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Domestic Radicalization of Women

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2020

OVERVIEW SUMMARY
FINAL

THE CREATION OF
MUHAJIRAT IN AMERICA:

SOCIAL MEDIA AS A
PLATFORM FOR
CRAFTING GENDER-
SPECIFIC
INTERVENTIONS FOR
THE RADICALIZATION OF
WOMEN

AWARD: 2016-ZA-BX-K002



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ABSTRACT: THE CREATION OF MUHAJIRAT IN AMERICA

The impetus for our study was two-fold: first, to inform the field of terrorism risk assessment specifically as it pertains to women; and second, to create a dynamic, multi-dimensional risk model for use by the intelligence community (IC) in monitoring at-risk individuals according to their fluctuating levels of threat over time. Derived from earlier theoretical work using the Situational Action Theory, we empirically explored the application of a Moral-Situational Action (MSA-EV) risk model of extremist violence to determine its usefulness in identifying women, who have become radicalized, and through this radicalization actively sought involvement in direct action related to violent extremism. The MSA-EV risk model contains three domains reflective of *propensity*, *mobilization*, and *capacity building*, which were coded quantitatively and qualitatively using a 41-page protocol made up of bilateral risk and protective factors and case narratives for vulnerability and scenario-based analyses. The model was assessed using 300 women that were selected from a total sample of 1,462 women identified as being involved with extremist violence. The second primary component of the project examined the reaction of a sample of conservative, liberal and Muslim women aged 18 through 35 to jihadist, alt-right, and alt-left propaganda using eye-gaze, pupil dilation, galvanic skin response, and facial emotion recognition along with self-report assessment of their emotions, cognitions, and arousal states when viewing the material. Their responses indicated that our sample of 45 women experienced different neurophysiological responses to different types of propaganda and that their responses to horrific images of violence were suggestive of a specific autonomic responses that appeared to be unconscious and which may serve a role in the unconscious internalization of extremist ideas and ideologies. This process could be distinct from and uninformed by rational thinking and logical decision-making. These findings are significant to the intelligence community (IC), and respond directly to the conclusions of the National Academies of Sciences, Engineering, and Medicine (2019), that emphasize the need for cutting-edge research from the social and behavioral sciences at a time when technologies and national security concerns are evolving at lightning speed. Specifically, the study has provided a practical framework for improving the understanding of the evolving ways in which adversaries influence the hearts and minds of people and the ways individuals are drawn into radicalization and extremism that condones civilian violence.

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Study One: The Moral-situational Action Risk Model of Extremist Violence in Women

On December 2, 2015, Tashfeen Malik, a 29-year old resident of San Bernardino, California, posted her online support of Abu Bakr Al-Baghdadi on Facebook before she posted her online support of Abu Bakr Al-Baghdadi on Facebook as she entered the Inland Regional Center, and assisted her husband, Syed Farook, in killing 14 civilians and seriously wounding 22 more. Some months earlier, two Somali-American sisters aged 15 and 17, and their 16-year-old friend of Sudanese descent, had been detained by German officials based upon a tip from the FBI as they were seeking to travel from their homes in Denver, Colorado to Syria. These actions reflected their prior engagement online with Umm Waqqas, a nom de guerre believed to belong to a woman and one of three accounts listed as a contact for those seeking to travel to Syria in the Islamic State's (IS) 2015 guidebook, *Hijrah to the Islamic State*.

However, fast-forward three years, and the landscape of the jihadist movement has changed, with 1,500 foreign women and children being held in the al-Hawl refugee camp in Syria. These women are described as falling into three gang-like groups made up of Russians, Tunisians, and a combination of other westerner countries. Hoda Muthana, the only American-born person being held at the camp, has recently expressed her deep regret for having traveled to Syria in 2014 to join the terror group and has conveyed through various news outlets that she is pleading to be able to come home with her 18-month-old son to join her family in Alabama. These sentiments appear sincere despite her previous role as one of IS's most prominent online agitators with her Twitter feed characterized as having been "full of bloodcurdling incitement" in which it she would call for the blood of Americans to be spilled (Chulov & McKernan, *The Guardian*, February 17, 2019). As she now holds her little boy in her arms, the progeny of her third marriage in Syria, Ms. Muthana acknowledges her prior arrogance. She says that she was brainwashed and as she began to realize her mistake, she has left her friends and now she is alone, asking the United States to give her a second chance.

These events were illustrative of concerns that served as the impetus for the current research - not only the growing threat of terrorist violence in the US but also the substantial involvement of women in it. Reports suggest that Ms. Malik was instrumental in the radicalization of her husband, that she carried the weaponry to the Inland Regional Center, and that she was first to open fire on the civilians who were meeting socially in the center at that time. Moreover, she committed herself to these acts knowing that she was leaving behind an infant daughter to be cared for by her mother-in-law, an older woman who had been present in the home as the planning for the attack unfolded around her over a significant period of time. The three young women from Colorado believed that they were traveling to Syria to marry and support the caliphate through procreation,

having been aided in their plans by an IS recruiter who used social media to support and guide them in the radicalization process and their efforts to plan a covert trip to Syria.

The unexpected contours of this emergent threat have been further complicated by the growing presence of white nationalists and supremacists in America. Believed by some to have been fed by the highly contested dynamics of the presidential election in 2016, issues of free speech have begun to provide fertile ground for increasingly violent interchanges between the liberal left and the alt-right. While initially reflective of certain populist beliefs, the alt-right label has begun to be associated with white supremacy groups such as the Ku Klux Klan, neo-Nazi groups, and other white hate groups banding together to support a racist agenda. Over time, these groups have integrated pro-white sentiments into an ideology referred to as Pro-European. Professing hostility and discrimination against black Americans, Jews, immigrants, and LGBTQ+ persons, these groups started to hold rallies that initially threatened violence and then erupted into violence in Charlottesville, VA in August of 2017. Discriminating against black Americans, Jews, immigrants, and LGBTQI persons, these groups started to hold rallies that initially threatened violence and then erupted into violence in Charlottesville, VA in August of 2017. The “Unite the Right” rally that took place on August 12, 2017 resulted in the death of one woman, two men, and the injury of many more. While reflecting a predominately male membership, and a conservative stance on the role of women in society, these groups have also attracted a significant female contingent, which adheres to an anti-feminist stance and has a prominent online presence, using sites like Twitter, YouTube, Reddit, and WhatsApp to communicate their anti-feminist ideas. George Hawley, author of *Making Sense of the Alt-Right*, estimates that 20% of alt-right supporters are women (2017).

Despite the compelling nature of the transformations observed in these women and their commitments to pathways that support violence both directly and indirectly, research has been slow to delve deeply into domestic and international radicalization, specifically as it pertains to women. In May 2015, the United Nations Security Council estimated that more than 25,000 foreign fighters from more than 100 countries had joined IS, with approximately 5,000 of these individuals believed to be European citizens or residents. Hoyle, Bradford, and Frenett (2015) in their study of female Western migrants to IS, referred to as “muhajirat,” estimated that as many as 550 of these women came from Europe. Closer to home, in May 2015, FBI Director James Comey referenced “hundreds, maybe thousands” of IS sympathizers and potential recruits across America (Johnson, 2015a, p. 1). As part of their report, *ISIS in America: From Retweets to Raqqa*, Vidino and Hughes (2015) released the court records of 84 individuals charged with IS-related activities in America, 10 of whom were women. They describe monitoring 300 American supporters of IS on Twitter, with nearly a third of the tracked

accounts purportedly being operated by women with much of their communication occurring in English.

The obvious oversights in our understanding of the radicalization of women to extremist violence prompted the evolution of our theoretical and empirical research over the past three years. This effort began with the development of a risk paradigm for assessing the radicalization of women over time. The paradigm was developed specifically for women, designed to integrate theory and clinical narration into the process of an empirically-based risk model, and sought to use material available on the surface and dark web to facilitate the identification and collection of information relevant to an iterative process of assessing relative and fluctuating levels of violence risk. The goal was to create a risk model to be used by various members of the IC to better monitor and intervene in instances of concern regarding the threat for domestic and international terrorism. Further, we sought to provide a structure for identifying relevant intervention points for mitigating risk as an individual began to manifest behavior suggestive of a significant threat within the United States or elsewhere. Nearing the end of the data collection, we initiated a small pilot study with the FBI's Counterterrorism Behavioral Analysis Unit (BAU1), to compare coding conducted at the University of Virginia using open source information only with coding of the same cases adding classified information available to crime analysts assigned to that unit.

The Moral-Situational-Action Model of Extremist Violence (MSA-EV)

In developing the Moral-Situational-Action Model of Extremist Violence (MSA-EV), we sought to identify a theoretically-based model of violence risk assessment that would combine empirical analyses with narrative formulations to provide direct guidance to crime and intelligence analysts responsible for preventing acts of extremist violence. We were aware that over the past 35 years, the fields of violence risk assessment and threat assessment had evolved along relatively distinct and separate trajectories, with practitioners in each arena remaining cognizant of research and writing in the field of the other, but largely separated by discipline, purpose, and the primary intent of the assessment being conducted. The goal was to combine the best from each of these fields with a theoretical foundation to enhance replication of the model with diverse groups while ensuring the model's operational significance across the different domains of the intelligence community.

In the development of our model, we turned to Wikström's (2004) Situational Action Theory (SAT) of crime and integrated its basic tenant with prior work on risk assessment, threat assessment, and terrorism by Randy Borum (2015), John Monahan (2012, 2015), Monica Lloyd and Christopher Dean (2015), Caroline Logan

(2017), and Robert Fein and Bryan Vossekuil (2000). Specifically, we sought to integrate the theoretical tenets of SAT — which include propensity, mobilization, and action and capacity-building — with established principles of risk and threat assessment; to create a framework that defined and embedded protective and risk factors on each dimension of analysis ensuring that interventions emerged holistically from the assessment process; and to ensure the integration of quantitative and narrative data so as to best gauge the behavior, motivation, and vulnerabilities of particular individuals at a particular moment in time. This process has been described in detail previously (Warren, Leviton, Reed, Saathoff, Patterson, Richards, & Fancher, 2018) and is presented diagrammatically below.

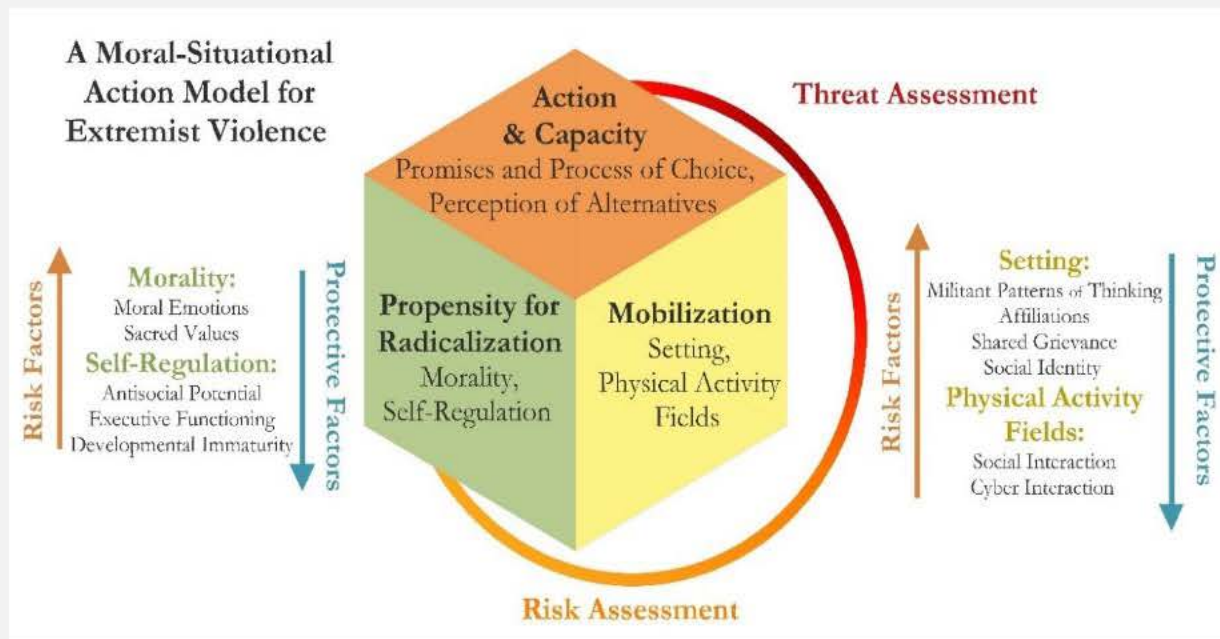


Figure 1: A paradigmatic presentation of the Moral-Situational Action Model for Extremist Violence

As reflected in the model and illustrated in the diagram above, *propensity* was defined as the individual’s moral values and self-regulatory capabilities associated with personality and development that created a susceptibility to radicalizing content and ideas. The term *mobilization* was designed to capture the interaction of the individual with their social settings and the physical and cyber activity patterns that emerge from these interactions, potentially giving rise to changes in the individual’s social affiliations, sense of shared grievances, militant forms of group thinking, and social identity, each of which might serve to increase the risk for involvement in extremist violence. *Capacity-building* was defined as actions that precedes and supports action, emerging swiftly or more gradually, and potentially varying over time based on the individual’s evolving perceptions and processes of choice (Warren et al., 2018). These risk and/or protective factors were further combined with a risk formulation that was narrative

in nature. The narrative segment of the model was built upon the work of Borum (2015) who recommended including a behavioral history analysis, a motivational analysis, a vulnerability analysis, and a formulation analysis in an inclusive violence narrative.

Study Goals and Hypotheses

The goals of our study are three-fold and are both empirical and theoretical in nature.

