)</td>
<td>96.5% (111)</td>
</tr>
<tr>
<td><strong>S-2: Peer-Immersion:</strong> Finding like-minded extremists, often in conjunction with dissociation from former peer-groups.</td>
<td>68.9% (93)</td>
<td>96.8% (90)</td>
</tr>
<tr>
<td><strong>S-2: Domestic Physical Training:</strong> Starts physical training, often with peers (e.g., seeks experience with guns, target practice, weight training, paintball, or training as a medic).</td>
<td>34.1% (46)</td>
<td>91.3% (42)</td>
</tr>
<tr>
<td><strong>S-2: Marriage Seeking:</strong> Starts online dating on websites, seeks marriage with someone met online or in real-life, or relocates abroad to marry.</td>
<td>20.7% (28)</td>
<td>89.3% (25)</td>
</tr>
<tr>
<td><strong>S-2: Societal Disengagement:</strong> Refuses to vote in elections; disdains democracy as disallowed for Muslims, seeks to relocate to a Muslim country (non-insurgent zone).</td>
<td>14.8% (20)</td>
<td>85.0% (17)</td>
</tr>
<tr>
<td><strong>Epiphany:</strong> Articulating that he or she has been called by God to take action or a sudden realization that violent jihad is an obligatory personal act.</td>
<td>8.9% (12)</td>
<td>No specific stage</td>
</tr>
<tr>
<td><strong>S-3: Steps Towards Violence:</strong> Procurement of materials for plot, surveillance, operation planning.</td>
<td>64.4% (87)</td>
<td>100% (87)</td>
</tr>
<tr>
<td><strong>S-3: Joins Foreign Insurgency:</strong> Travel (successful or attempted) abroad with the intention of taking part in a foreign insurgency.</td>
<td>45.9% (62)</td>
<td>100% (62)</td>
</tr>
</tbody>
</table>

(continued)
The window of opportunity exists, but it is easy to miss. In the study, 125 individuals (out of 135) showed overt indications of a period of exploration as they learned the ropes and absorbed the lessons of the extremist belief system.

Only a few individuals radicalized online, stereotypically spending hours on the computer, isolated at home. Early-stage radicalization takes many forms. **Information seeking** includes research about religion broadly and specifically about *Salafi-jihadism*. It may be indicated by passive participation in forums and communities, watching *jihadist* propaganda, or exploring new hard-line spiritual settings. **Authority seeking** involves seeking out or becoming fixated on newfound authority figures. These are examples of pull factors that draw individuals to the extremist ideology. Overall, pull variables occurred with far greater frequency in the offenders’ biographies than did push variables.

The specific behavioral indicators indicated by the model were observed in 74–85 percent of cases. We identified attempts in seventy-seven cases in which individuals sought out new religious authorities, but this did not always occur in the initial phase when the subjects were exploring extremism (74 percent fit with model expectations.) While not indicative of pre-radicalization, however, searching for new authority figures generally did occur in stage 1. Typically, at this stage the individual turns against the Islam of the parents, rejects the local mosque, or starts obsessively seeking religious instruction online—often, all of the above.

Push factors include traumatic events or other adverse circumstances that may cause an individual to seek a solution in extremism. Expressions of **disillusionment** were especially common. They were found in 57 percent of cases and fell within the anticipated stage of radicalization 80 percent of the time. We looked for other indicators thought to be associated with pre-radicalization: **trauma** (parental divorce or the death of a parent, a serious accident) and **personal crisis** (such as drug addiction or incarceration). We expected traumatic experiences to be a constant variable that might occur sporadically throughout the process, but in actuality it was an early-stage occurrence in the case of nearly all of the subjects who were identified as having experienced trauma. Personal crises were accurately predicted as a pre-radicalization event, identified 76 percent of the time as a precursor to stage 1 radicalization. However, traumatic experiences were found in only twenty-six biographies. Personal crisis was slightly more common: evident in thirty-seven cases. (In some cases these indicators were linked.) Although uncommon, when these push-factors were present they evidently catalyzed searching behaviors that are typical for this initial phase of radicalization.

