Waves of Extremism

A data analysis and visualization project focused extremist ideological trends in the U.S.

Chris Green – 3 March 2022

Introduction

Background

On March 1, 1971, a left-wing extremist group, the Weather Underground, successfully detonated a bomb in the Senate wing of the U.S. Capitol. Although no one was injured, the device caused hundreds of thousands of dollars in damage and further highlighted the threat from left-wing extremists protesting U.S. Government policies at the time.

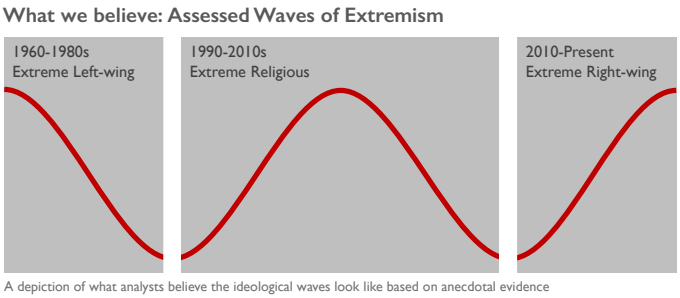
Clockwise from left: 1971 Capitol bombing, 1993 World Trade Center attack, 2017 Charlottesville car attack

On February 26, 1993, a truck bomb detonated in the parking garage beneath the North Tower of the World Trade Center in New York City. While the device failed to bring down the tower as planned, six people were killed and over 1,000 were wounded. The attack was conducted by an individual linked to a relatively new religious extremist group -- al-Qaida.

On August 12, 2017, a right-wing extremist drove his car into a crowd of people in Charlottesville, Virginia; killing one person and injuring 35 others. The targets of the attack were protesting the "Unite the Right" rally being held in Charlottesville that day.

In addition to these three examples, the University of Maryland has documented over 200,000 extremist attacks occurring between 1970 and 2019. Over 5,000 of these occurred inside the United States. These incidents cost countless lives and caused millions of dollars in damage.

Visualizing the problem on a large scale is challenging. Analysts and academics talk about "waves of extremism" in an attempt to describe the ideological motivation behind these attacks and how those motivations shift over time. The general idea is that the predominate ideological motivation for violence has moved from far left-anti-government in



A depiction of what analysts believe the ideological waves look like based on anecdotal evidence

the 1970's, to religious – Islamic extremism in the late 90's and 2000's, far right extremism today. The picture is one of "waves" over time.

These assessments have driven policy and resource decisions for programs to counter extremist violence. Between 2002 and 2017, U.S. Government spending on homeland security increased to roughly $61 billion per year (Heeley, 2018). Over $100 million will be allocated in 2022 for programs to prevent or respond to domestic violent extremism (Tucker, 2021). Understanding which ideological motivations are driving current incidents is essential to targeting these resources effectively.

$61 billion

Annual amount spent on Homeland Security between 2002 and 2017

$100 million

Amount allocated in 2022 for countering Domestic Violent Extremism

Purpose of Spending	Total FY2002 – FY2017	Percent Change FY2002 – FY2017
Border and Transportation Security	$379.1 billion	121%
Defending Against Catastrophic Threats	$94.3 billion	958%
Domestic Counterterrorism	$78.6 billion	59%
Emergency Preparedness and Response	$101.5 billion	33%
Intelligence and Warning	$9.7 billion	318%
Protecting critical Infrastructure and Key Assets	$313.7 billion	113%

Trends in Historical Homeland Security Spending by Purpose, Fiscal Years 2002-2017 (Heeley, 2018)

Research Questions

The research questions for this project are: "What shifts, if any, have occurred in the ideology of extremists conducting attacks in the homeland?" and "Can machine learning help identify ideological motivations for attacks?"

Methodology

The methodology for answering these questions followed the OSEMN framework described by Dr C.H. Lau in his 2019 article entitled "5 Steps of a Data Science Project Lifecycle." Dr Lau's steps were Obtain, Scrub, Explore, Model, and Interpret.

Obtain - I obtained the data directly from the University of Maryland website. The two datasets I used were available in Excel spreadsheets and had detailed codebooks that explained the categories and methods for collection.

Scrub - I had to scrub each dataset individually before I could combine them. The effort at this stage was accurately identifying and extracting incidents that occurred outside the United States. After joining the sets, I had to manually research over 200 extremist groups that had not been coded with a specific ideology. This meant researching their attacks and then assigning an ideology by hand.

Explore - Exploring the data was an exercise in slicing features and creating visualizations to highlight unique insights for each. This was also the time where I compared the actual data to the existing wave model.