1. To apply the *Moral-Situational Action Model of Extremist Violence* (MSA-EV) to a sample of women involved in various types of extremist ideologies and actions to assess the significance of each dimension (i.e., *propensity*, *mobilization* and *capacity-building*) to the outcome associated with each women.
2. To examine the relevance of each risk/protective factor to its assessment domain, for example the association between and relevance of moral emotions, sacred values, antisocial tendencies, and executive functioning/developmental maturity to an assessment of *propensity*.
3. To determine the interactions occurring between each component of the model as it informs levels of risk but actually the W does that help else has little to do as good looking good is always a will securely him for each subject according to their specific type of involvement in extremist violence.

We were intent upon ensuring the integrative integrity of our model with the theory driving the data collection, the risk and protective functions being combined for each assessment component, and quantitative data being expanded upon through the use of various types of narrative summaries.

We hypothesize that each domain will contribute to the classification accuracy of the MSA-EV model. Further, we hypothesize that the use of the MSA-EV with 300 extremist-involved subjects will demonstrate a classification accuracy into High Risk Categories (HRC) and Medium/Low Risk Categories (MRC/LRC) that is significantly better than chance.

Methodology

Sample: Our study sample was made up of 300 women chosen from a larger group of 1,468 women identified as having been involved violent extremism. For inclusion in the sample of 300 women, the following conditions were necessary: 1) the subject's legal identity was known; 2) the circumstances of the subject's involvement in violent extremism were clear; 3) the subject's involvement was significant enough to warrant criminal charges; and 4) there was sufficient information in the subject's folder that gave the researcher a sense of her personality and decision-making process.

The 300 subjects in our sample were involved with 58 distinct violent extremist groups; were originally from every continent except Antarctica, 45 countries in total. The majority of the subjects (61.5%) in our sample were 25 years of age or younger when they first became involved in an extremist organization. Of these subjects, 21.5% were known to have died as a result of their involvement in extremist activities.

Data collection. Sources were saved as Microsoft Word documents and PDFs, which were saved online on an encrypted web platform (UVA Box). Each subject identified online was added to the Female Terror Database (FTD), and a folder was created for her on the Box platform to store sources about her. Within her folder, sub-folders were created to house background information about the subject and social media information about the subject. Researchers were instructed to not add redundant information to each subject's folders. In other words, documents were only saved if they contained new information about the subject. Researchers were further instructed to search for as much insight into the subjects' lives as possible, including but not limited to: childhood information, romantic relationships, criminal histories, causes of death, socioeconomic indicators, et cetera. Interestingly, but not surprisingly, much of the information about our subjects was found by searching for them in terms of their husbands, brothers, and fathers. The subjects' background information folders include media coverage, court documents, photographs, books, videos, websites, and interviews. After background sources were collected, researchers were asked to search online for subjects' social media accounts using the Social Media Coding Form.

Instrumentation. Two primary instruments were used in the collection and coding of the relevant information.

Social Media Coding Form. The Social Media Coding Form, a seven-page tool including instructions, queried the coder about any material generated by or pertaining to each subject on Facebook, Twitter, YouTube, VKontakte, Pinterest, Tumblr, Reddit, Ask.fm, 4Chan, dating sites or any other platforms found to be relevant to a particular subject. These data were collected using screen-shots and saved with labels identifying the risk/protective factor that each image appeared to most directly illuminate.

The social media accounts, blogs, and personal websites related to each subject were uploaded to their online communications folders on Box. Social media research accounts were created for our researchers to search for posts and profiles of the subjects and social media platforms were contacted and made aware of our research. We were not interested in collecting the entirety of any subject's social media use; instead, we instructed our researchers to read through the MSA-EV risk assessment module and only save information which pertained to it. Of note, when we began this endeavor, there was very little social media censorship of any non-jihadist social media accounts; however, with the events of the election of Donald Trump and the Unite the Right rally in Charlottesville, VA, social media platforms began censoring far-right content more and more frequently.

Beyond using special research accounts for our social media searching, we also made research computers available to our social media researchers. Researchers were free to use their personal computers when searching on the open internet if that was their preference; however, all searches on the dark web were required to be conducted on the research computers. The Chief Security Officer at UVA granted permission for us to search on the dark web for this study and installed Tor on each of our research computers. However, certain strict guidelines were required of each coder including that they not use any personal information online; that they have no direct contact with any other online users; and that they needed to report to the research manager if they encountered a person whom they believed were a potential risk to themselves or others.

MSA Risk Formulation Coding Protocol (MSA-RFCP). Each of the 300 subjects were coded using the MSA Risk Formulation Coding Protocol, a 41-page Microsoft Word document with 496 empirical variables, an expandable section for screenshots and photographs, and a risk narrative section structured according to ten topics and four different types of descriptive analyses. The MSA-RFCP was accompanied by a 35-page coding manual and a narrative compilation memorandum. When coding the MSA coding instrument for each subject, we sought to fully explore all open source information available concerning them, including a structured catalogue of their online activities, photographs and preferred images, personal writings and references, available media reports, and referenced interactions with others. The coding of each risk/protective factor also included a summary of information, images and/or social media posts that served as the bases for the coding of each risk/protective factor.

Each of the ten research assistants who coded the sample of 300 women underwent a two-day training before they began coding. Each coder was given in-depth specific feedback for their coding of the training case. From there, coders were assigned between three and five subjects to code each week with each case requiring approximately eight hours to complete. The first five completed risk assessments for each coder were reviewed and provided feedback for by the research manager. Seven reliability cases were selected to represent various ideological backgrounds and had robust information about each subject. Ultimately, each protocol and its final risk coding was examined by one of the two research managers before being authorized for data entry. Our reliability across the two research managers based upon the final risk coding and using percent agreement was 71.8% with this varying from a low of 50 percent to a high of 87.5 percent across the seven reliability cases. The one case that resulted in a reliability of 50% involved a subject who had left an extremist group and begun a self-help group for other women involved in it. One of the research managers coded the case based only on the subject's behavior manifest during her period of radicalization, while the other coded her beliefs and actions based upon her final resolution and exist from the extremist group in which she had been involved.

Outcome Measures/ Action Roles and Risk Category. Based upon the totality of the information that was available on each subject, we identified their actions roles within their primary organization of choice.

The categories included plotters, supporters, travelers, being necessary agents of state building, active recruiters, conveyors of image/propaganda distributors, and direct action. Each of these action roles could be coded as: (1) never attempted but aspirational; (2) attempted but failed; and (3) attempted and successful. To address relative levels of risk, we assigned each subject to a single action role that seemed to indicate her highest level of involvement

Our data analyses followed three lines of inquiry. First, we used descriptive statistics to examine the content validity of our model by assessing the relevance and presence of the *propensity*, *mobilization*, and *capacity-building* variables among our study sample of women. Second, we examined the theoretical relevance of each domain by using logistic regression to examine the accuracy of each of the three domains in differentiating subjects identified as being of high or medium/low risk. All variables found to be statistically significantly different between the HRC and the MRC/LRC were entered into the logistic regression analyses for each of the three model domains. Third, we used area under the Receiver Operator Characteristics curve (AUROC) to assess the specificity and sensitivity of the three domains separately and as a total model score to assess the classification capability of each of these domains and the combined MSA-EV model. In all of the data analyses, missing data were excluded and statistics were only computed with validated data in the specified ranges for all variables in each table. In order to assess the relevance of the various factors included in the MSA-EV, we chose to analyze each variable in terms of “if selected,” meaning that it had been identified as being relevant to each subject as not present, somewhat present, or present, and a risk factor, protective factor, or both a risk factor and protective factor combined.

Results

Table 1 summarizes the characteristics of the subjects based upon whether they were under any type of legal supervision at the time of coding.

Table 1

Characteristics of Women Involved with Extremist Violence

	Known legal status ¹				Believed alive or dead ²					
	Supervision (N=190)		No supervision (N=96)		χ^2	ϕ	Alive (N=218)	Dead (N=62)	χ^2	ϕ
Age ^{3,4,5}					.42	.04			.030	.01
25 or younger	117	(59.6 %)	56	(69.6%)	-	-	132 (61.0%)	36 (60.0%)	-	-
26 or older	72	(78.1%)	38	(40.4%)	-	-	84 (38.9%)	24 (40.0%)	-	-

Race ^{6,7}				12.82		.21					20.64	.26
American Indigenous	2	(1.1%)	-	-	-	-	3	(1.4%)	-	-	-	-
Arab/Middle Eastern	29	(15.3%)	20	(20.8%)	-	-	38	(17.4%)	12	(19.4%)	-	-
Asian	11	(5.8%)	8	(8.3%)	-	-	13	(6.0%)	4	(6.5%)	-	-
Black/African American	23	(12.1%)	6	(6.3%)	-	-	26	(11.9%)	1	(1.6%)	-	-
White/Caucasian	104	(54.7%)	55	(57.3%)	-	-	114	(52.3%)	39	(62.9%)	-	-
Multiracial	2	(1.1%)	1	(1.0%)	-	-	2	(0.9%)	-	-	-	-
Unknown	18	(9.5%)	6	(6.3%)	-	-	13	(6.0%)	3	(4.8%)	-	-
Ethnicity ^{8,9}					5.30	.13					.930	.06
Hispanic/ Latino	8	(4.2%)	3	(3.1%)	-	-	9	(4.1%)	3	(4.8%)	-	-
Not Hispanic/ Latino	130	(68.4%)	73	(76.0%)	-	-	153	(70.2%)	46	(74.2%)	-	-
Unknown ethnicity	52	(27.4%)	20	(20.8%)	-	-	56	(25.7%)	13	(21.0%)	-	-
Highest education level ^{10,11}				25.51*		.29*				29.45**		.31**
Less than high school	21	(11.1%)	19	(19.8%)	-	-	23	(10.6%)	13	(21.0%)	-	-
High school/equivalent	19	(10.0%)	13	(13.5%)	-	-	20	(9.2%)	9	(14.5%)	-	-
Some college	38	(20.0%)	20	(20.8%)	-	-	42	(19.3%)	14	(22.6%)	-	-
Associate's degree	6	(3.2%)	1	(1.0%)	-	-	6	(2.8%)	1	(1.6%)	-	-
Bachelor's degree	33	(17.4%)	5	(5.2%)	-	-	38	(17.4%)	2	(3.2%)	-	-
Some graduate work	4	(2.1%)	7	(7.3%)	-	-	6	(2.8%)	5	(8.1%)	-	-
Terminal professional	18	(9.5%)	4	(4.2%)	-	-	20	(9.2%)	4	(6.4%)	-	-
Unknown	51	(26.8%)	27	(28.1%)	-	-	63	(28.9%)	14	(22.6%)	-	-
Marital status ^{13,14}				10.55*		.19*				1.03		.06
Never married	65	(34.2%)	24	(25.0%)	-	-	66	(30.3%)	19	(30.6%)	-	-
Ever married	105	(55.3%)	58	(60.4%)	-	-	127	(58.3%)	36	(58.1%)	-	-
Unknown	20	(10.5%)	14	(14.6%)	-	-	25	(11.5%)	7	(11.3%)	-	-
If ever married, times ^{15,16}				14.39*		.29*				2.60		.12
One	95	(94.1%)	53	(94.6%)	-	-	115	(94.3%)	32	(91.4%)	-	-
Two	5	(5.0%)	3	(5.4%)	-	-	5	(4.1%)	3	(8.6%)	-	-
Three or more	-	-	-	-	-	-	1	(0.8%)	-	-	-	-
Unknown	1	(1.0%)	-	-	-	-	1	(0.8%)	-	-	-	-
If ever married, status ^{17,18,19}				7.15		.18				1.88		.09
Currently	56	(44.8%)	32	(44.4%)	-	-	72	(47.4%)	17	(39.5%)	-	-
Separated/divorced	30	(24.0%)	10	(13.9%)	-	-	30	(19.7%)	9	(20.9%)	-	-
Widowed	19	(15.2%)	16	(22.2%)	-	-	25	(16.4%)	10	(10.0%)	-	-
Unknown	20	(16.0%)	14	(19.4%)	-	-	25	(16.4%)	7	(16.3%)	-	-
Children ^{20,21,22}				9.96*		.18*				16.28**		.23**
No children	83	(43.7%)	38	(39.6%)	-	-	84	(38.5%)	32	(51.6%)	-	-
Children	94	(49.5%)	50	(52.1%)	-	-	123	(56.4%)	24	(38.7%)	-	-
Unknown	11	(5.8%)	8	(8.3%)	-	-	11	(5.0%)	6	(9.7%)	-	-
If children ^{23,24}				5.10		.18					9.11	.24
One	43	(44.8%)	17	(34.0%)	-	-	49	(39.8%)	12	(50.0%)	-	-
Two	24	(25.0%)	19	(38.0%)	-	-	32	(26.0%)	7	(29.2%)	-	-
Three	12	(12.5%)	7	(14.0%)	-	-	18	(14.6%)	3	(12.5%)	-	-
More than three	17	(17.7%)	7	(14.0%)	-	-	24	(19.5%)	2	(18.3%)	-	-
If children ^{25,26}												
Conceived through radicalization	18	(20.0%)	10	(18.8%)	.56	.06	24	(19.5%)	-	-	13.68***	.30***
Subject attempted radicalization and failed	6	(6.3%)	3	(6.0%)	.23	.04	9	(7.3%)	1	(4.2%)	.99	.08
Subject radicalized child	6	(6.3%)	12	(24.0%)	11.40**	.27**	13	(10.6%)	4	(16.7%)	8.51*	.23*
Child known to travel with subject	19	(19.8%)	18	(36.0%)	4.75	.17	29	(22.6%)	7	(29.2%)	.69	.07
Child abandoned	5	(5.2%)	4	(8.0%)	1.13	.09	5	(4.1%)	3	(12.5%)	3.13	.14
No involvement	50	(52.1%)	16	(32.0%)	6.16*	.20*	61	(49.6%)	11	(45.8%)	8.30*	.23*

Subject no custody of 2 child	(2.1%)	1	(2.0%)	.21	.04	2	(1.6%)	1	(4.2%)	.88	.08
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Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

¹Legal status: 14 missing/unknown.