### Stage 1: Lifestyle adaptation

Adaptive lifestyle changes conforming to the preaching of ideologues and preparatory to “learning to be a terrorist” were prevalent in the next stage of the radicalization process.
Stage 1 behaviors entail some degree of transformation in the individual’s identity, apparent in outward lifestyle changes. The radicalizing individual begins to adhere more strongly to their newfound ideology, incorporating previously non-existent expressions of piety such as wearing traditional clothing, growing a beard, or abstaining from alcohol and other substances deemed haram. Seventy-three individuals exhibited some outward show of increased spiritual devotion, and in fifty-eight cases (79.5 percent), these changes appeared as anticipated. However, it sometimes proved difficult to obtain information about cues thought to indicate the behavioral changes associated with this stage.

Engagement in actively bringing others into the circle of believers, which we describe as proselytizing (da’wah) activities, proved to be so common at every stage of the radicalization process that it is not helpful for dynamic modeling of the radicalization process. Proselytizing is one of the first assignments given to a newly radicalized individual. It can involve setting up a booth for distributing leaflets or organizing communal activities and demonstrations, or active participation in online extremism. Some form of da’wah activity was present in sixty-nine instances (51 percent) but proved to be not specific to stage 1 in the radicalization process. Nine individuals undertook active proselytizing both online and in real life. We identified a number of individuals who were active proselytizers in stages 1 and 2 (seventeen online and ten in real life). But since this type of behavior is often regarded as constitutionally protected in the United States, it is not generally mentioned in the judicial process, which may explain why we did not find more evidence of proselytizing as a gateway to radicalization.

Premature school-leaving, or “dropout,” was not as frequent as we expected. Many offenders are well educated and complete their education. Some manage to stay in school while they develop highly extremist personae. Of forty-three total school dropouts in the dataset, only twenty-one left school at the predicted stage in the sequence. Some offenders dropped out of school (or college) well before they embraced extremism. Individuals with a history of criminal activities before they became radicalized typically dropped out of school much earlier. Overall, no obvious connection between dropping out of school and becoming an extremist was identified. Dropping out could be interpreted as a possible distal factor for radicalization but could not credibly be seen as a causal factor. An example is Najibullah Zazi, a 24-year-old man who was arrested in September 2009 in connection with a foiled plot to plant bombs in the New York Subway system. He dropped out of school in 2003 but showed no signs of radicalization until three years later, when he started to watch extremist videos with friends who became coconspirators.37

Nor was dropping out closely correlated with any particular phase of the radicalization trajectory. Eleven dropped out while exhibiting stage 2 behaviors and already were radicalized. Another five withdrew from the educational programs after they actively started planning for criminal terrorism-related action. In sum, while dropping out of school before graduation is common among terrorist offenders, the timing of their alienation from education can occur pretty much any time before or after they radicalized.

We also examined disengagement from educational or occupational responsibilities as a possible anticipatory indicator of radicalization. Dzhokhar Tsarnaev, the youngest
of the brothers responsible for the Boston Marathon bombing, was considered a promising student in high school and was admitted as a fellowship student to one of the University of Massachusetts’s campuses. In his first year, he stopped studying and was facing expulsion on the grounds of failing grades when he and his brother carried out their attack in April 2013.38

Evidence of a sudden fall in performance in school only appeared as predicted in twelve instances, occurring in late in stages 2 and 3 of the radicalization trajectory. Choosing underemployment was also considered. Radicalized jihadists have been known to seek out work that does not violate a strict code of beliefs or that requires little oversight, often with the aim of raising funds for travel abroad. This was evident in twenty-three biographies, occurring as predicted in fifteen instances. Other examples of lifestyle changes and detachment from previous routines were signature cues in the offenders’ biographies. These included changed clothing styles and verbal expressions of extremist interpretations of Islam following the teaching of the preachers.