Model - For modeling, I ran the cleaned data through a machine learning algorithm to see if this method could provide efficiencies for analysts trying to identify trends.

Interpret - Finally, this paper and the associated presentation were the mechanisms I chose for communicating the results of the analysis above.

Data Sources

The foundation of any data science project is the data. The data sources for this project are both from the National Consortium for the Study of Terrorism and Responses to Terrorism (START) at the University of Maryland.

The first source is the Global Terrorism Database (GTD) which provides data on worldwide extremist incidents beginning in 1970 and covering up to 2019.

The second source is the Profiles of Perpetrators of Terrorism in the US data base (PPT) which focuses on extremist groups and individuals who have conducted attacks inside the U.S.

Combining the datasets resulted in over 200,000 entries. Once the attacks outside the U.S. were removed, the resulting dataset had nearly 3,000 incidents with over 70 separate descriptive features for each.

Definitions

Created from definitions of terrorism (Falk, 2019 and Prabha, 2000)

Defining what is or is not a terrorist attack is an entire project unto itself. Different agencies of the U.S. Government have subtle differences in their definitions based on their desired outcomes. For this project, both the GTD and PPT define a terrorist attack as "the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation." To be included in the dataset, an incident must meet the following three standards (START, 2021):

- "The incident must be intentional – the result of a conscious calculation on the part of a perpetrator.
- The incident must entail some level of violence or immediate threat of violence -including property violence, as well as violence against people.
- The perpetrators of the incidents must be sub-national actors. The database does not include acts of state terrorism."

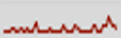
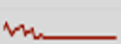
To further delineate terrorist incidents from other types of violence, the GTD and PPT also require that each event meet two of the following three criteria (START, 2021):

- "The act must be aimed at attaining a political, economic, religious, or social goal. In terms of economic goals, the exclusive pursuit of profit does not satisfy this criterion. It must involve the pursuit of more profound, systemic economic change.

- There must be evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) than the immediate victims. It is the act taken as a totality that is considered, irrespective if every individual involved in carrying out the act was aware of this intention. As long as any of the planners or decision-makers behind the attack intended to coerce, intimidate or publicize, the intentionality criterion is met.
- The action must be outside the context of legitimate warfare activities. That is, the act must be outside the parameters permitted by international humanitarian law, insofar as it targets non-combatants."

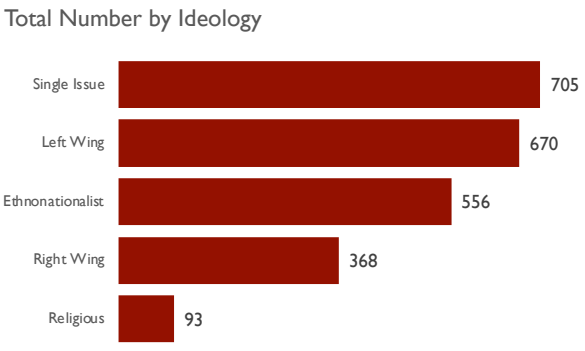
Ideological Motivations – Why did they conduct the attack?

Having established the project's definition of terrorism and the criteria for data inclusion, we can begin to explore the data. The PPT categorizes attacks and perpetrators into five "Dominant Ideologies." While many groups or perpetrators may have multiple levels of ideological motivation, the dominant ideology is defined as "the perpetrator group's raison d'etre – that is, it should capture the group's most important goal" (START, 2019). These ideologies are extreme right-wing, extreme left-wing, religious, ethnonationalist/ separatist, and single issue.

50 year Trend	Ideology	Definition (START, 2019)
	Extreme Right-wing	"Extreme right-wing perpetrator groups are those that use violence to achieve their goals and believe that one's personal and/or national "way of life" is under attack and is either already lost or that the threat is imminent (for some the threat is from a specific ethnic, racial, or religious group)."
	Extreme Left-wing	"Extreme left-wing perpetrator groups want to bring about change through violent revolution rather than through established political processes. In addition, this category includes secular left-wing groups that rely heavily on terrorism to overthrow the capitalist system and either establish "a dictatorship of the proletariat" or, much more rarely, a decentralized, non-hierarchical sociopolitical system."
	Religious	"Religious perpetrator groups are those that use violence to achieve their goals and seek to smite the purported enemies of God and other evildoers, impose strict religious tenets or laws on society (fundamentalists), forcibly insert religion into the political sphere (i.e., those who seek to politicize religion, such as Christian Reconstructionists and Islamists), and/or bring about Armageddon (apocalyptic millenarian cults)."
	Ethno-nationalist/ Separatist	"These are perpetrator groups that have used violence to achieve their goals and are regionally concentrated with a history of organized political autonomy with their own state, traditional ruler, or regional government, and who are committed to gaining or regaining political independence through any means and who have supported political movements for autonomy at some time since 1945."
	Single Issue	"Single issue perpetrator groups are those that rely heavily on violence motivated by very specific or narrowly-defined causes of various sorts. This category includes groups from all sides of the political spectrum."