²Death status: 20 missing/unknown.

³Age was calculated using the difference between subject's recorded DOB and earliest date of involvement. If earliest date of involvement was missing, latest date of involvement used. If both earliest date and involvement and latest date of involvement were missing, then the date of coding was used; 4 missing age values in the sample.

⁴Age for 14 LS missing/unknown: 7 missing 25 and younger (50.0%); 6 missing 26 and older (42.0%); 1 missing with age unknown (7.1%).

⁵Age for 20 DS missing/unknown: 12 missing 25 and younger (60.0%); 8 missing 26 and older (40.0%).

⁶Race for 14 LS missing/unknown: 1 missing American Indigenous (7.1%); 3 missing Arab or Middle Eastern (21.4%); 1 missing Black or African American (7.1%); 8 missing White/Caucasian (57.8%).

⁷Race for 20 DS missing/unknown: 2 missing Arab or Middle Eastern (10.0%); 2 missing Asian (10.0%); 3 missing Black or African American (15.0%); 7 missing White/Caucasian (35.0%); 1 missing multi-racial (5.0%); 5 missing with unknown race (35.0%).

⁸Ethnicity for 14 LS missing/unknown: 1 missing Hispanic/Latino (14.3%); 9 missing not Hispanic/Latino (64.3%); 3 missing with unknown ethnicity (21.4%).

⁹Ethnicity for 20 DS missing/unknown: 1 missing Hispanic/Latino (5.0%); 13 missing not Hispanic/Latino (65.0%); 6 missing with unknown ethnicity (30.0%).

¹⁰Educational attainment for 14 LS missing/unknown: 3 missing less than high school (21.4%); 3 missing some college (21.4%); 2 missing bachelor's degree or similar (14.3%); 3 missing terminal professional (21.4%); 3 missing with unknown educational attainment (21.4%).

¹¹Educational attainment for 20 DS missing/unknown: 7 missing less than high school (35.0%); 3 missing high school or equivalent (15.0%); 5 missing some college (25.0%); 1 missing terminal professional (5.0%); 4 missing with educational attainment unknown (20.0%).

¹²Terminal professional encompasses the following: Master's degree or similar, JD or similar, MD or similar, and PhD or similar.

¹³Marital status for 14 LS missing/unknown: 13 missing married (92.9%); 1 missing with marital status unknown (7.1%).

¹⁴Marital status for 20 DS missing/unknown: 4 missing never married (20.0%); 13 missing ever married (65.0%); 3 missing with marital status unknown (15.0%).

¹⁵Times married values reflect 169 subjects who ever married with identifiable partners including 13 LS missing/unknown; 12 missing had one identifiable partner (92.3%); 1 missing had three or more partners (7.7%).

¹⁶Times married values reflect 169 subjects who were ever married with identifiable partners including 12 DS missing/unknown: 12 missing with 1 partner/spouse (100%).

¹⁷Ever married encompasses N=211 subjects that were categorized as ever married, divorced, separated, or widowed (N=176) combined with those who ever married with unknown marital status at the time of coding (N=35).

¹⁸If ever married or unknown, current marital status for 14 LS missing/unknown: 9 missing married (64.3%); 1 missing divorced/separated (7.1%); 3 missing widowed (21.4%); 1 missing with current marital status unknown (7.1%).

¹⁹If ever married or unknown, current marital status for 16 DS missing/unknown: 8 missing married (50.0%); 2 missing divorced/separated (12.5%); 3 missing widowed (18.6%); 1 missing with current marital status unknown (7.1%).

²⁰Indication of 156 subjects with identifiable children in the sample including those with 10 LS missing/unknown and 9 DS missing/unknown. (356 identifiable children born in the sample).

²¹Parental status for 14 LS status missing/unknown: 1 missing no children (7.1%); 10 missing with children born (71.4%); 3 missing unknown if children born (21.4%).

²²Parental status for 20 DS status missing/unknown: 6 missing no children (30.0 %); 9 missing with children born (45.0%); 5 missing unknown if children born (25.0%).

²³Values are based on N=156 subjects in the sample

²⁴10 subjects with children with LS unknown/missing: 1 missing conceived through radicalization (10.0%); 1 missing subject attempted radicalization and failed (10.0%); 3 missing subject radicalized children (30.0%); 2 missing known to travel with subject (20%); 6 missing no indication of children's involvement (60.0%);

²⁵9 subjects with children with DS unknown/missing: 5 missing conceived through radicalization (55.6%); 4 missing subject radicalized children (44.4%); 3 missing known to travel with subject (33.3%); 1 missing child was abandoned (11.1%).

Within the sample, 61% of the subjects were 25 years of age or younger when they became involved in an extremist group and 20.6% were known to have died as a result of their involvement in these activities. Age was not associated with this outcome. Over one-half of the women were White/Caucasian but race and ethnicity had no association with either being under legal supervision or dying as a result of participation in extremist activities. Level of educational attainment was related

to both legal supervision, $\chi^2(2, N = 286) = 25.51, p < .05$, and lethality of the extremist involvement, $\chi^2(2, N = 280) = 29.45, p < .01$. Marital status was associated with the legal status of the subject with those who had never been married being more likely to be under legal supervision, $\chi^2(2, N = 286) = 10.55, p < .05$. Current marital status was not related to legal status or potential lethality.

Over one-half of the subjects in the sample (51.3%) were known have given birth to at least one child, including those born before, during, and after the subject's radicalization. The subjects were known to have given birth to at least 356 children of whom 189 (53%) were involved in the radicalization activities of their mothers. These radicalization activities included the children having been conceived through the mother's radicalization, the mother having successfully radicalized her child(ren), the mother having attempted and failed to radicalize her child(ren), having traveled with the mother, and/or having been abandoned by a radicalized mother. Having no children was associated with a greater likelihood of the subject being under some type of legal supervision, $\chi^2(2, N = 286) = 9.96, p < .05$, and a higher risk of fatality for the subject, $\chi^2(2, N = 280) = 16.28, p < .01$.

Table 2 examined three risk categories, HRC, MRC, and LRC, as they were associated with the action role of each woman, the motivational catalysts for their actions, and the presence of coercion in prompting them to engage in extremist activities. We also examined the different types of religious and political involvement demonstrated by the subjects according to their risk classification. As indicated in Table 2, the subjects fell predominantly into the HRC (43%) and MRC (50.6%) with only 6.33% of the subjects being classified as falling within the LRC. Subjects identified as plotters, $\chi^2(8, N = 300) = 41.367, p < .001$, and those involved in direct action, $\chi^2(8, N = 300) = 300.00, p < .001$, were more often classified in the HRC. There was no difference in the proportion of travelers falling into the HRC and the MRC. Agents of state building, $\chi^2(8, N = 300) = 19.125, p < .001$, recruiters, $\chi^2(8, N = 300) = 14.617, p < .001$, and image conveyers, $\chi^2(8, N = 300) = 23.103, p < .001$, were more likely to fall in the MRC.

Table 2

Actions Roles Risk Categories of a Sample of 300 Extremist-involved Women

Risk category

	High risk (HRC) N=129		Medium risk (MRC) N=152		Low risk (LRC) N=19		χ^2	ϕ
Action roles ^{1,2}								
Plotters	75	(58.1%)	41	(27.0%)	-	-	41.367***	.371***
Supporters	76	(58.9%)	123	(80.9%)	-	-	55.099***	.429***
Travelers	91	(70.5%)	88	(57.9%)	14	(73.7%)	5.638	.137
State builders	39	(30.2%)	84	(55.3%)	11	(57.9%)	19.125***	.252***
Recruiters	32	(24.8%)	58	(38.2%)	-	-	14.617***	.221***
Image conveyers	23	(17.8%)	59	(38.8%)	-	-	23.103***	.278***
Direct action/violent	129	(100%)	-	-	-	-	300.000***	1.000***
Motivational catalyst ³								
Morality ^{4,5}								
Morality only	20	(15.5%)	38	(25.5%)	7	(36.8%)	6.460*	.147*
Morality combined	85	(65.9%)	72	(47.4%)	5	(26.3%)	15.897***	.230***
Antisocial ^{6,7}								
Antisocial only	7	(5.4%)	8	(5.3%)	2	(10.5%)	.900	.055
Antisocial combined	83	(64.3%)	70	(46.8%)	3	(15.3%)	20.007***	.258***
Developmental immaturity ^{8,9}								
Immaturity only	1	(0.8 %)	3	(2.0%)	-	-	1.036	.059
Immaturity combined	42	(32.6%)	54	(34.2%)	4	(21.1%)	1.331	.514
Other ¹⁰								
No catalyst selected	14	(10.9%)	27	(17.8%)	5	(26.3%)	4.451	.122
Indications of coercion								
Evidence yes	20	(15.5%)	30	(19.7%)	3	(15.8%)	.909	.055
Evidence no	109	(84.5%)	122	(80.3%)	16	(84.2%)		
If yes, coercion type								
Threats violence	3	(15.8%)	5	(16.7%)	-	-	.591	.106
Physical violence	7	(36.8%)	4	(13.3%)	1	(33.3%)	3.424	.254
Threat family/friends	5	(26.3%)	6	(20.7%)	1	(33.3%)	.379	.085
Harm family/friends	-	-	1	(3.4%)	-	-	.781	.121
Other coercion	13	(65.0%)	21	(70.0%)	1	(33.3%)	1.966	.194
Religious identification ¹¹								
Uninterested	11	(8.5%)	7	(4.6%)	-	-	3.971	.115
Longstanding	50	(38.8%)	82	(53.9%)	12	(63.2%)	8.464	.168
Conversion	23	(17.8%)	39	(25.7%)	6	(31.6%)	3.578	.109
Increased observances	11	(8.5%)	26	(17.1%)	2	(10.5%)	5.086	.130
Participation others	4	(3.1%)	8	(5.3%)	-	-	2.265	.087
Political identification ¹²								
Uninterested	3	(2.3%)	2	(1.3%)	-	-	-	-
Very liberal	60	(46.5%)	10	(6.6%)	-	-	-	-
Somewhat liberal	2	(1.6%)	1	(0.7%)	-	-	-	-
Centrist/moderate	-	-	1	(0.7%)	-	-	-	-
Somewhat conservative	-	-	3	(2.0%)	-	-	-	-
Very conservative	2	(1.6%)	20	(13.2%)	1	(5.3%)	-	-
Other	7	(5.4%)	8	(5.3%)	-	-	-	-
Unknown	55	(42.6%)	107	(70.4%)	18	(94.7%)	-	-

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

¹Action roles reflected in this table include only attempts of action (failures and successes) made by the subject.

²Action role classification defined in detail in the methods; HRC: all subjects who were coded as having been involved in direct action; MRC: subjects coded as plotters, recruiters, or conveyors of images/propaganda distributors who had not been coded as being involved in HRC activities; LRC: subjects coded as being travelers, necessary agents of state-building, and supporters who were not coded as being involved in the MRC or HRC activities.

³Motivational catalyst categorizations are defined in the methods section.

⁴Morality only was determined to be the motivational catalyst for 65 subjects (21.7%).

⁵Morality combined with another motivational catalyst was selected for 162 subjects (54.0%).

⁶Antisociality only was determined to be the motivational catalyst for 17 subjects (5.7%).

⁷Antisocial tendency combined with another motivational catalyst was determined for 156 subjects (51.0%).

⁸Developmental immaturity only was determined to be the motivational catalyst for 4 subjects (1.3%).

⁹Developmental immaturity combined with another motivational catalyst was selected for 98 subjects (32.7%).

¹⁰No catalyst was selected for 46 subjects (15.3%).

¹¹Evidence of coercion was selected for 53 subjects (17.7%).

¹²Religious identification missing for 27 subjects; HRC: 13 missing (10.1%); MRC: 13 missing (8.6%); LRC: 1 missing (5.3%).

The majority of the subjects were not seen as having been coerced into their various roles within the different extremist organizations (82.3%). When there was evidence of coercion, it involved threats of violence, physical violence, and threats of violence to family and friends within both the HRC and the MRC. Other unspecified forms of coercion, such as “brainwashing” were also noted in the HRC and the MRC. Varying levels of involvement with religious beliefs and activities did not differ across the various risk levels. However, the majority of the subjects (70.6%) demonstrated a significant commitment to various religious ideologies, as reflected in a longstanding adherence (48%) or conversion (22.7%) to them. Political identifications were associated with the various risk levels with subjects coded as being “very liberal” being over-represented in the HRC and subjects coded as being “very conservative” being over-represented in the MRC, $\chi^2(14, N = 300) = 84.314, p < .001$.

When the criteria of at least three elements per propensity factor was applied to the data, in most instances, the subjects were found to not be motivated by a single propensity factor but rather by a combination of the three including morality, antisociality, and developmental immaturity. In the

HRC, morality occurred alone for only 15.5% of the sample, but in combination with either antisociality or developmental immaturity for 65.9% of the HRC. Antisociality occurred alone for only 5.4% of the HRC but in combination with either morality or developmental immaturity occurred for 64.3% of this group. Developmental immaturity was identified as the single propensity factor for less than one percent of the HRC but in combination with morality or antisociality accounted for 32.6% of the HRC. Among the HRC, morality and antisociality were the most common propensity factors identified.