Educational attainment, employment, and school drop-out are indicators of what sociologists call social alienation. Interestingly, our findings do not support the idea that radicalization is the product of social alienation. Many, even most, American jihadists are educated and stay in school while they radicalize, suggesting that the relationship between radicalization and social alienation is rather more complex. Ideological extremism is the cause rather than the product of social isolation.

**Stage 2: Extremist engagement**

The behaviors linked to this stage may involve criminality but often do not. They are, for the most part, life-altering behaviors that are difficult for friends and family not to notice. Peer-immersion emerged as an exceptionally salient indicator, generally appearing at a predictable point in each individual’s radicalization trajectory. Indeed, seeking out and spending time with like-minded extremists can be regarded almost as a prerequisite for motivating the move to action. Of the subjects examined, coders were able to approximate the presence and timeframe of immersive behavior in the vast majority of cases, often with a high degree of certainty. Peer-immersion proved to be precisely located in the expected stage of radicalization in 97 percent of cases where it was present (ninety of ninety-three subjects). Peer-immersion frequently occurred in conjunction with other stage 2 behaviors, all of which conformed to the model’s expectation with respect to the sequencing of behaviors.

**Domestic physical training** involving firearm training with other extremists or similar activities was discovered in forty-six biographies, or for about one third of all the subjects. This type of activity nearly always appeared at this stage (91 percent). The offenders often attempted to create a “pop-up” cell around them by recruiting friends or schoolmates to join in activities that are recommended by jihadist recruiters (e.g., going to a shooting range together or fitness training).

**Marriage seeking** was only considered an indicator of radicalization if the act was motivated by beliefs. Marriages arranged by parents were not considered an indicator of radicalization, for example. Characteristically, in violation of Islamic religious law, parents are not consulted in these marriage arrangements. Generally, they are informal
marriages and sometimes conducted online through online *jihadist* dating sites without any parental involvement. One out of five (20 percent) of the subjects married another extremist, and generally did so in this late stage of the radicalization process just prior to taking active criminal steps. Marriage to another extremist was a particularly important step in the radicalization of the women in the study and generally occurred in this stage of the radicalization process. Two thirds (seven) of the women sought marriage to a fellow *jihadist*. Marriage into the community of extremists is highly recommended by preachers and recruiters, and is one of the ways that the cult of *jihadism* separates new followers from family and community.

One of the variables that did not work well was what we called *epiphany*, a moment when the radicalized individual claims to have had a divine revelation. Myths and dreams play a large role in *jihadist* culture. The embrace of the violent *jihad* as an obligatory personal act is often presented as an exterior call, and we expected that the offenders at some point would have announced the completion of their psychological journey by claiming that Allah sent a messenger telling them to take action. We did identify examples of claims to revelations, but they were too few to prove helpful, and when we were able to identify such examples the place of this experience in the radicalization trajectory varied.

Revelations are not typically introduced as evidence in judicial proceedings, and we relied on autobiographical statements posted online or attributed to the offender by peers. The cue might have performed better if we were able to track the evidence in real time rather than having to forensically reconstruct evidence.

*Rebellion* was another variable that did not work out in the model. Consideration of this variable was motivated by accounts of offenders berating mosque officials or parents for practicing Islam “wrongly,” or, in the case of converts, accusing them of ungodliness. Cues for this variable included an individual acting out against formerly central life figures on an ideological basis, haranguing individuals at a place of worship, or defacing property considered *haram*. Tamerlan Tsarnaev, the older of the Boston Marathon bombers, on several occasions berated a local imam for his Americanized ways. Shelton Thomas Bell, a young convert to Islam who grew up in a rural county near Jacksonville, Florida, similarly turned on a local imam. The imam reported Bell, but similar events may often go unreported in many cases, which perhaps accounts for the null finding. Court documents also do not typically refer to incidents that are unrelated to criminality. Analysts drawing on more detailed and private information sources may be able to make more use of cues such as these.