The first three dominant ideologies (left-wing, right-wing, and religious) are the ones I will use to compare to the existing assessment of ideological trends later in the paper.

The ethno-nationalist trend nearly matches the left-wing trend with a peak early in the time period and a taper thereafter. This makes sense given that the focus of these groups often overlapped – with left-wing extremists often supporting the nationalist revolutions the ethno-nationalists were fighting for.

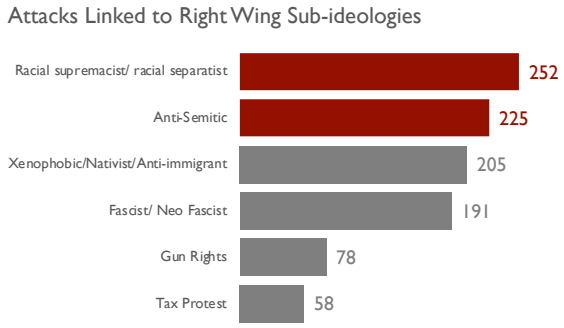


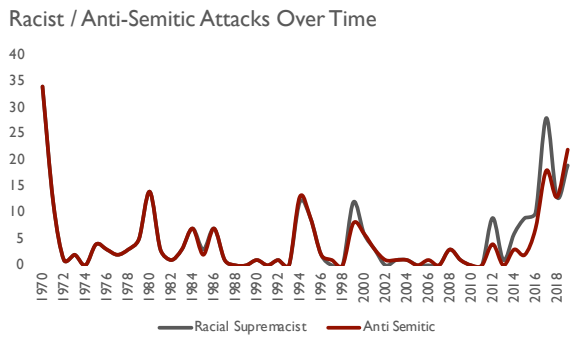
The single issue ideological trend has a fairly steady heartbeat. This category acts as a "catch-all" for the attacks that met the criteria for inclusion in the data but did not meet the definitions of the other ideological categories.

Key Sub-Ideologies

While this project focused on the dominant ideologies, there were a few key sub-ideologies that merited further analysis as a means of providing context to the larger ideological motivations. The only one without was the ethno-nationalist ideology because there was no subordinate motivation for those attacks. For each of the other dominant ideologies, I decided to look closer at their top two sub-ideologies.

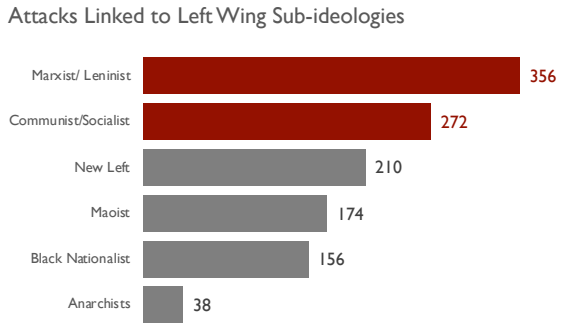
Extreme Right-wing Sub Ideologies

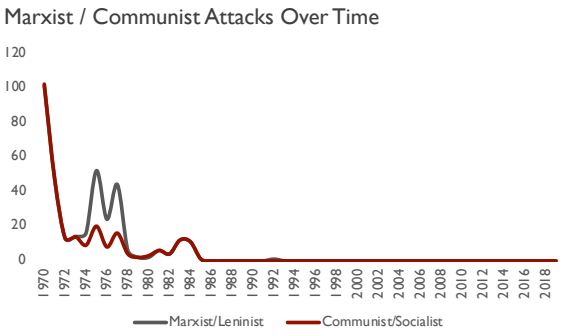




Extreme right-wing sub-ideologies were dominated by racial issues or anti-Semitism. This was followed closely by xenophobic or anti-immigrant ideologies. The overlap generates a picture of an ideology dominated by extreme views on racial and social supremacy. The attack trend for these sub-ideologies mirrors the broader trend for right-wing extremism. Notably, however, the rise in the number of attacks for these sub-ideologies is more pronounced.