Table 3

Propensity as Reflected by Morality, Self-regulation, and Executive Functioning

	Risk category			χ^2	ϕ
	High risk (HRC) N=129	Medium risk (MRC) N=152	Low risk (LRC) N=19		
Morality ¹					
Moral emotions ²					
Other-condemning	91 (70.5%)	101 (66.4%)	10 (52.6%)	2.525	.092
Self-conscious	75 (58.1%)	73 (48.0%)	6 (31.6%)	6.025*	.142*
Other-suffering	73 (56.6%)	78 (51.3%)	6 (31.6%)	4.281	.119
Other-praising	46 (35.7%)	83 (54.6%)	7 (36.8%)	10.698**	.189**
Disinterested elicitors	50 (38.8%)	43 (28.3%)	5 (26.3%)	3.850	.113
Prosocial action	49 (38.0%)	28 (18.4%)	- -	21.002***	.265***
Moral emotions: other	- -	- -	- -	-	-
Sacred values ³					
Refuses to compromise	88 (68.2%)	100 (65.8%)	12 (63.2%)	.297	.031
Subject sacrifices	87 (67.4%)	65 (42.8%)	8 (42.1%)	18.103***	.246***
Altered perceptions	30 (23.3%)	26 (17.1%)	- -	6.394*	.146*
Backfire effect	19 (14.7%)	18 (11.8%)	2 (10.5%)	.624	.046
Self-regulation ⁴					
Antisocial tendency ⁵					
Family history					
Yes	49 (38.0%)	56 (37.5%)	8 (42.1%)	.152	.053
No	80 (62.0%)	95 (62.5%)	11 (57.9%)		
If yes, person ⁶					
Parent	20 (58.8%)	22 (62.9%)	- -	3.097	.209
Sibling	25 (73.5%)	24 (68.6%)	2 (100%)	1.017	.120
Other	7 (21.9%)	6 (16.7%)	- -	.773	.105
If yes, pattern ^{7,8}					
Adolescent-limited	22 (17.1%)	26 (17.1%)	3 (15.8%)	.021	.008
Life-course persistent	76 (58.9%)	79 (52.0%)	9 (47.4%)	1.793	.077
If yes, antisocial behaviors					
Failure to conform	89 (69.0%)	76 (50.0%)	7 (36.8%)	13.771***	.214***

Deceitfulness	69 (53.5%)	86 (56.6%)	7 (36.8%)	2.672	.094
Impulsivity	30 (23.3%)	36 (23.7%)	4 (21.1%)	.066	.015
Aggressiveness	29 (22.5%)	29 (19.1%)	3 (15.8%)	.757	.050
Irresponsibility	31 (24.0%)	44 (28.9%)	7 (36.8%)	1.773	.077
Lack of remorse	75 (58.1%)	68 (44.7%)	6 (31.6%)	7.669*	.160*
Criminal versatility	76 (58.9%)	53 (34.9%)	3 (15.8%)	22.927***	.276***
Self-regulation: other	1 (0.8%)	-	-	1.330	.067
Developmental immaturity ⁹					
No delay gratification	23 (17.8%)	27 (17.8%)	3 (15.8%)	.049	.013
Sensation seeking	33 (25.6%)	37 (24.3%)	-	6.234*	.144*
No appreciation consequences	40 (31.0%)	60 (39.5%)	6 (31.6%)	2.314	.088
Strongly influenced peers	40 (31.0%)	62 (40.8%)	7 (36.8%)	2.889	.098
Lack of regulation	50 (38.8%)	44 (28.9%)	2 (10.5%)	7.386*	.157*
No long-term planning	36 (27.9%)	34 (22.4%)	4 (21.1%)	1.294	.066
Inability to remain focused	32 (24.8%)	31 (20.4%)	2 (10.5%)	2.283	.087
Benefit only risk perceptions	42 (32.6%)	56 (36.8%)	4 (21.1%)	2.086	.083
Executive functioning: other	7 (5.4%)	5 (3.3%)	-	1.675	.075

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

¹A morality variable was selected for 281 subjects (93.7%); 19 missing/not selected.

²A moral emotions variable was selected for 237 subjects (79.0%); 63 missing/not selected.

³A sacred values variable was selected 257 subjects (85.7%); 53 missing/not selected.

⁴A self-regulation variable was selected for 291 subjects (97.0%); 9 missing/not selected.

⁵A antisocial tendency variable was selected for 272 subjects (90.7%); 28 missing/not selected.

⁶Subjects could have multiple family members who demonstrated antisocial behavior.

⁷To be coded as demonstrating a pattern of adolescent-limited antisocial tendency, subjects needed to be coded as having at least three antisocial traits manifesting before the age of 25.

⁸To be coded as demonstrating a pattern of life-course persistent antisocial tendency, subjects needed to be coded as having at least three antisocial traits manifesting after the age of 25.

⁹A developmental immaturity variable was selected for 247 subjects (82.3%); 53 missing/not selected.

In Table 3, we further examined the nature of the three propensity factors in terms of their individual criteria. The majority of the subjects were coded as manifesting the variables contained in the *propensity* domain of the MSA model. A morality variable was identified for 281 subjects (93.7%) with 237 subjects (79%) manifesting at least one moral emotion, and 257 subjects (85.7%) demonstrating at least one sacred value. A self-regulation variable was identified for 291 subjects (97%) with 272 subjects (90.7%) being identified as demonstrating at least one antisocial tendency and 247 subjects (82.3%) being identified as demonstrating some aspect of developmental immaturity. Within our model, only 46 subjects (15.3%) did not meet criterion for one of the three propensity factors, and in the majority of these instances, these subjects demonstrated a co-mingling of the three propensity

factors, but at a level that did not meet the criteria of three behaviors for each of the three propensity categories.

Other-condemning was the most common moral emotion observed across all three risk levels and a refusal to compromise was the most common sacred values found within the sample. Self-conscious moral emotions, $\chi^2(2, N = 300) = 6.03, p < .05$, and prosocial action tendencies, $\chi^2(2, N = 300) = 21.00, p < .001$, were more common among the HRC. The sacred values of being willing to sacrifice, $\chi^2(2, N = 300) = 18.10, p < .001$, and altered perceptions, $\chi^2(2, N = 300) = 6.39, p < .05$, were also more common among the HRC group. When antisociality was observed, it was perceived to more often be of a life-course persistent variety as contrasted to an adolescent-limited course of antisocial behavior. When eight behaviors characteristic of antisociality were examined, a failure to conform one's behavior, $\chi^2(2, N = 300) = 13.77, p < .001$, a lack of remorse, $\chi^2(2, N = 300) = 7.67, p < .05$, and criminal versatility, $\chi^2(2, N = 300) = 22.93, p < .001$, were more frequently observed among women falling into the HRC.

The characteristics of developmental immaturity tended not to differentiate between the three risks levels identified in the sample. Only a lack of regulation in dealing with emotions was found to more often be characteristic of subjects falling in the HRC, $\chi^2(2, N = 300) = 7.39, p < .05$.

Table 4 examined the various variables including social setting and activity fields that were associated with the *mobilization* component of the MSA-EV risk model. A social setting variable was selected for 299 (99.7%) of the subjects. This included an affiliations variable being selected for 293 subjects (97.7%), a grievances variable—capturing personal and/or group grievances—for 185 subjects (61.7%), a social identity variable for 265 subjects (88.3%); a collective cognitive structure variable for 188 subjects (62.7%); and a component of militant thinking for 263 subjects (87.7%). The activity fields of the model were identified for 269 (89.7%) subjects. This included a social interactions variable being selected for 269 subjects (89.7%), and a cyber interactions variable being selected for 137 (45.7%) subjects.

Subjects were often involved in social relationships that were routinely supportive of extremist violence; 278 subjects (92.7%) were identified as being involved in at least one social relationship that condoned extremist violence. Subjects were often involved in close and meaningful relationship with

family members, although the family members were not routinely supportive of extremist violence. Subjects identified with family members who condoned extremist violence were more likely to fall within the HRC, $\chi^2 (4, N = 300) = 6.169, p < .05$. Involvement with romantic partners was also a common component of the mobilization process and these romantic partners were routinely supportive of extremist violence, however, these relationships did not appear particularly close and meaningful. Moreover, they did not differentiate between subjects falling within the three risk categories. Approximately one third of the subjects had close friends, and while these relationships did not appear to be consistently close and meaningful, the friends were often supportive of extremist violence. These relationships did not differentiate between the three levels of violence. Involvement in virtual relationships was most common among the subjects classified as falling in the MRC, $\chi^2 (2, N = 300) = 46.423, p < .001$, and these relationships were generally condoning of extremist violence, particularly among the MRC, $\chi^2 (4, N = 300) = 44.087, p < .001$. Coworkers played a limited role in the mobilization process, and they tended to not be supportive of extremist violence. These work relationships were not different across the three risk categories.

Table 4

Mobilization as Reflected in Social Setting and Activity Fields

	Risk category							
	High risk (HRC) N=129		Medium risk (MRC) N=152		Low risk (LRC) N=19		χ^2	ϕ
Social setting ¹								
Affiliations ²								
Family	99	(76.7%)	107	(70.4%)	14	(73.7%)	1.440	.069
Condones violence	45	(34.9%)	39	(25.7%)	2	(10.5%)	6.169*	.143*
Close/meaningful	65	(50.4%)	73	(48.0%)	8	(42.1%)	.505	.041
Romantic partner	98	(76.0%)	123	(80.9%)	17	(89.5%)	2.316	.088
Condones violence	82	(63.6%)	104	(68.4%)	14	(73.7%)	1.190	.063
Close/meaningful	43	(33.3%)	58	(38.2%)	6	(31.6%)	.856	.053
Friends	44	(34.1%)	65	(42.8%)	7	(36.8%)	2.232	.086
Condones violence	35	(27.1%)	47	(30.9%)	2	(10.5%)	3.569	.109
Close/meaningful	24	(18.6%)	32	(21.1%)	4	(21.1%)	.275	.030
Virtual communities	20	(15.5%)	79	(52.0%)	2	(10.5%)	46.423***	.393***
Condones violence	19	(14.7%)	76	(50.0%)	2	(10.5%)	44.087***	.383***
Close/meaningful	-	-	15	(9.9%)	-	-	15.374***	.226***
Coworkers	23	(17.8%)	37	(24.3%)	2	(10.5%)	3.077	.101
Condones violence	11	(8.5%)	14	(9.2%)	1	(5.3%)	.338	.034

Close/meaningful	6	(4.7%)	10	(6.6%)	-	-	1.656	.074
Personal/group grievances ³								
Internalized/personal	53	(41.1%)	44	(28.9%)	5	(26.3%)	5.115	.131
Internalized/group	78	(60.5%)	63	(41.4%)	4	(21.1%)	16.152***	.232***
Grievances: other	1	(0.8%)	-	-	-	-	1.330	.067
Social identity ⁴								
Group language	46	(35.7%)	45	(29.6%)	1	(5.3%)	7.359*	.157*
Refer to as family	20	(15.5%)	40	(26.3%)	3	(15.8%)	5.249	.132
Attempts family creation	50	(38.8%)	94	(61.8%)	10	(52.6%)	14.896**	.223**
Alters appearance	48	(37.2%)	71	(46.7%)	5	(26.3%)	4.484	.122
Changes name	44	(34.1%)	42	(27.6%)	1	(5.3%)	6.973*	.152*
Moves residency	64	(49.6%)	83	(54.6%)	15	(78.9%)	5.783	.139
Social identity: other	10	(7.8%)	4	(2.6%)	1	(5.3%)	3.854	.113
Collective cognitive structure ⁵								
Dualistic thinking	43	(33.3%)	53	(34.9%)	1	(5.3%)	6.869*	.151*
Paranoia/sensitivity	13	(10.1%)	36	(23.7%)	1	(5.3%)	11.201**	.193**
Apocalyptic	9	(7.0%)	15	(9.9%)	-	-	2.557	.092
Charismatic leader	60	(46.5%)	54	(35.5%)	6	(31.6%)	4.108	.117
Conversion experience	28	(21.7%)	37	(24.3%)	1	(5.3%)	3.594	.109
Collective cognitive: other	1	(0.8%)	-	-	-	-	1.330	.067
Militant forms of thinking ⁶								
Extreme means necessary	105	(81.4%)	78	(51.3%)	7	(36.8%)	33.317***	.333***
Self-absolution for violence	33	(25.6%)	19	(12.5%)	2	(10.5%)	8.858*	.172*
Military terms	30	(23.3%)	30	(19.7%)	-	-	5.611	.137
Group obstructed	53	(41.1%)	48	(31.6%)	2	(10.5%)	7.896*	.162*
Glorification of past	3	(2.3%)	15	(9.9%)	-	-	8.334*	.167*
Utopia future	17	(13.2%)	32	(21.1%)	2	(10.5%)	3.669	.111
Expected catastrophes	16	(12.4%)	20	(13.2%)	1	(5.3%)	.975	.057
Supernatural intervention	6	(4.7%)	10	(6.6%)	1	(5.3%)	.491	.040
Need to annihilate evil	13	(10.1%)	14	(9.2%)	1	(5.3%)	.459	.039
Death for a cause	37	(28.7%)	45	(29.6%)	1	(5.3%)	5.117	.131
Duty to kill	49	(38.0%)	52	(34.2%)	3	(15.8%)	3.630	.110
Accept immoral means	44	(34.1%)	32	(21.1%)	3	(15.8%)	7.294*	.156*
Intolerance as a virtue	48	(37.2%)	51	(33.6%)	3	(15.8%)	3.414	.107
Demonizing opponent	34	(26.4%)	40	(26.3%)	-	-	6.642*	.149*
Modern world is disaster	13	(10.1%)	21	(13.8%)	3	(15.8%)	1.126	.061
Government illegitimate	28	(21.7%)	24	(15.8%)	2	(10.5%)	2.422	.090
Militant thinking: other	-	-	1	(0.7%)	-	-	.977	.057
Activity fields ⁷								
Social interactions ⁸								
Place of work	64	(49.6%)	73	(48.0%)	7	(36.8%)	1.082	.060
Place of study	72	(55.8%)	66	(43.4%)	7	(36.8%)	5.364	.134
Place of worship	15	(11.6%)	37	(24.3%)	4	(21.1%)	7.506*	.158*
Place to exercise	4	(3.1%)	2	(1.3%)	-	-	1.548	.072
Public outdoor spaces	26	(20.2%)	26	(17.1%)	-	-	4.706	.125