*Jihadist* ideology tells adherents to assume pious behaviors that cause them to disengage from society. It is therefore not surprising to find evidence of rage and disenchantment. But, surprisingly, *secularized societal disengagement*, defined as overt expressions of a rejection of the civic obligations of democracy or, more broadly, rejection of life in the West, was evident in the biographies of only twenty subjects. It was nearly always associated with this advanced stage of radicalization (85 percent). It may be that such expressions of growing extremism simply go underreported. Or perhaps they are not noticed. Many people do, after all, give expression to angry feelings about the political system or society. Utopian statements about the blessings of life in the caliphate and of the “good life” under the proper *jihadist* authority may well have proven a better metric.
for growing extremism. It is difficult to get inside the head of a jihadist extremist, and too often analysts and researchers fail to understand the symbolisms and speech patterns associated with the belief system. We did not think to search for romantic longing rather than oppositional rage until after the evidence was reviewed.

Finally, expressions of desire for action emerged as a highly salient indicator of progressive radicalization. This variable tracked when offenders started to express willingness to take part in terrorist activity but before they had begun to take concrete steps to take action. It was the most prevalent marker, present in 115 subjects. In 111 of those cases (96.5 percent), the initial expression of a desire for action fell within the timeframe of stage 2 activities.

### Stage 3: Preparing for criminal action

Late-stage indicators generally result in criminal actions that led to arrest, departure, or, at the very least, surveillance. The model’s assumptions with respect to behaviors associated with stage 3 were generally accurate. The acts in this stage are all criminal offenses and are typically the reason the offenders ended up in our study in the first place. Today offenders intending to go abroad to fight are typically apprehended in the airport on their way out of the United States. In earlier years, offenders often traveled back and forth several times between visits to training camps before they were arrested, or might spend years traveling to find a sponsor. Individuals who attempted to join a foreign insurgency or began actively plotting for domestic action were fully radicalized by the time of their involvement. Once they engaged in these types of activities they rarely reverted to second-tier activities. If foiled, they would try again until successful or until they were arrested.

The stage 3 behaviors nearly all fell neatly into the stage anticipated by the model. One exception was nonviolent criminal activities such as what in U.S. law is called material support for terrorism, which typically refers to the recruitment of others to go abroad to fight and fund-raising for terrorist organizations or illegal terrorism-related actions. These types of actions proved to be diffused across stages 2 and 3. But, once people committed themselves to the practical steps of preparing to become fully fledged terrorists, they kept trying until they were arrested, or died, or managed to go abroad. Nonviolent support for terrorism covers low-threshold activities that while clearly criminal do not put the individual at risk of a violent death. These activities include fund-raising for terrorism, efforts to recruit others to join a terrorist organization, and the communication of threats. A few offenders continued with these activities until taking steps to move on to violence—most often attempting to go abroad to join a terrorist organization.

Olivier Roy has argued that the jihadists are revolutionaries by another name and describes jihadism as a “generational nihilistic radicalized youth revolt.” According to Roy, homegrown radicalization is “more about the Islamization of radicalism than the radicalization of Islam.”

The argument that youth rebellion rather than conversion to the Salafi-jihadist never-never land drives the homegrown phenomenon can be tested through a thought experiment. Let us assume that this would be true if any number of our subjects failed to exhibit one or more of the following behavioral cues: becoming a convert to Islam,
seeking new religious authority and information about the rules and requirements of Salafi-jihadism, engaging in lifestyle changes, or participating in proselytizing activities online or offline (\textit{da’wah}). Most of the subject exhibited several if not all of the cues to religiously inspired extremism. Converts and natural-born Muslims are no different in this regard. Both groups parade their newfound adherence to sectarian extremism before they do “something.” In fact, only eight of 135 subjects exhibited no overt signs of at least one of the behavioral cues related to a religious conversion experience. In all eight cases, however, we had trouble finding any information for the early stages of the individuals’ biographies. It is probable that the issue is not that they did not do those things but that we did not evidence that they did. But Roy’s argument has broader validity. The embrace of extremist religion and violent extremism are twinned in the radicalization process. The appearance of new, militant religious fervor was a strikingly consistent factor among the study subjects.