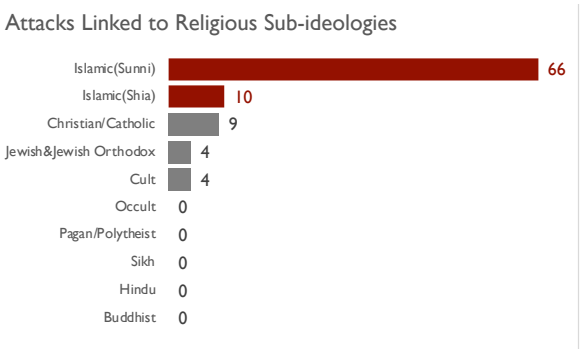
Extreme Left-wing Sub Ideologies

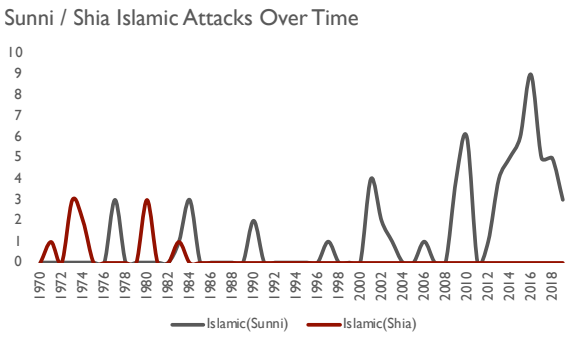




For left-wing sub-ideologies, the bulk of the focus was on Marxism/ Leninism and Communism/ Socialism. The trend for attacks linked to these sub-ideologies mirrors the broader left-wing trend. Both of these drop from favor with the end of the Cold War and dissolution of the USSR.

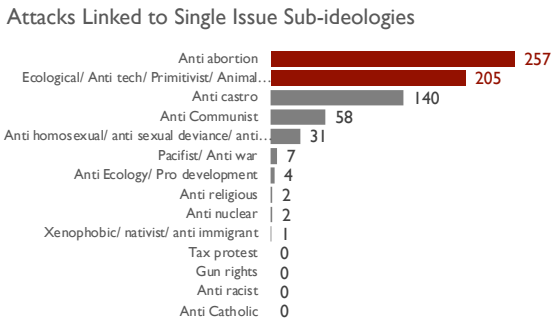
Religious Sub-ideologies

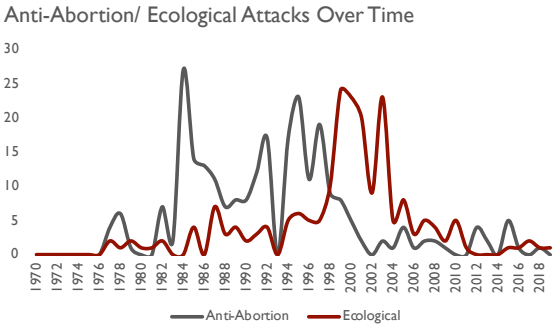




Attacks motivated by religious sub-ideologies were fewer in number. Not surprisingly, Shia and Sunni Islamic extremism topped the list. Shia extremist attacks peaked during the period surrounding the Iranian Revolution while Sunni extremist attacks took off after 9-11 and have continued since.