Public indoor spaces	20	(15.5%)	21	(13.8%)	3	(15.8%)	.179	.024
Private spaces/homes	71	(55.0%)	74	(48.7%)	6	(31.6%)	3.981	.115
Social interactions: other	14	(10.9%)	16	(10.5%)	3	(15.8%)	.483	.040
Cyber interactions ⁹								
Consuming radical content	12	(9.3%)	59	(38.8%)	4	(21.1%)	32.585***	.330***
Sharing radical content	9	(7.0%)	63	(41.4%)	2	(10.5%)	46.802***	.395***
Endorsing attack	3	(2.3%)	18	(11.8%)	-	-	11.234**	.194**
Post of committing attack	2	(1.6%)	5	(3.3%)	-	-	1.411	.069
Creating radical content	12	(9.3%)	32	(21.1%)	1	(5.3%)	9.065*	.174*
Actively recruiting	6	(4.7%)	37	(24.3%)	-	-	25.428***	.291***
Actively being recruited	11	(8.5%)	38	(25.0%)	5	(26.3%)	13.779**	.214**
Cyber interactions: other	5	(3.9%)	13	(8.6%)	2	(10.5%)	2.938	.099

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

¹A social setting variable was selected for 299 subjects (99.7%); 1 missing/not selected.

²An affiliations variable was selected for 293 subjects (97.7%); 7 missing/not selected.

³A grievances variable was selected for 185 subjects (61.7%); 115 missing/not selected.

⁴A social identity variable was selected for 265 subjects (88.3%); 35 missing/not selected.

⁵A collective cognitive structure variable was selected for 188 subjects (62.7%); 112 missing/not selected.

⁶A militant forms of thinking variable was selected for 263 subjects (87.7%); 27 missing/not selected.

⁷An activity fields variable was selected for 269 subjects (89.7%); 31 missing/not selected.

⁸A social interactions variable was selected for 269 subjects (89.7%); 31 missing/not selected.

⁹A cyber interactions variable was selected for 137 subjects (45.7%); 163 missing/not selected.

Various sentiments and collective ways of thinking differentiated between subjects within the three risk categories. The internalization of group grievances associated with injustice being perpetrated against particular groups of individuals were more frequently expressed by subjects classified in the HRC, $\chi^2 (2, N = 300) = 16.152, p < .001$. The creation of a social identity, which included behaviors such as adopting a group language, $\chi^2 (2, N = 300) = 7.359, p < .05$, and changing one's name, $\chi^2 (2, N = 300) = 6.973, p < .05$, were similarly more common among subjects falling in the HRC. Attempting to create a family structure through engagement, marriage, or procreation, $\chi^2 (2, N = 300) = 14.896, p < .001$, was more common among subjects classified as falling into the MRC. The collective cognitive structure variable was more characteristic of the MRC subjects with these subjects demonstrating more dualistic ways of thinking, $\chi^2 (2, N = 300) = 6.869, p < .05$, and a more general sense of paranoia and sensitivity, $\chi^2 (2, N = 300) = 11.201, p < .01$.

Militant forms of thinking were not particularly common among the sample although six of these did differentiate between the three risk categories. Women falling in the HRC were more often to convey

beliefs that extreme measures were necessary, $\chi^2 (2, N = 300) = 33.317, p < .001$, trust that one would find self-absolution for any violence that was perpetrated, $\chi^2 (2, N = 300) = 8.858, p < .05$, the conviction that one's group was being obstructed by external forces, $\chi^2 (2, N = 300) = 7.896, p < .01$, and the acceptance of immoral means for a desired end, $\chi^2 (2, N = 300) = 7.294, p < .05$. Glorification of the past was more often found among subjects who were classified as falling with the MRC, $\chi^2 (2, N = 300) = 8.334, p < .05$. Demonizing the opponent, $\chi^2 (2, N = 300) = 6.642, p < .05$, was not observed among any of the subjects falling within the LRC.

The activity fields identified in the MSA–EV model identify various locations in which subjects encountered individuals directly or through cyber interactions. Places of study, private settings such as friends' and relatives' homes, and places of work were the most common locations identified as being significant to the radicalization of our subjects. Places of worship were not commonly associated with the radicalization and recruitment process. When places of worship were identified as being involved in the radicalization process, they tended to occur more often among women falling in the MRC, $\chi^2 (2, N = 300) = 7.506, p < .05$. Cyber interactions were far more common among subjects within the MRC, with these activities including the consumption of radical content, $\chi^2 (2, N = 300) = 32.585, p < .001$, sharing radical content, $\chi^2 (2, N = 300) = 46.802, p < .001$, endorsing an attack online, $\chi^2 (2, N = 300) = 11.234, p < .01$, creating radical content, $\chi^2 (2, N = 300) = 9.065, p < .05$, actively recruiting through social media, $\chi^2 (2, N = 300) = 25.428, p < .001$, and being recruited through social media, $\chi^2 (2, N = 300) = 13.779, p < .001$. Subjects classified as falling within the HRC tended to manifest a relatively minor involvement with social media and its use for interacting with others.

Table 5 examines the various behaviors that reflected *action* and *capacity building* of a particular subject towards the desired end goal as defined by their action role. The perceptions of alternatives variable was selected for 300 subjects (100%). This included beliefs in multiple opportunities which was selected for 267 subjects (89%) and mechanisms concerning processes of choice for 289 subjects (96.3%). A capacity-building variable was selected for 262 subjects (87.3%).

The three risk groups varied in terms of mechanisms of perceptions of alternatives. Women classified in the HRC were more intent upon and interested in educational, $\chi^2 (2, N = 300) = 13.555, p < .01$, and career opportunities, $\chi^2 (2, N = 300) = 8.623, p < .05$. Although not absent in the HRC, subjects categorized in the MRC tended more often to view themselves as interested in and capable of accessing

social, $\chi^2 (8, N = 300) = 6.735, p < .05$, and romantic opportunities, $\chi^2 (2, N = 300) = 6.977, p < .05$. Subjects falling within the HRC were more often seen as manifesting a clear decision-making process when assessing their processes of choice relevant to involvement in extremist violence, $\chi^2 (2, N = 300) = 9.975, p < .01$. There were no statistical differences in the deliberative processes undertaken by subjects within the three risk categories with subjects in each risk category debating with others, engaging in the discounting of information or observations, and forming judgments. There was information that decision-making moments could be discerned with the majority of subjects and that this decision-making process tended not be disorganized or unclear in its unfoldment.

Table 5

Action Expressed by Mechanisms of Perceptions of Alternatives, Mechanisms Concerning Processes of Choice, and Capacity-building

	Risk category			χ^2	ϕ
	High risk (HRC) N=129	Medium risk (MRC) N=152	Low risk (LRC) N=19		
Mechanisms of perceptions of alternatives ¹					
Belief in multiple opportunities ²	117 (90.7%)	133 (87.5%)	17 (89.5%)	.733	.049
If yes, context ³					
Education	70 (59.8%)	54 (40.6%)	4 (23.5%)	13.555**	.225**
Career/job	64 (54.7%)	61 (45.9%)	3 (17.6%)	8.623*	.180*
Financial	22 (18.8%)	28 (21.1%)	-	4.390	.128
Geographic	29 (24.8%)	36 (27.1%)	2 (11.8%)	1.888	.084
Social	35 (29.9%)	61 (45.9%)	7 (41.2%)	6.735*	.159*
Romantic	45 (38.5%)	73 (54.9%)	7 (41.2%)	6.977*	.162*
Opportunities: other	21 (17.9%)	23 (17.3%)	5 (29.4%)	1.500	.075
Mechanisms concerning processes of choice ⁴					
Clear decision-making process					
Yes	84 (65.1%)	71 (46.7%)	9 (47.4%)	9.975**	.182**
No	45 (34.9%)	81 (53.3%)	10 (52.6%)		
If yes, processes					
Deliberating/debating others	40 (47.6%)	42 (59.2%)	3 (33.3%)	3.356	.143
Process of discounting	34 (40.5%)	37 (52.1%)	5 (55.6%)	2.420	.121
Forming judgements	56 (66.7%)	44 (62.0%)	3 (33.3%)	3.904	.154
Moments decisions were made	47 (56.0%)	42 (59.2%)	2 (22.2%)	4.426	.164
Disorganized decision-making process					
Yes	8 (6.2%)	15 (9.9%)	1 (5.3%)	1.481	.070
No	121 (93.8%)	137 (90.1%)	18 (94.7%)		
Unclear decision-making process					
Yes	39 (30.2%)	60 (39.5%)	10 (52.6%)	4.905	.128

No	90	(69.8%)	92	(60.5%)	9	(47.4%)		
Capacity-building ⁵								
Finances								
Yes	34	(26.4%)	69	(45.4%)	1	(5.3%)	18.910***	.251***
No	95	(73.6%)	83	(54.6%)	18	(94.7%)		
Formal education								
Yes	14	(10.9%)	21	(13.8%)	1	(5.3%)	1.452	.070
No	115	(89.1%)	131	(86.2%)	18	(94.7%)		
Knowledge acquisition								
Yes	34	(26.4%)	54	(35.5%)	2	(10.5%)	6.457	.147
No	95	(73.6%)	98	(64.5%)	17	(89.5%)		
Skill acquisition								
Yes	44	(34.1%)	30	(19.7%)	2	(10.5%)	9.971**	.182**
No	85	(65.9%)	122	(80.3%)	17	(89.5%)		
Fitness/physical health								
Yes	6	(4.7%)	1	(0.7%)	-	-	5.367	.134
No	123	(95.3%)	151	(99.3%)	19	(100%)		
Religious/spiritual								
Yes	24	(18.6%)	52	(34.2%)	5	(26.3%)	8.627*	.170*
No	105	(81.4%)	100	(65.8%)	14	(73.7%)		
Social capital								
Yes	66	(51.2%)	96	(63.2%)	2	(10.5%)	19.999***	.258***
No	63	(48.8%)	56	(36.8%)	17	(89.5%)		
Romantic support								
Yes	54	(41.9%)	96	(63.2%)	4	(21.1%)	20.114***	.259***
No	75	(58.1%)	56	(36.8%)	15	(78.9%)		
Capacity-building: other								
Yes	18	(14.0%)	12	(7.9%)	-	-	5.100	.130
No	111	(86.0%)	140	(92.1%)	19	(100%)		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

¹A perceptions of alternatives variable was selected for 300 subjects (100%).

²A belief in multiple opportunities variable was selected for 267 subjects (89.0%); 33 missing/not selected.

³Values reflect whether or not a variable was selected, not the type of factor.

⁴A process of choice variable was selected for 289 subjects (96.3%); 11 missing/not selected.

⁵A capacity-building variable was selected for 262 subjects (87.3%); 39 missing/not selected.

The building of capacity to engage in extremist violence varied across the three risk groups. The only capacity building activity that distinguished subjects within the HRC involved skill acquisition, χ^2 (2, $N = 300$) = 9.971, $p < .01$. Subjects in the MRC were more often involved in financial acquisitions, χ^2 (2, $N = 300$) = 18.910, $p < .001$, religious or spiritual enhancements, χ^2 (2, $N = 300$) = 8.627, $p < .05$, the creation of social capital, χ^2 (2, $N = 300$) = 19.999, $p < .001$, and the generation of romantic opportunities, χ^2 (2, $N = 300$) = 20.114, $p < .001$.

To assess the accuracy of the MSA-EV model, we ran four logistical regressions to gauge the ability of the *propensity*, *mobilization*, and *capacity-building* domains to classify subjects falling in the HRC. We also created composite scores for each subject on the significant variables entered into each of the

three domains and ran a fourth logistic regression to measure the accuracy of the entire model when all the domains were combined.

Table 6

Logistic Regression Analysis Concerning the Propensity Domain of the MSA-EV Model (83.1%)¹

	β	S.E.	Wald	Odds Ratio	95% CI for Odds Ratio Upper	Lower
Age: 25 or younger	.904*	.357	6.428	2.470	1.228	4.968
Race ²						
Arab/Middle Eastern	.357	.709	.254	1.429	.356	5.729
Black/African American	-1.317	.955	1.899	.268	.041	1.743
White/Caucasian	.705	.676	1.088	2.024	.538	7.613
Other	-.335	.866	.150	.715	.131	3.902
Subject does not have children	.165	.621	.071	1.180	.350	3.980
Subject has children	-.615	.613	1.005	.541	.162	1.799
Political identification ³						
Uninterested	.991	1.126	.775	2.694	.296	24.484
Very liberal	2.570***	.470	29.903	13.068	5.202	32.831
Combined centralist	-.231	1.171	.039	.793	.080	7.874
Very conservative	-1.552	.839	3.419	.212	.041	1.098
Other	.203	.664	.094	1.225	.333	4.505
Motivated by executive functioning/developmental immaturity	-.754	.399	3.570	.471	.215	1.029
Moral emotions: other-praising	-1.084**	.366	8.778	.338	.165	.693
Moral emotions: prosocial actions	1.262**	.401	9.899	3.533	1.610	7.757
Sacred values: subject sacrifices	1.070**	.341	9.864	2.914	1.495	5.681
Self-regulation: failure to conform	.629	.372	2.853	1.876	.904	3.893
Developmental immaturity: lack of regulation of emotion	.786*	.382	4.225	2.195	1.037	4.644

Note. Standardized beta coefficients are shown.