**Sequencing behavioral changes**

In theory, there may be thousands of unique combinations of behavioral cues that exist that anticipate violent extremist behavior or action in support of terrorism. In fact, however, our evidence strongly supports the idea that terrorist learning follows a limited number of highly scripted pathways, although only a handful of sets of sequenced behavioral changes proved to anticipate terrorism-related criminality.

In mathematics, a “set” is a collection of distinct objects, which, when considered together, become an object in its own right. Here, a “set” is understood to mean a chronological sequence, a segment, of two or more behaviors that are tightly linked and that, taken together, define a path leading to a high likelihood of criminal action. A \textit{triad} is a set of three sequential cues that span at least two stages in the radicalization process.

Combinations of verbalized expressions of desire for action, peer immersion, lifestyle changes, and information seeking comprised four of the top five triads preceding the types of criminal terrorist actions associated with stage 3. Those four indicators appear in the top six most frequent indicators. By analyzing the typical sequences of these behaviors we identified some typical dynamic templates for radicalization.

The most common triad included real-life peer immersion rather than online social media engagement. Peer immersion, followed by expressions of desire for action, might follow any one of a range of pre-radicalization indicators. Peer groups often include cousins, siblings, or school friends, who had ties prior to their radicalization and radicalized together. They also include couples, who matched up after radicalizing on their own.

“Peer immersion” and expressions of “desire for action” were both behaviors that we classified as stage 2 of the radicalization process, and so they preceded attempts to take criminal action. This triad—in this sequence—appears in 46.7 percent (sixty-three) of timelines (Figure 5).

The prevalence of real-life peer immersion followed by public announcements of a desire for action threw new light on the role of small group dynamics in the escalation of the individual radicalization trajectory. In fact, the reverse sequence, with expressions of desire for action preceding peer immersion, appeared only in 8.9 percent (twelve) of cases.
An effort to seek out new religious authority proved the single most common pre-radicalization behavior. The triad of seeking new religious authority, joining up with extremist peers, followed by professions to “do something” occurred in 25 percent of all cases. The “seeking new religious authority” variable was defined to imply significant efforts (e.g., turning against a local mosque or seeking out a particular figure thought to teach the “right ideas”). Merely following, say, Anwar al-Awlaki online, was not considered a sufficiently intense expression of interest in jihadism to be an indicator of pre-radicalization.

Some of the behavior associated with stage 1 radicalization reliably anticipated later terrorist activity. Again, real-life peer immersion and public expressions of desire for action feature prominently. Expressions of secular discontent were a less frequent risk factor presaging the peer-immersion and the desire-for-action combination, and it occurred in only 16.3 percent (twenty-two) of the cases. The most common stage 1 indicator comprising a triad connecting peer immersion and expressions of desire for jihadist action was overt change in lifestyle. This occurred in 23.7 percent of cases (thirty-two).

Overall, the analysis of the combinational logic of triads pointed to the exceptional importance of peer groups in pushing radicalization. Generally, an individual verbalizes interest in carrying out violence and terrorist action after having become immersed in a radical peer-group, suggesting that peer-immersion is central to the process.

**Modeling radicalization as a discrete-time, stochastic dynamical system**

The Colorado State University collaborators drew on mathematical path-dependence theory to model the radicalization process as a discrete-time, stochastic dynamical system of behavioral indicator outcomes. The modeling aimed to aid in the visualization of radicalization trajectories and to help identify additional sequence patterns of indicators of growing extremism. Here, the phase requirement was relaxed and the analysis sought instead to identify any pattern of pairwise segments anticipating a criminal outcome. Given that $t$ is the index of discrete time intervals, $X_t$ is the random variable representing the outcome at time $t$, $H_t = \{X_1, \ldots, X_{t-1}\}$ is a set of outcomes up to time $t$ (i.e., the history of previous outcomes), $G_t$ is a probabilistic function at time $t$ that maps current history to the next outcome, we can characterize a path-dependent radicalization process as follows.

$$X_{t+1} = G_t(H_t)$$

The twenty-six radicalization indicators in the dataset constitute the state space, or possible outcomes, of $X_t$. Even without fully knowing $G_t$, this framework of analysis coupled with the empirical data enabled the rigorous use of state transition diagrams.
and network analysis techniques to reveal insights into radicalization pathways and the relative frequencies of transitions between certain states (indicator outcomes).