Single Issue Ideologies



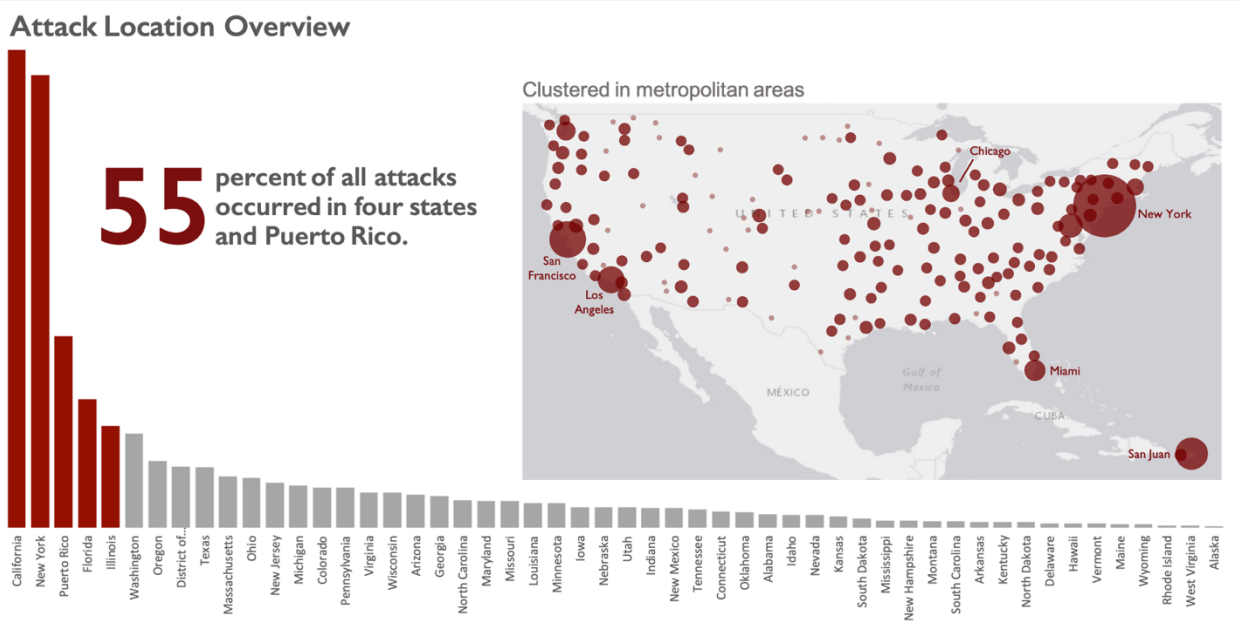


When we look at single issue sub-ideologies, it is anti-abortion and ecological motivations that made up the bulk of attacks. While neither have a clear trend line, anti-abortion motivated attacks began growing after the 1973 Roe v. Wade decision and eco-terrorist attacks gained prominence beginning in the mid-1990's.

Key Features – What do the incidents look like?

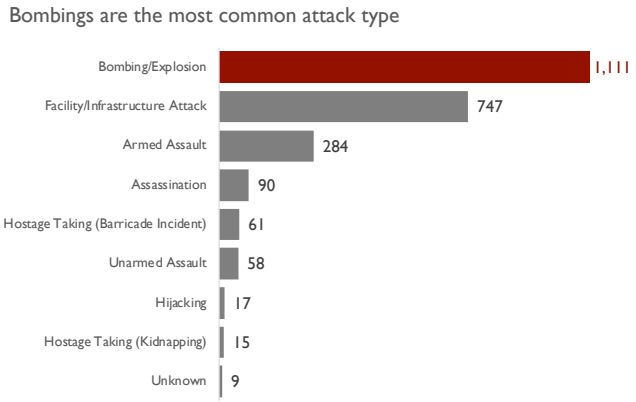
Location

During the 50 year period from 1970-2019, every state experienced at least one extremist attack. Alaska had the fewest with only one and California had the most with over 460.



Four states (California, New York, Illinois, and Florida) and Puerto Rico made up over half of the total attacks. Within these, it was the metropolitan areas of San Francisco, Los Angeles, New York City, Chicago, Miami, and San Juan that contributed the most to their attack numbers.

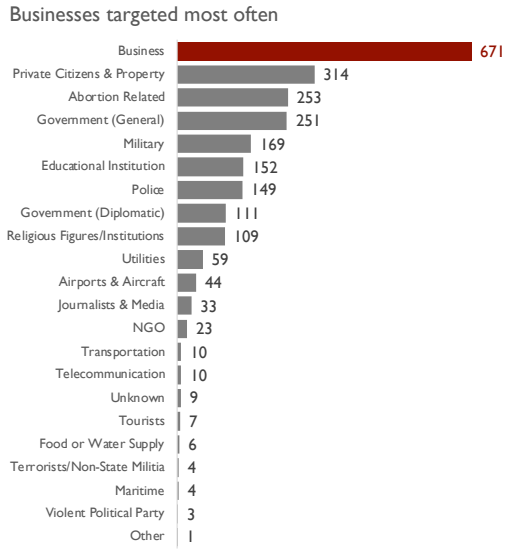
Attack Type



Ideology	Preferred Attack Type
Extreme Right-wing	Armed Assault
Extreme Left-wing	Bombing
Religious	Armed Assault
Ethno-nationalist/ Separatist	Bombing
Single Issue	Facility/ Infrastructure Attack

Bombings were the most common attack type. This makes sense given that they were the preferred attack for left-wing and ethnonationalist extremists and these two groups were the most prolific attackers during the period.

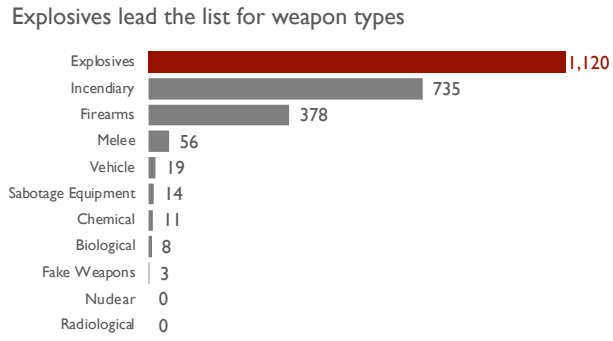
Target



Ideology	Preferred Target
Extreme Right-wing	Private Citizens
Extreme Left-wing	Business
Religious	Private Citizens
Ethno-nationalist/ Separatist	Business
Single Issue	Abortion-related

Again, the predominance of left-wing and ethnonationalist attacks made their targets, businesses, the most prolific targeting choice.