HRC = 1, MRC/LRC = 0, * $p < .05$, ** $p < .01$, *** $p < .001$.

¹The final model predicted risk category for subjects with 83.1% total accuracy: HRC: 78.7% accurate; MRC/LRC: 86.4% accurate.

²Race category: other reflects a combined category of the following races: American Indian or Alaskan Native, Multi-racial, and Asian.

³Political identification: combined centralist reflects a combined category of the following political identifications: somewhat liberal, centrist/moderate, and somewhat conservative, which each had less than 5 values.

As indicated in Table 6, demographic, political and propensity factors combined into a *propensity* model that classified subjects into the HRC with an accuracy of 78.7%, and subjects following into the combined MRC/LRC with an accuracy of 86.4%, with an overall accuracy for the propensity domain of the MSA–EV of 83.1 percent. Subjects who fell in the HRC tended to be under the age of 25 years, $\beta = -.904, p < .05$, OR = .405, 95% CI [.201, 8.15], to be extremely liberal in their political identification, $\beta = -.2570, p < .001$, OR = .077, 95% CI [5.202, 32.831], and to not be characterized by or express the other-praising moral emotions of gratitude, awe and elevation, $\beta = -1.084, p < .001$, OR = .338, 95% CI [.165, .693]. The presence of prosocial actions such as revenge, affiliation and comforting behaviors increased the odds ratios of being in the HRC, $\beta = 1.262, p < .01$, OR = 3.533, 95% CI [1.610, 7.757], as did sacred values that condoned and encouraged acts of self-sacrifices $\beta = 1.070, p < .01$, OR = 2.914, 95% CI [1.495, 5.681]. Being characterized by developmental immaturity related to unregulated emotions, $\beta = .786, p < .05$, OR = 2.195, 95% CI [1.037, 4.644] also increased the odds ratio in the logistic model predicting higher levels of risk. The logistic regression analysis went through nine steps before the optimal model was identified.

Table 7

Logistic Regression Analysis Concerning the Mobilization Domain of the MSA-EV Model (82.8)ⁱ

	β	S.E.	Wald	Odds Ratio	95% CI Ratio Lower Upper	for Odds
Age: 25 or younger	.797*	.358	4.959	2.219	1.100	4.476
Race ²						
Arab/Middle Eastern	-.022	.725	.001	.979	.236	4.050
Black/African American	-1.239	.944	1.726	.290	.046	1.840
White/Caucasian	.624	.676	.851	1.867	.496	7.028
Other	-.661	.860	.590	.516	.096	2.787
Subject does not have children	.227	.707	.103	1.255	.314	5.022
Subject has children	-.859	.708	1.473	.423	.106	1.696
Political identification ³						
Uninterested	.314	1.143	.075	1.369	.146	12.866
Very liberal	1.231**	.476	6.691	3.425	1.348	8.707
Combined centralist	-1.108	1.010	1.202	.330	.046	2.393
Very conservative	-2.700**	.903	8.947	.067	.011	.394
Other	.337	.696	.234	1.400	.358	5.481
Grievances: internalized personal grievances	.924*	.362	6.529	2.520	1.240	5.121
Collective cognitive: paranoia/sensitivity	-1.137*	.521	4.753	.321	.116	.892

Militant forms of thinking: extreme means necessary	1.414***	.385	13.478	4.111	1.933	8.745
Militant forms of thinking: accept immoral means	.767	.405	3.578	2.153	.973	4.766
Cyber interactions: sharing radical content	-1.848***	.479	14.900	.157	.062	.403
Cyber interactions: actively being recruited	-.890	.492	3.267	.411	.157	1.078

Note. Standardized beta coefficients are shown.

HRC = 1, MRC/LRC = 0, * $p < .05$, ** $p < .01$, *** $p < .001$.

¹The final model predicted risk category for subjects with 82.8% total accuracy: HRC: 78.7% accurate; MRC/LRC: 85.8% accurate.

²Race category: other reflects a combined category of the following races: American Indian or Alaskan Native, Multi-racial, and Asian.

³Political identification: combined centralist reflects a combined category of the following political identifications: somewhat liberal, centrist/moderate, and somewhat conservative, which each had less than 5 values.

As illustrated in Table 7, the logistic regression examining the *mobilization* domain of the MSA–EV classified the women falling within the HRC with an accuracy of 78.7% and of those falling within the MRC/LRC with an accuracy of 85.8%, resulting in a total accuracy of 82.8%. Once again, being younger coupled with being very liberal, $\beta = 1.231$, $p < .01$, OR = 3.425, 95% CI [1.348, 8.707], and not very conservative $\beta = -2.700$, $p < .01$, OR = .067, 95% CI [.011, .394], was associated with women being classified as falling within the HRC. Being characterized by grievances that were personally internalized further increased the odds ratio, $\beta = .924$, $p < .05$, OR = 2.520, 95% CI [1.240, 5.121], while the collective cognitive stance characterized by paranoia/sensitivity decreased the odds ratios $\beta = -1.137$, $p < .05$, OR = .321 95% CI [.116, .892]. Militant forms of thinking characterized by the belief that extreme means were necessary, $\beta = 1.414$, $p < .001$, OR = 4.111, 95% CI [1.933, 8.745], increased the odds ratio substantially that the subject would be classified as being of high risk. Cyber interactions which involved sharing radical content online were negatively associated with falling in the HRC, $\beta = -1.848$, $p < .001$, OR = .157, 95% CI [.062, .403]. The logistic regression went through 17 iterations before the optimal model was identified.

Table 8

Logistic Regression Analysis Concerning the Capacity-building Domain of the MSA-EV Model (77.0%)¹

	β	S.E.	Wald	Odds Ratio	95% CI for Odds Ratio Lower Upper	
Age: 25 or younger	.663	.343	3.740	1.942	.991	3.83

Race ²						
Arab/Middle Eastern	.222	.642	.119	1.248	.355	4.393
Black/African American	-1.604	.886	3.282	.201	.035	1.141
White/Caucasian	.809	.590	1.880	2.246	.706	7.143
Other	-.203	.779	.068	.817	.177	3.757
Subject does not have children	-.001	.659	.000	.999	.274	3.638
Subject has children	-.846	.644	1.726	.189	.429	.121
Political identification ³						
Uninterested	1.319	1.160	1.293	3.741	.385	36.347
Very liberal	2.181***	.457	22.730	8.854	3.612	21.702
Combined centralist	-1.280	1.001	1.635	.278	.039	1.977
Very conservative	-1.777**	.810	4.808	.169	.035	.828
Other	.275	.665	.171	1.316	.358	4.841
Mechanism of opportunities: education	.580	.344	2.851	1.786	.911	3.502
Mechanism of opportunities: social	-.664	.346	3.679	.515	.261	1.015
Capacity-building: financial	-1.165***	.364	10.231	.312	.153	.637
Capacity-building: skill acquisition	.781*	.369	4.478	2.184	1.059	4.501
Capacity-building: romantic partner	-.587	.326	3.234	.556	.293	1.054

Note. Standardized beta coefficients are shown.

HRC = 1, MRC/LRC = 0, * $p < .05$, ** $p < .01$, *** $p < .001$.

¹The final model predicted risk category for subjects with 77.0% total accuracy: HRC: 70.1% accurate; MRC/LRC: 82.2% accurate.

²Race category: other reflects a combined category of the following races: American Indian or Alaskan Native, Multi-racial, and Asian.

³Political identification: combined centralist reflects a combined category of the following political identifications: somewhat liberal, centrist/moderate, and somewhat conservative, which each had less than 5 values.

The logistic regression examining the *capacity-building* processes of the subjects went through eight iterations before finding its best fit, which resulted in a 70.1% accuracy for the HRC, an 82.2% accuracy for the MRC/LRC group, with a total accuracy of 77 percent. Age and race remained in the final model but were not significant. Capacity-building that was related to skill acquisition, $\beta = .781$, $p < .05$, OR = 2.184, 95% CI [1.059, 4.501], increased the odds ratio that the subject would be classified as being of high risk, while capacity-building related to financial acquisition, $\beta = -1.165$, $p < .01$, OR = .312, 95% CI [.153, .637], decreased the likelihood that the subject would be classified as falling with the HRC.

Table 9

Logistic Regression Analysis Concerning the Three Combined Domains of the MSA-EV Model (75.7%)

	β	S.E.	Wald	Odds Ratio	95% CI Interval	
					Lower	Upper
Age: 25 or younger	.609	.325	3.513	1.838	.973	3.473
Race ²						
Arab/Middle Eastern	.635	.610	1.084	1.887	.571	6.240
Black/African American	-1.473	.842	3.056	.229	.044	1.195
White/Caucasian	.754	.576	1.714	2.126	.687	6.574
Other	-.503	.765	.432	.605	.135	2.707
Subject does not have children	-.037	.610	.004	.963	.291	3.186
Subject has children	-.975	.609	2.560	.377	.114	1.245
Political identification ³						
Uninterested	.964	1.003	.922	2.621	.367	18.730
Very liberal	2.155***	.422	26.060	8.626	3.771	19.728
Combined centralist	-1.024	.928	1.218	.359	.058	2.213
Very conservative	-1.808*	.811	4.964	.164	.033	.805
Other	.384	.610	.395	1.468	.444	4.855
Composite variable of all domain 1 variables ⁴	.117*	.046	6.527	1.125	1.028	1.231
Composite variable of all domain 2 variables ⁵	-.142*	.056	6.504	.868	.778	.968

Note. Standardized beta coefficients are shown.

HRC = 1, MRC/LRC = 0, * $p < .05$, ** $p < .01$, *** $p < .001$.

¹The final model predicted risk category for subjects with 75.7% total accuracy: HRC: 62.2% accurate; MRC/LRC: 85.8% accurate.

²Race category: other reflects a combined category of the following races: American Indian or Alaskan Native, Multi-racial, and Asian.

³Political identification: combined centralist reflects a combined category of the following political identifications: somewhat liberal, centrist/moderate, and somewhat conservative, which each had less than 5 values.

⁴The composite of all domain 1 variables includes all variables captured in the propensity domain.

⁵The composite of all domain 2 variables includes all variables captured in the mobilization domain.

The final logistic regression involved a composite of all the variables that were found significant in the domain-specific multivariate analyses. This resulted in a model that was 62.2% accurate for the HRC, 85.8% accurate for the MRC/LRC with a total accuracy of 75.7 percent. Being very liberal increased the risk of being classified as being of high risk, $\beta = 2.155$, $p < .001$, OR = 8.626, 95% CI [3.771, 19.728], while being very conservative decreased the risk of falling into the HRC, $\beta = -1.808$, $p < .05$, OR = .164, 95 % CI [.033, .805]. The composite variable made up of *propensity* variables, $\beta = .117$, $p < .05$, OR = 1.125, 95% CI [1.028, 1.231], increased the likelihood that the subject was viewed as falling in the HRC. The composite variable made up of *mobilization* variables, $\beta = .142$,

$p < .05$, $OR = .868$, 95% CI [.778, .968], decreased the likelihood that the subject was considered as being of high risk. This model went through four iterations before finding its optimal fit.

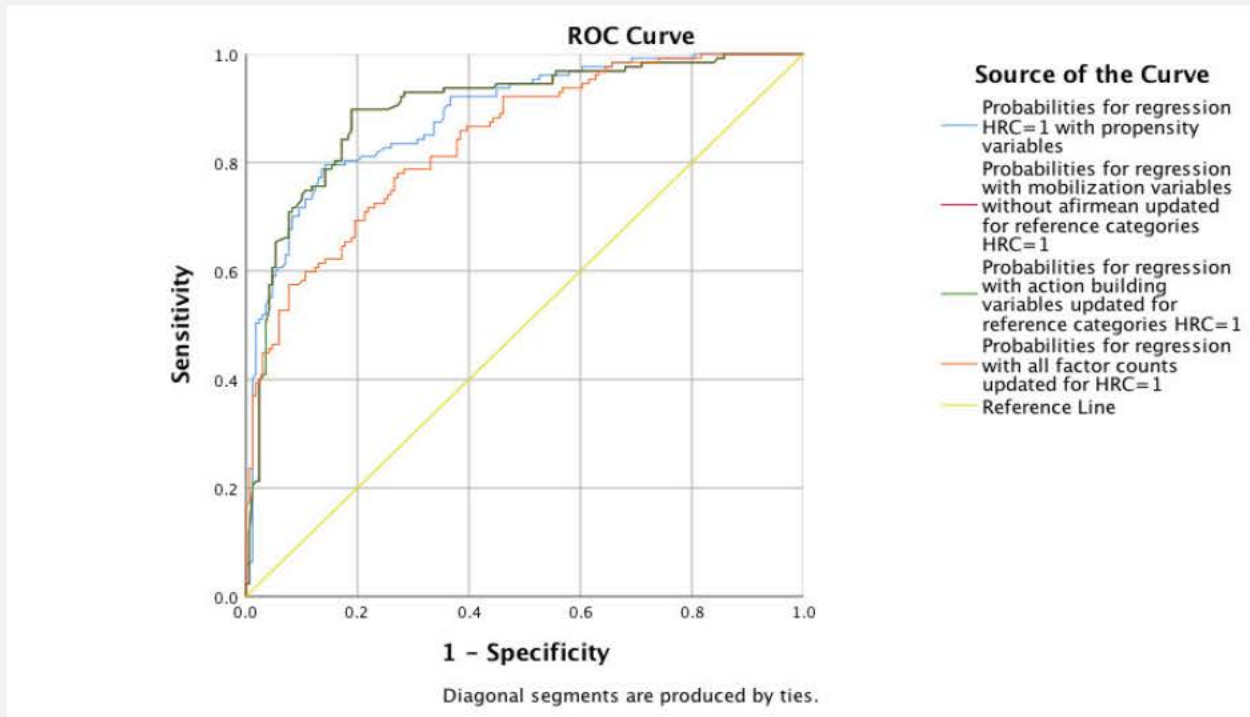


Figure 2: Receiver Operator Characteristics area under the curve analyses using the three domains of propensity, mobilization, and action and capacity-building

¹The afvircomean variable was removed from the final model because of multicollinearity.