To graphically represent the radicalization pathway of behavioral indicators, a state transition diagram was developed in which each of the twenty-six observable behaviors appears as its own node. A discernible radicalization behavioral sequence for each of the 135 U.S. radicalized violent extremists appears as a multi-hop pathway from the “Year of Birth” node to the “Date of Criminal Action” node. Those who had not relocated abroad or died in their terrorist act had an additional path segment from “Date of Criminal Action” to “Arrest Date” or an alternative terminal outcome, typically death or travel abroad. Figure 6a depicts all the transitions aggregated from among the 135 violent extremists, where the twenty-six nodes are features/behaviors and the weighted paths represent instances when a feature/behavior sequentially followed another in the offender histories. The varied behavioral radicalization paths toward criminal action clearly support the conclusion by many researchers that there is no single path toward violent extremism.

In Figure 6b all transitions that comprise less than 10 percent frequency from each behavior were removed and color codes were applied to the remaining transitions according to their weight. This technique reveals the common or most frequented pairwise sequences of behavioral indicators. We note the high proportion transitions as particularly informative of what behaviors may immediately come next in the trajectory for those confirmed cases of violent extremism. For example, 73.3 percent (eleven out of fifteen) of the offenders who had issued threats subsequently followed with some form of criminal action. Other notable transitions that would be informative to intelligence and law enforcement analysts include:

- 53.5 percent (forty-six out of eighty-six) of those subjects who took discernible steps toward violence subsequently followed up with some form of criminal action that was not averted through preventive arrest,
- 27.8 percent (thirty out of 108) of those who immersed themselves with like-minded peers subsequently communicated some desire for violent action,
- 27.5 percent (fourteen out of fifty-one) of those who undertook da’wah (proselytizing) online subsequently communicated some desire for violent action, and
- 24.2 percent (thirty-one out of 128) of those who communicated some desire for action subsequently took steps toward violence.

These dynamic insights into the radicalization process go beyond simply providing prevalence statistics of the kind typically offered by other researchers. For instance, we find that eighty-six out of the sample of 135 perpetrators (63.7 percent) took some discernible steps toward violence while on their path toward violent radicalization. Our methodology allows us to then ask, “What comes next?” In this case, the very next step, for around 53 percent of these individuals, would be some form of criminal action.

This modeling approach also allowed us to determine the mean transition probability for each individual’s radicalization pathway by averaging all the transition probabilities along an individual’s path, and then identify the maximum transition probability pathway utilized. Across all cases, the results demonstrated that only very few individuals followed sequences of behaviors that were truly unique, showing no commonalities with
other violent extremists in the dataset. On the contrary, most offenders utilized at least one or more common path segments as part of their radicalization trajectory.

**Inferences and conclusion**

The research demonstrated the feasibility of a new approach for modeling radicalization as a dynamic process. Although we were reliant on imperfect real-world data, culled from publicly available sources, it was possible to establish common trajectories for the terrorist offenders included in the study. The analysis showed that while the pathways, and specifically the length of time, taken by perpetrators varied, an overwhelming majority followed at least some common segments of paths. In other words, the radicalization pathway for each of the perpetrators exhibited some infrequent pairwise sequences of behaviors, but almost invariably included a few very common pairwise sequences. This finding could prove useful for law enforcement and intelligence analysts. Refocusing on risk behaviors rather than beliefs or demography may also alleviate some of the costs associated with preventive antiterrorism policing, and help protect civil liberties, and prevent stereotyping of Muslims.