Weapons

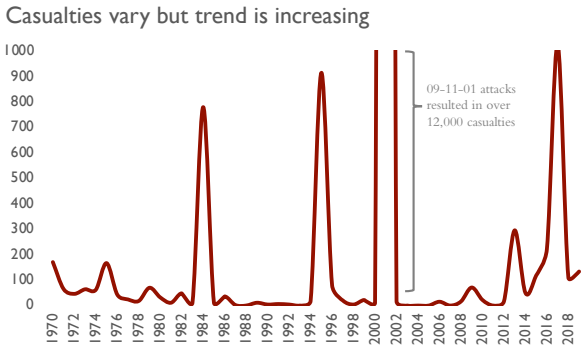


Ideology	Preferred Weapon
Extreme Right-wing	Firearms
Extreme Left-wing	Explosives
Religious	Firearms
Ethno-nationalist/ Separatist	Explosives
Single Issue	Incendiary

The choice of weapons matched up to the dominant attack type (bombings). Explosives led the list. When tied with incendiary devices, over 80% of all attacks involved one of these two methods.

Casualties

Ideology	How likely is an attack to generate casualties?	How many casualties could they cause per attack?
Extreme Right-wing	**38.32%**	**6.50**
Extreme Left-wing	15.52%	0.45
Religious	**54.84%**	**3.76**
Ethno-nationalist/ Separatist	16.01%	0.76
Single Issue	12.91%	0.45
All Ideologies	19.9%	1.58



Finally, exploring casualty data revealed some different trends. While left-wing, ethnonational, and single issue motivations dominated the overall numbers and many of the previous attack characterizations, they did not generate the largest number of casualties. This could be intentional, or it could be linked to their choice of targets.

Even after removing the large numbers of dead and wounded during the 9-11 attacks, religiously motivated attacks were the most likely to generate casualties with right-wing attacks following closely. Both motivations exceeded the number of casualties per attack by far and outpaced the average across all five ideologies.

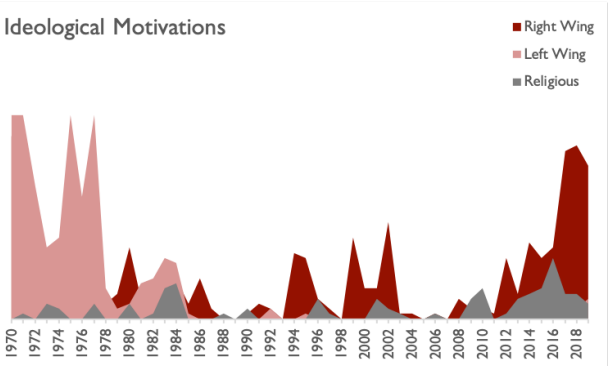
Comparing Ideological Waves

The Current Assessment

A depiction of what analysts believe the ideological waves look like based on anecdotal evidence

So, having looked at the motivations and the characterization of the attacks during the period, we can go back to our first question of what do the waves or ideological trends look like. Here again is out current assessment with three clean waves from left-wing, through religious, to right-wing.

The Actual Wave



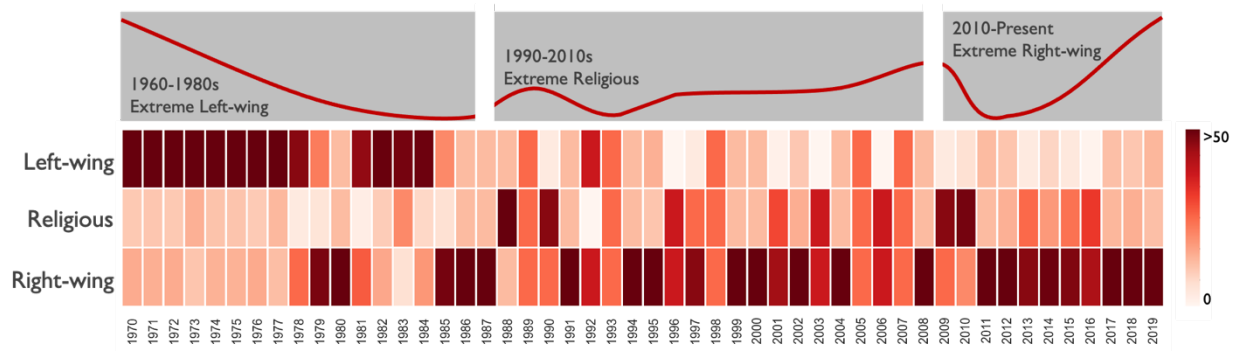
Using the data from the GTD and PPT, we can create a similar view of the period and see if the ideological waves follow the assessed pattern. While the data included five dominant ideologies (right-wing, left-wing, religious, ethnonationalist, and single issue), I only looked at the three ideologies used in the