The AUROC analysis, as illustrated in Figure 2, obtained a maximum area under the curve of .90 using the probabilities identified in the *mobilization* domains and the *capacity* domain of the MSA-EV model. The *propensity* domain resulted in an AUROC of .89. The probabilities identified in the logistic regression resulted in an AUROC of .84. All measures of specificity and sensitivity were statistically significant at $p < .001$ with an area under the curve of .90 being interpreted as reflecting excellent classification accuracy of the dependent variable.

Discussion

Our empirical findings lend support to the integration of theory into the dynamics of violence risk assessment, and more specifically the incorporation of Wikström's (2004) Situational Action Theory (SAT) into the study of extremist violence using the risk domains of *propensity*, *mobilization*, and *action and capacity-building*. This integration of a three domain approach made up of distinct but interrelated aspects of evolving levels of risk or threat resulted a robust ability of the model to classify 300 women into a HRC and a MRC/LRC with a .90 accuracy. Given that this is the first empirical examination of the MSA-EV model, the strength of these findings is encouraging and supports further study of the model both with men and women and with additional groups of extremist-involved individuals. Conceptually, these outcomes highlight the significance of theory, which integrates the individual within their social environment, as they progress through the psychological, social and behavioral antecedents of violent action. For federal law enforcement, it offers a preliminary framework, which if further validated, could serve as a shared platform for monitoring individuals of concern, and identifying fluctuating levels of threat over large cohorts of at-risk individuals.

To be included in our sample, each subject's involvement in extremist activities had to have been significant enough to warrant criminal charges. Based upon this criterion, 129 subjects or 43% of the sample were found to have been involved in some type of direct action that involved violence. Many of the women had also travelled as part of their extremist activities, were actively involved in plotting attacks against their perceived enemies, and were viewed as supporters of the larger organization. Less often, they became involved in state-building, recruiting others to their ideological beliefs and group membership, and/or in actively creating propaganda that was designed to convey an image of the group to which they belonged. The women identified as falling with the MRC had also often travelled as part of their involvement in an extremist organization, but their activities focused more on supporting the activities of their group, recruiting other individuals to it, and becoming involved in state-building primarily through marriage and procreation with other group members. We had only 19 women who were classified as falling in the LRC and these women exclusively involved travel that was related to state building, most often within the context of utopian ideals. These findings suggest that the women in the sample do fall into relatively distinct risk levels, and while some of the roles overlap, there is a core of women, which equals almost half of the sample, that becomes involved in plotting attacks and being directly involved in them. While this proportion of individuals involved in direct action is likely lower than found with men, it clearly demonstrates the potential danger of women when they become active in ideological groups that condone extremist violence and

underscores the importance of not under-estimating their risk or threat level based exclusively on gender.

As we developed our paradigm, we initially assumed that *propensity* for involvement in extremist violence, as defined by at least three attributes of each selected factor, would emerge based upon a primary propensity factor, most likely that of morality as indicated in our choice of the model's name. This assumptions implied that extremist violence was different than general violence per se and that "higher values" might be at play in these types of violent actions. We also assumed that developmental immaturity would play a role in this type of organizational activity based upon the relatively young age of most of the women in our sample. However, when we examined the data, we found that that only 21.7% of the sample was characterized only by morality and 1.3% only by developmental immaturity. Rather, we found the propensity factors to coalesce into combinations of two and three factors with some of these combinations being more malignant than others. In particular, antisocial tendencies were identified as a single propensity factor for only 5.7% of the sample, yet when combined with another propensity factor, it captured the motivations underpinnings of 51% of the sample. Moreover, when combined with morality, it became a blend that was significantly associated with inclusion in the HRC. In contrast, developmental immaturity, even when combined with morality, did not differentiate the risk levels across our sample. These patterns suggest that while morality and developmental immaturity may play a role in the radicalization and call to action experienced by some young women, it is the antisocial tendencies that tend to place them into the HRC, which by definition is associated with direct action involving violence. This pairing of morality and developmental immaturity with antisocial tendencies appears to create a dangerous and potent mixture of motivations, which may help to explain the radicalization that has been observed to proceed quickly and convincingly within prison environments where up to 44% to 50% of the inmates meet diagnostic criteria for Antisocial Personality Disorder (Warren, Jackson, Agee, Alam, & Millsbaugh, 2020).

Research has confirmed that most individuals age out of antisocial behavior (Moffitt, Caspi, Rutter, & Silva, 2001), which is almost normative in mid-adolescence, and relatively uncommon by young adulthood. The antisocial tendencies identified within our study sample, might therefore suggest that some of our sample will age out of their radicalized stance if they are not further entwined in it through marriage, the birth of children, injury or death, and/or international policies that can prohibit them from returning to their countries of origin. However, approximately one-third of these subjects were

identified as coming from families with another family member characterized similarly, and over one-half of these subjects were coded as manifesting a life-course persistent rather than adolescent-limited pattern of antisocial behavior. When viewed developmentally, these contiguous findings would argue that the antisocial tendencies preceded the internalization of moral emotions and sacred values, and that any attempt at de-radicalization would need to remain cognizant of both the personality and ideological content associated with a higher risk for extremist violence. Given the relatively lower base rate of antisocial behavior in women, this finding would further suggest that antisociality is likely to exert an even more powerful effect on the propensity toward extremist violence perpetrated by men.

Based upon a cut-off score of three characteristics for the positive coding of each of the three propensity factors including morality, antisocial tendency, and developmental immaturity, we were able to classify 254 subjects or 84.6% of our sample according to the tenets of SAT. When we examined the 46 subjects who did not demonstrate characteristics or behaviors reflective of at least one of the three propensity factors, we found that each displayed a scattering of the criteria across the three propensity factors -- but not enough to pass the threshold for a formal coding of at least one of them. In examining these patterns, we did not identify an additional underlying vulnerability that might enrich the MSA-EV theory. Demographically, being younger, being white/Caucasian, not being a mother, and being very liberal also played a role in determining which of the 300 subjects would fall into the HRC.

Apparent throughout all of the bivariate and multivariate analyses was the finding that religious identification was not significant in classifying women according to the high and lower risk categories. While the majority of the subjects experienced themselves as being religious, either as a longstanding characteristic or as an effect of a recent conversion, the different types of religious adherence did not differentiate the subjects who fell into the HRC and the MRC/LRC. In contrast, political identification remained significant throughout our analyses with subjects who identified as being very liberal demonstrating an increased likelihood for engaging in direct violence, while those who identified as being of very conservative being less likely to fall into the HRC. It is not possible to determine if this association is a cause or an effect of the broader radicalization process. To some extent, it appears to be associated with the traditional and gendered roles that women assume once they become radicalized not only in the far-right groups but also the caliphate proclaimed by IS in Syria less than five years ago. Not unexpectedly, our sample's role as mothers also played a part in

their propensity for becoming involved in violent extremism. When women in our sample had children who had been given birth through relationships that had no association with their extremist ideologies and practices, they were less likely to engage in violent behavior, possibly due to a sense of responsibility for maintaining their own safety in order to care for their children. This protective function was not observed when the children were born as part of the woman's involvement in extremist organizations with a significant number of these children traveling with and being radicalized by their mothers.

When examining the processes of *mobilization* within the MSA-EV, we found affiliations with significant others who condoned violence common among subjects across all three risk levels with these relationship including romantic partners, family members, and to a lesser extent interactions occurring through virtual communities. This finding supports SAT, which argues that a propensity for criminal or violent behavior must be galvanized through social relationships for it to become an action-based reality. In contrast, we found that involvement with social media and virtual communities was not characteristic of subjects classified as falling in the HRC. Rather, it was subjects falling in the MRC and the LRC, who were more involved in the consuming of radical content, sharing of radical content, endorsing attacks, creating radical content, actively recruiting others, and actively being recruited into extremist organizations. This finding supports the different action roles that we identified for our various subjects and suggests that the most prolific and provocative individuals found on social media are less likely to engage in extremist violence against others.

Certain *mobilization* attitudes involving individual and group grievances, social identity, and militant forms of thinking were also commonly observed and predictive of inclusion in the HRC. Common aspects of social identity included the adopting of some form of group language, and changing one's name. Subjects in the HRC also more commonly demonstrated various militant patterns of thinking including the belief that extreme means were necessary, that they would receive absolution for any violence they perpetrated, that the group with which they identified was being "tragically" obstructed, and that it was acceptable to accept immoral means given the importance of what they were trying to achieve through their extremist activities. Subjects across all three risk categories tended not to be radicalized by activities or interactions occurring in places of worship and more often engaged in radicalizing interactions in private locations involving their homes or the homes of others.

The *action* and *capacity-building* building domain of the MSA-EV provided some contours to the differences observed between the subjects who chose to engage in violent behavior in contrast to those who did not. The subjects falling into the HRC tended to be prioritize educational and career opportunities and to demonstrate clear decision-making processes in terms of their extremist activities. Their primary preparation activity involved various forms of skill acquisition. Alternatively, subjects falling into the MRC/LRC conveyed more interest in social and romantic opportunities, were less clear cut in their decision-making, and tended to be involved in financial acquisitions, religious pursuits, and expansion of their friendships and romantic relationships. These differences, while making intuitive sense in terms of group differences, lacked some of the specificity that we came to understand were central to a risk paradigm designed to assess and capture fluctuating level of risk manifest by a single individual over time.

While we were conducting our research, the National Counterterrorism Center (NCTC), the FBI, and the Department of Homeland Security (DHS) released an unclassified version of a guide that they had compiled for alerting investigators to increasing threat levels manifested by homegrown extremists' intent upon violence. They emphasized that no single risk factor was predictive of a violent event but that an accumulation of these behaviors was likely to signal an increasingly high threat level. Some of these actions included preparing martyrdom videos or a last will; attempting to obtain explosive precursors; stimulating an attack or assault with focus on local or other real-world targets; surveilling potential targets; seeking jobs that provided sensitive access; sending financial resources to high risk locations; purchasing electronic equipment; collecting and transporting survivalist care to people overseas; receiving unexplained monies from third-parties overseas; placating directly violent extremists online; seeking relationships with incarcerated or influential extremists; initiating outbursts or behaviors that resulted in exclusion or rejection by the family or the community; suspicious, unexplained, or unusual physical or weapons training; actively praising past successful or attempted terrorist attacks; condemning behavior of family and/or peers based upon violent extremist doctrine; and lying to law enforcement officers or obstructing investigations. The specificity of these actions is compelling and would suggest that their inclusion in further research with men -- and women -- might further enhance the predictive power of the MSA-EV model, particularly as it defines the *action* and *capacity-building* component of it.

Two primary findings emerge from the AUROC values obtained using the probabilities obtained from the logistic regressions run on the three domain-specific sets of variables. First, the classification accuracy or area under the curve estimates obtained for the *propensity* (.89), *mobilization* (.90), and *action and capacity-building* (.90) domains were large and reflective of excellent classification accuracy. Second, the domain-specific AUROC values demonstrated greater classification power than the AUROC that included all the significant variables obtained from the three domain-specific logistic regression (.84) analyses. While counter-intuitive in terms of inclusiveness, this finding might be indicative of interactions occurring within the domain-specific analyses that are predictively useful and offer additional classification strength to the model exceeding a linear approach that is more atheoretical in nature. Of importance to further research is the finding that the MSA-EV model made up of *propensity*, *mobilization* and *capacity-building* can sort female subjects into high and lower risk categories with levels of specificity and sensitivity comparable to those found in the natural sciences.

Finally, our research illustrates not only the risk that our sample of women poses to others but also the risk that their involvement with extremist ideologies poses to their own well-being and survival. In our sample of 300 women, at least 62 subjects (20.6%) were known to have died ostensibly because of their involvement with extremist activities. Lethal outcomes were often associated with women who chose to become suicide bombers but also occurred when women were killed during battles or died because of unforeseen realities such as inadequate medical care and severe deprivation. The subjects were known to have given birth to at least 356 children of whom 189 (53%) were involved in the radicalization activities of their mothers. This risk associated with these progenies is being demonstrated at this time at the al-Hawl refugee camp in Syria where 1,500 women and children are being retained. Reports coming from the camp suggests that the women are becoming angry and resentful and that their anger toward Western countries is being viscerally transferred to their developing children. Moreover, less than half of these women (46%) remain married with 18% being widowed and 19.4% separated or divorced from their partners. These chilling outcomes might well modulate some of the ardor experienced by some young women when first encountering radicalizing ideas.