Concern about so-called false positives is an oft-voiced criticism of risk assessment protocols. These occur if individuals are incorrectly identified as posing a risk when in fact they do not. False positives are seen as a liability because of the potential for injury to people who in fact pose no risk to society. They also compromise the effectiveness of a risk assessment protocol, and a major objective of our research and of any evidence-based risk assessment model is precisely to minimize false positives. Moreover, the research presented here shows that an evidence-based approach to risk assessment may counter stereotypes and lessen the risk of excessive policing and the multiplication of
broad-based intervention programs that respond to uninformed fears. We would also wish to reduce the incidence of false negatives. These are instances where individuals who do in fact pose a risk are misidentified as no risk and indicate failures of law enforcement.

This leads us to another objection against considering extremist religiosity as a factor in radicalization. Jihadist extremism develops in opposition to the social and religious practices of American Muslim communities. The question is often raised whether the essential factor here is not simply some pathology of extremism. This may be true in so far as networks and detachment from ordinary life are the essential elements of the recruitment to cults and sects—or gangs. But even if the fundamental psychological processes are broadly similar, the scripts for “what to do” vary greatly between the jihadists and other brands of violent extremism (e.g., the White supremacists or antifederalists). Little can be learned that is of practical use for crafting intervention programs addressing homegrown terrorism, if the ideological and religious components are downplayed or ignored.

The evidence supports the conceptualization of jihadist extremism as “work” in the sense proposed by Howard Becker. This “work” requires training and is scripted by the ideology and by peers and “bosses.” Preachers, recruiters, and opinion leaders of Salafi-jihadism play important roles. They teach and model the roles and expectations that the adherents have to meet to become members of the global congregation of the “saved sect,” one of the names used by the jihadist extremists to describe themselves. Becoming involved with extremist peers and seeking out avenues to join the imagined community of the global vanguard proved a pivotal step toward late stage radicalization.

Acculturation to extremist and violent action involves a process of identity formation that is associated with behavioral changes. Overall, a picture emerged of some common and highly frequent behavioral segment pairs and associated cues that generally work as indicators of growing extremism, but we found also important variation, specifically with respect to the speed with which the offenders became engaged in criminal behaviors. The heterogeneity of the subject population (and the evidence available to us through public records) did not support the drawing of inferences with respect to the causes of such variations beyond noting that demographic factors (e.g., female or male, young or old) clearly matter. Further research is required to assess variations in the process and to specify more precisely the behaviors associated with different subgroups: women, youths, older converts, and former criminal offenders, for example. Some behaviors that did not work in a dynamic model may nevertheless point to an underlying vulnerability. Further research is required to assess variations in the process and to specify more precisely the behaviors associated with different subgroups: women, youths, older converts, and former criminal offenders, for example. Drug abuse, a history of violence, or various types of trauma are examples of underlying risk factors.

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Notes

2. The term is used here to refer to Al Qaeda–inspired offenders as well as those inspired by Abū Bakr al-Baghdādi’s splinter group, ISIS, and other aligned groups. Despite disagreements on tactics, the Salafi-jihadi groups draw ideological cohesion from their shared interpretation of jihad as a religious obligation to use violence to establish a revolutionary Islamic state; Quintan Wiktorowicz, “Anatomy of the Salafi Movement,” Studies in Conflict and Terrorism 29, no. 3 (2006): 207–239.
9. Psychologists point to the low incidence rate of violence among the mentally ill as a reason to not profile the mentally ill; nevertheless, it is also true that seriously mentally ill individuals have committed terrible mass shootings; see John D. Milby, “Preempting Mass


The legal “Doctrine of True Threats” holds that as long as the speaker is merely telling other people to carry out violence, incitement is constitutionally protected speech but the doctrine does not apply to social media because users sign Terms of Service agreements, which give the service providers (e.g., Facebook, YouTube, and Twitter) the right to police content; see Michelle Roter, "With Great Power Comes Great Responsibility: Imposing a Duty to Take down Terrorist Incitement on Social Media," *Hofstra Law Review* 45, no. 4 (2017): 1379–1414.