assessed wave – right, left, and religious. In this case, the extreme left-wing incidents seem to follow the assessment closely. The extreme right-wing incidents seem to match up as well. The religiously motivated incidents are not as pronounced as the assessed waves would have us expect. Overall, the picture is not as clear as I had hoped.

Revisiting The Research Question

To improve the accuracy of our assessment, I needed a different method. Combining the visuals and plotting the attacks in a time-based heat map gives us a better picture of what is happening.

The original research question was "What shifts, if any, have occurred in the ideology of extremists conducting attacks in the homeland?" The standing assessment, or analytic line is that there have been three waves of ideological motivation – extreme left-wing, religious, and now extreme right-wing. Using the GTD and PPT data, we can see that reality does not quite match the simplicity of this assessment.



Attacks motivated by extreme left-wing ideologies do drop off in the early eighties. Many left-wing extremists were inspired by the battle for civil rights and the protests against the Vietnam war. Unsurprisingly, when these became less of an issue, the activities of these groups decreased as well.

At the other end of the timeline, extreme right-wing groups have increased their activities since 2010. However, this is not a new phenomenon, as these groups have consistently conducted attacks in some form since 1990. This wave was there longer than we thought. It just grew faster in the last decade.

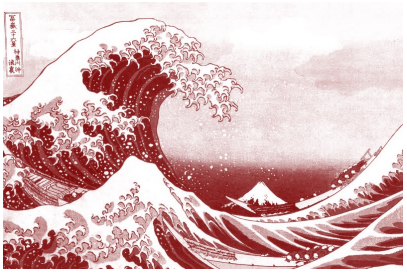
In the middle period are the attacks motivated by religion. The wave is not as pronounced and the number of attacks is not as high as the others. Why then, do analysts assess this as the "second wave" of extremism? There a number of possibilities. The waves analysts see may be global but not local. What this means is that the wave of religious extremism during the period in question may have been more pronounced overseas and less pronounced within the U.S. This led analysts to assume that the wave would be the same in the homeland. While it was slightly elevated, it was much smaller at its peaks than the waves of extreme left and right attacks. The other possibility is simple exposure and impact. This is sometimes labeled as the "illusion of validity" where we see an outcome based on consistent data despite the fact that we lack detail (Kahneman, 1973).

Religiously motivated extremism was a rising topic after the 1993 World Trade Center attacks and only increased as we moved to September 11, 2001 and then into the wars in Afghanistan, Iraq, and Syria. Based on coverage and numbers of deaths, analysts felt this had to be a wave, and it probably was. It just was not a wave that was as pronounced here inside the homeland as many analysts thought.

The pattern we do see in the data is that extremist attacks inside the U.S. spike during times of national division. Whether it was the schism caused by civil rights and Vietnam driving left-wing extremists to take up arms, or whether it is right-wing extremists who feel disenfranchised in the modern political climate and are seeking to gain more influence. The activities of both sides seem to reflect the political divides of the times.

Improving Wave Detection

The Problem


The Great Wave Off Kanagawa by Katsushika Hokusai, 1831

One of the keys to surfing is seeing the wave early so you can start to paddle before it gets to you. If you don't do this you risk missing the wave entirely as it rolls under you, or, the worst outcome, you get crushed by the wave when it breaks on top of you. Planning a government response to extremism is similar. You need to identify the next threat (wave) early enough to plan resources (paddling) for countering the threat.

The current state of data collection and analysis on violent extremist ideologies is slow. The actual data is three years behind. There are local repositories in different agencies on more current incidents, but there is not a comprehensive, real-time effort to watch for the next wave.

The reasons for this are many, with the largest being that identifying the true ideological motivation behind a given attack is often difficult. Why humans do things is inherently complex. For example, if a student expresses an affinity for WWII history, writes about supporting the beliefs of Adolph Hitler, and then conducts an armed attack on fellow students at school, is that an extreme right-wing ideology motivated attack? Or is it just because he was bullied and isolated at school and wanted revenge?