Silber and Bhatt identified the phases of as Pre-radicalization, Self-identification, Indoctrination, and Jihadization; see "Radicalization in the West,” 6–8.

<here > Readers are directed to the previously published Research Note for a visual depiction of the conceptual model. Klausen et al., “Towards a Behavioral Model,” 71.


22. The estimate of the total number of cases brought by the U.S. Department of Justice derives from a database collected by Trevor Aaronson and Margot Williams; see https://github.com/firstlookmedia/trial-and-terror-data (accessed 20 February 2018).

23. The UN Security Council defined “foreign terrorist fighters” in Resolution 2178 as “nationals who travel to a State other than their States of residence or nationality, and other individuals who travel or attempt to travel from their territories to a State other than their States of residence or nationality, for the purpose of the perpetration, planning, or preparation of, or participation in, terrorist acts, or the providing or receiving of terrorist training, including in connection with armed conflict” (United Nations Security Council, Resolution 2178 [2014]: Adopted by the Security Council at its 7272nd meeting, on 24 September 2014, S/RES/2178 [2014]), www.un.org/en/sc/documents/resolutions/2014/shtml (accessed 20 February 2018).

24. The demographic and timeline data for each of the nine cases used in the test produced a matrix of forty variables, corresponding to 360 cells in the test spreadsheet. The test followed the template recommended for reliability testing in comparable studies; see Mary Joyce, “Picking the Best Intercoder Reliability Statistic for Your Digital Activism Content Analysis,” Digital Activism Research Project 243 (11 May 2013).


27. A Vietnamese-American convert, for example, was counted as ethnicity = Vietnamese, nationality = US, and religious status = convert. For further information about methodology, see Homegrown Terrorism: The Demographic Transformation of American Islamic Extremism, 1993 to 2013. Working Paper No. 1 (The Western Jihadism Project, Brandeis University, Waltham, MA, June 2014).


34. It is a fallacy to think that because terrorist extremists are often caught because of their activities on the Internet, they were also radicalized on the Internet. See: John Mueller and

35. The median value refers to the midpoint of the frequency distribution where there is an equal probability of falling above (lower 50 percent) or below the number (upper 50 percent). Another frequently used metric is the mode, which is the value that occurs most often. Reporting modes is not very useful in the case of a small dataset such as this one. An example will show why. If there are twenty arrests in one year, one involving five teenagers trying to go to Somalia and another three pensioners trying to blow up tankers at JFK airport, the most frequently occurring age values will be below twenty and above fifty-five. Each is in fact atypical for the data as a whole.

36. The difference between “not present” and “not known” is a methodological conundrum. A subject would be omitted from the study if the available documentation were insufficient to code dates for information about any cues in two stages in the model. If reliable information could be retrieved for a range of indicators but not on a particular indicator, we assumed that the specific behavior tracked by the cue did not occur.


41. Scott E. Page, "Path Dependence," *Quarterly Journal of Political Science* 1, no. 1 (2006): 87–115. Page's original formulation of this equation did not include the random variables for outcome and history, but he did explicitly allow for the generation of a probability distribution over the outcomes.

42. The state space consists of all the date features from Table 1 except for sentencing date, which characterizes the criminal justice system response rather than the radicalization process.

43. In the Klausen dataset, there were multiple instances in which an offender was coded to have exhibited two or more behavioral indicators on the same date due to the granularity available in source documents. For each of these individuals, the radicalization pathway contains additional segments to show how each indicator (even if they occurred on the same day) could be preceded or followed by other indicators. For the description of how the state transition diagram was constructed to account for these types of transitions, see Benjamin W. K. Hung, “A Graph-Based, Systems Approach for Detecting Violent Extremist Radicalization Trajectories and Other Latent Behaviors” (Ph.D. dissertation, Colorado State University, 2017): 232–235.