These questions and others contribute to analysts having to generate a picture for leaders based on what they see or feel from their individual position.

Experimenting with a Machine Learning Solution

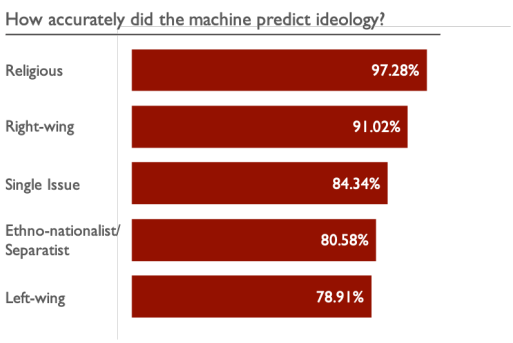
Despite the challenges with identifying motivation, the ability of computers to recognize patterns in data may make it possible to at least point analysts and policy-makers in a given direction and begin to identify the next wave quicker. Individual incidents will never be 100% predictable, but

the aggregate of cases could show the impending arrival of a new ideological wave. Using machine learning may provide that early identification.

To test this, I applied a supervised machine learning method to the existing data on attacks between 1970 and 2019. Supervised machine learning is where I show the computer a portion of the dataset to "teach" it what right looks like. I tell it what the inputs are and what the output should be. It learns that when it sees variables "A, B, and C," the resulting output is "D." Once this is done, I give the machine a set of data without the answers and ask it to look at the patterns and identify the output. Then I grade its work and identify how accurate it is. Granted, a human can do this analysis in small bits over a long time. The advantage of the machine is speed and volume.

The method I chose is called "K Nearest Neighbors" or KNN. Using this method, the machine looks for patterns and then classifies its answers based on where its answers fall most closely – the "nearest neighbor." The challenge for this effort was that I needed to have the machine identify which of the five dominant ideologies a given incident may fall under. To solve this, I created a run for each ideology. This allowed me to ask the machine to provide a binary or yes/no answer to the question of which ideology most likely motivated a given attack. To confirm if I was on the right track, I used a cross validation method and tested the data using four other methods to ensure the KNN results were not outrageously far off.

The results of the experiment with this method were mixed. The accuracy of the machine's answers ranged roughly around 80-90%, but the machine's accuracy for identifying religiously motivated attacks was over 97%. This sounds great, but it is more likely that there is a variable in the data that is pointing too closely to the answer and essentially allowing the machine to "cheat." The system also identified some other machine learning methods that may produce slightly better accuracy, but none of them seemed to significantly outpace the chosen KNN method.



Future Improvements – More Data!

Data scientists love more data like a skateboarder loves Red Bull. We can never get enough. Aside from identifying the "rogue variable" that is boosting the accuracy for identifying religiously motivated attacks, more data on things like the perpetrators could help increase confidence of the model outcomes. While trying to avoid any accusations of "profiling," there are some backgrounds, age groups, nationalities, economic levels, that do seem to anecdotally match to certain ideologies. Having this data may help the machine refine its pattern for certain types of motivation.

Conclusions – Waves, Machines, and Ideological Threats

Waves do exist but they are more rogue than predictable

The current assessment of waves of extremism is largely correct although it may be overly simplistic. Extreme left-wing attacks did drop off during the period in question. Religiously motivated attacks did increase in the late 90's and early 2000's, but have not completely dropped off as described. Extreme right-wing linked incidents are on the rise, but they have been rising longer than originally assessed. Accurately targeting counter-violent extremism resources requires more detail than an anecdotal wave chart.

A classifying algorithm can tip and cue analysts but needs more detail

Using machine learning to classify the motivations behind extremist attacks can help analysts look for upcoming waves but should not be used to strictly analyze individual attacks. If the machine is increasingly pointing to a single ideology over a given time, that can cue analysts to look deeper at what is going on. This is the equivalent of a fellow surfer saying "hey man, I think I see a wave building out there." Having more detailed data, particularly about the perpetrators of attacks, will help the machine give more confident warning.

Right Wing extremism is becoming the greatest ideological threat

Extreme right-wing motivated attacks are on the rise. Events like the 2017 Charlottesville incident or the January 6, 2021 attack on the U.S. Capitol highlight the threat from groups and individuals motivated to violence by their belief in this ideology. This wave of extremism began growing steadily over eight years ago. We largely "missed" this wave and are now paddling furiously to keep from letting it get away from us. As we go forward it will be important to not just talk anecdotally about these waves, but to actually sit up on our board, use all the tools available, and identify them as early as possible.

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