Limitations and Future Directions

Our empirical findings must be assessed with an eye to the limitations of our study. First, our study involved only women and it is not yet clear to what extent our model will be directly applicable

to men. Replication with men will require the further development of the coding manual and could be enhanced by more detailed capacity-building behaviors. Second, our study was correlational in nature and therefore not predictive per se with our assessment of risk occurring after rather than before the involvement of our subjects in any types of extremist violence. A truly predictive study, should it occur, will require that federal and state law enforcement use the MSA-EV model to track high-risk individuals to assess the validity of the risk markers in it, a task that would be warranted only after further postdictive verification of the model with men. Third, our coding derived from open source information only and it is not possible to assess at this time how the coding might have differed had it been enhanced by the availability of classified information. As indicated, empirical analyses are now underway in the FBI's BAU1 using our data and model to begin discerning the relevance of classified information to the coding of the MSA-EV model. Finally, while not a limitation per se, it is important to remain aware that our model is designed to assess risk or threat level among at-risk women, who are known to be involved with an extremist organization, and as such, it is not a predictive model designed to assess the risk for radicalization among women in general.

Conclusion

In conclusion, our study supports the use of a theory-based risk model which assesses domains of *propensity*, *mobilization* and *action and capacity-building* to determine varying levels of risk among women involved in extremist violence. As such, it appears to hold potential for use by law enforcement and the IC in monitoring at-risk individuals and determining optimal interventions given the degree of risk and progressive movement of an individual toward violent action. Further work is required to determine the applicability of this risk model to men, to more fully identify the capacity-building options of at-risk men and women, and to determine if there are additional risk variables that might further enrich the three domains of the MSA-EV model. Further analyses will focus on the differential effects, if any, of individual factors when they are identified as being only risk factors, only protective factors or a combination of both. Content analyses will also be used to examine the relevance of the case narratives embedded in the MSA-EV to the investigative and intervention strategies of federal law enforcement.

STUDY TWO: EXPLORING THE EFFECTS OF PROPAGANDA ON WOMEN

In the spring of 2019, the National Academies of Sciences, Engineering, and Medicine released a consensus report that responded to the charge emanating from the Office of the Director of National Intelligence (ODNI) to identify opportunities for research from the social and behavioral sciences that held potential for supporting the work of intelligence analysts and enhancing national security over the next ten years. While observing that the intelligence community (IC) was no stranger to the valuable contribution made by research in the social and behavioral sciences (SBS), ODNI concluded that “in an age when both technologies and national security concerns are evolving at lightning speed, the IC has recognized the critical need to more systematically take advantage of cutting-edge research from diverse SBS fields” (p. ix). One direction identified within this multidimensional field of inquiry involved the development of research on affect and emotion which could enhance understanding of primary targets of intelligence analysis, the potential impact of actions taken by the intelligence community, and the individual and social processes relevant to security threats. Specifically, they identified the importance of a better understanding of social cybersecurity threats and the evolving ways adversaries influence the hearts and minds of others and the ways individuals are drawn into radicalization and extremism (p. 7).

The current study responds to this broad mandate by seeking to explore quantitatively the mechanisms through which extremist propaganda both captures the attention of individuals and evokes in them emotional reactions which may facilitate the internalization of ideological content. These processes can be powerful in promoting processes of radicalization that can be swift and compelling and which can convince individuals with little prior exposure the relevance and necessity of various forms of extremist violence. However, while the power of propaganda has been analyzed by modern philosophers, sociologists, linguists, theologians, and historians with a rich and vivid description of its effect on the human mind and human spirit, there exists a significant lacunae in our understanding of the neurophysiological processes by which and through which these forceful changes of thinking and feeling occur within the individual – and through them within their social environment.

As a first step in this type of inquiry, we examined responses of young women to various propaganda images currently being circulated through social media by jihadist, alt-right and alt-left organizations. These materials have been shown to play a role in prompting affiliation and recruitment to informal or formal groups adhering to particular ideological or religious content. In our study, these responses were examined using eye gaze and pupil dilation, galvanic skin response, and facial emotion recognition. Our goals were twofold: first, to initiate a new more scientific methodology for studying the effects of propaganda; and second, to begin a process of pinpointing the neuropsychological processes that underlie propaganda’s pervasive and potentially encompassing effect on the human mind.

An Overview of the History and Conceptualization of Propaganda

While manipulative or persuasive forms of communication designed to capture power or profit have been used throughout history, the first use of the terms is attributed to Pope Gregory XV who in 1622 created the Congregation de Propaganda Fide to identify a group of cardinals who were responsible for the spread of the Catholic faith into non-Catholic countries. The term originated from modern Latin with its gerundive form being derived from the verb of *propagare*, meaning to spread or propagate a plant by cutting (Diggs-Brown, 2011). With the spread of the printing press throughout Europe, the use of the term began to acquire a more secular and political connotation with newspapers and printers playing a major role in the call for independence during the American Revolution; during the French Revolution and Napoleonic wars when broadsheets were used with the enemy troops offering rewards for desertion; and as part of the Indian rebellion of 1857 when 48 young English girls were supposedly raped by Indian rebels, a false propaganda story that was clarified by Karl Marx who noted that the story was reported by a clergy man who was far from the events of the rebellion (Beckman, 2003; Welch, 2003).

According to Noam Chomsky (1991), modern propaganda emerged in the early 20th century in America when Woodrow Wilson concluded that war was necessary and that a largely pacifist country had to be transformed into a population ready to go to war. Propaganda experts at that time, Walter Lippmann and Edward Bernays, were asked to serve on the Creel Commission, or the Committee on Public Information (1917-1919), and over a two-year-period, they helped to orchestrate a nation-wide campaign that generated 75,000 volunteers, 7.5 million four-minute oration sessions, and a plethora of newsprint releases, posters, radio shows, telegraphs, movies, academic papers and seminars, all designed to complement each other and convey a shared support for the war effort. Carey (1997) observed that the Creel Commission accomplished in generating over a six-month period such an “intense anti-German hysteria” as to permanently impress American business and Adolf Hitler of the potential of large-scale propaganda to control public opinion. The power of this type of effort or technique was replicated in Operation Coffeecup in 1961 when the American Medical Association funded a persuasive public opinion campaign, largely through the Medical Auxiliary made up of their wives, designed to convince Congress and the larger society that there was much to be feared from “socialized medicine” (Onge, 2017).

In his famous book, *Propaganda: The formation of men's attitudes* (1965), Ellul, a French philosopher, theologian, legal scholar, and sociologist, created a taxonomy of propaganda which included concepts such as paired opposites, vertical and horizontal influence, rational-irrational processes, and effects of agitation and integration. He theorized that in order for propaganda to be successful, it must work unconsciously to short-circuit all thought and decision, and while remaining indiscernible to the individual, affect a “central core” in him which must be reached in order to trigger the appropriate and desired action. He offered a historical contextualization of this effect:

The aim of modern propaganda is no longer to modify ideas, but to provoke action. It is no longer to change adherence to doctrine, but to make the individual cling irrationally to a process of action. It is no longer to lead to a choice, but to loosen the reflexes. It is no longer to transform an opinion, but to arouse an active and mythical belief (p.25).

Ellul (1965) defined propaganda as a set of methods employed by an organized group that wanted to bring about the active or passive participation in its actions of a mass of individuals, unified through psychological manipulations and incorporated into an organization (p. 61). Through the encircling power of what he referred to as the “organized myth,” the content of the propaganda came to provide the individual with a fully encompassing range of “intuitive knowledge,” which inevitably leads to only one interpretation of the world and which perceptually eliminated divergence and simultaneously made the individual immune to other ideas and influences.

Recently, Winter (2015) used the theoretical framework of Jacques Ellul to explore IS’s propaganda machine and the underpinnings of its powerful influence through different media sources. Based upon an analysis of the Islamic State’s propaganda output over the 12 months following the Caliphate declaration in June 2014, Winter concluded that the organization’s propaganda did not singularly radicalize individuals to a new set of religious beliefs and attitudes, but did play a central role in the transformation of the individual from a tacit supporter to an active member of the organization. Referencing Ellul’s principle of paired opposites, Winter identified six narrative themes that were pervasive in the communications crafted by IS including brutality, mercy, victimhood, war, belonging and utopianism; he maintained that the use of gruesome images of violence were a “red herring” to the more complicated integration of these underlying themes. He further observed that when galvanized by frequent references to the Armageddon, these themes “leverage... urgency and religio-political legitimacy with one another such that the imperative to act – whether the ‘act’ in question is joining, disseminating propaganda, or carrying out an attack – is as pressing as possible” (p. 31).

In his analysis, Winter also identified the different roles that individuals played within the IS as potential opponents, international public, active members, potential recruits, disseminators, proselytizers and enlists. Embedded in each of these was the intent, again articulated by Ellul, wherein propaganda was designed to ultimately activate an individual’s participation in the transmission of ideas while they remain under the illusion of independent thought. In a later publication, *Media Jihad: The Islamic State’s Doctrine for Information Warfare*, Winter (2016) provided an English translation of the 55-page document written in Arabic that was published by the IS in 2016 to synthesize and communicate their media strategy as developed by Abu-Bakr al-Baghdadi. The text makes clear that mainstream media is to be considered an effective weapon and that at times propaganda production and dissemination is more important to the organization than military jihad.

The Pupil as a Measure of Emotional Arousal and Autonomic Activation

In 1960, Hess and Polt wrote a seminal paper in which they reported a bidirectional effect of emotion on pupil change, indicating that the pupil constricted when individuals viewed unpleasant stimuli and dilated when they viewed pleasant images. While the initial study suffered from a number of limitations including few pictures, a limited sample size, a rudimentary method of assessing pupil change in dilation, and a lack of statistical analyses, it introduced into the field of psychology the notion that pupil dilation and constriction reflected mental activity and could be used as a measure of interest, emotion, thought processes, and attitudes. When presenting this conclusion, Hess (1965) referenced the observation made by French poet Guillaume that eyes held the clue to emotion and were “windows of the soul,” as is commonly recognized in literature and everyday language.

As part of later research, Hess and his colleagues examined differences in pupil dilation to distressing images such as dead soldiers on the battlefield, piles of corpses in a concentration camp, and the body of murdered gangsters. They found that while these negative stimuli produced extreme pupil constriction among some subjects, they elicited a large increase in pupil dilation among others. Assuming that these differences reflected some type of “shock response,” the researchers attached electrodes to the hands of the volunteers that had demonstrated the most extreme reactions. They found that the “shock responses” were correlated with high galvanic skin responses in most subjects. After repeated presentations of the same images, the skin response decreased rapidly as the pupil response shifted from dilation to constriction. As part of this early research, Hess also discovered many of these responses were not only extremely sensitive but also occurred outside the subject’s conscious awareness. When 20 male participants were presented with two versions of the same photograph of an attractive young woman, one in which the pupils had been retouched to be dilated and in the other constricted, the male participants demonstrated twice as strong a pupil response to the picture with the large pupils. However, when asked about their reactions after the experimental sessions, most participants reported that the two pictures were identical. When reporting these findings, Hess referred to the practice in the Middle Ages when women would dilate their pupils with the drug belladonna, which in Italian is translated as “beautiful woman.”

When commenting retrospectively on his work, Hess (1965) wrote that what he found most interesting was the power of the pupil to indicate changes in attitudes. Commenting that this process could be related to straightforward information, psychotherapy, political propaganda, advertising or any other material intended to change attitudes, Hess reported on a study which presented photographs of President Johnson, Goldwater, Kennedy, and Eisenhower, followed by the participants reading anti-Johnson, anti-Goldwater, and generic excerpts from a psychology journal with no political content. Those participants who read the president-specific material demonstrated the expected decrease in response to both of these presidents and even to Eisenhower, suggesting that bitter campaign propaganda can lower not only a person’s attitude towards specific politicians

but also politicians in general. When reflecting on the totality of his research, Hess concluded that “pupil response promises to be a new tool with which to probe the mind” (p. 54).

Almost 40 years later, Bradley, Miccoli, Escrig, and Lang (2008) undertook a series of studies to examine pupil diameter during picture viewing to assess the effects of hedonic valence and emotional arousal. Automatic activity including heart rate and skin conductance were also measured to determine whether pupillary changes were mediated by parasympathetic or sympathetic activation. Bradley et al. (2008) used 96 pictures selected from their International Affective Picture System (IAPS: Lang et al., 2005). These included 32 pleasant, 32 neutral and 32 unpleasant images. All of the pictures portrayed people, were balanced for stimulus complexity, used a landscape orientation, were displayed in 16-bit grayscale, and had been altered to ensure that the mean and distribution of luminosity was the same for each series of images. Following an initial light reaction, Bradley and colleagues (2008) found that mean pupil diameter was affected by picture emotionality with a sustained difference in pupil diameter when participants viewed emotional, comparative to neutral pictures. Skin conductance changes were found to be consistent with this pattern of pupillary changes, while heart rate was found to decelerate in response to unpleasant photographs and showed no change when the subjects were viewing pleasant and neutral pictures. Based upon these findings, the researchers concluded that the close covariation between pupil dilation and skin concordance suggested that in emotional processing, the mechanisms are different and involve direct sympathetic innervations of the dilator muscle. This finding is consistent with the hypothesis that pupillary changes during affective picture viewing are mediated by increased sympathetic activity reflective of emotional arousal, independent of whether the photos are pleasant or unpleasant in hedonic valence.

In 2018, Zekveld, Koelewijn, and Kramer published an overview of 146 studies published from 1966 through 2017, which examined pupil dilation in response to auditory stimuli. The studies, summarized based upon their internal or external emphases, included sections on automatic or involuntary attention, intentional or voluntary attention, arousal level as affected by input-related demands, the individual’s evaluation of the expected benefits of successful performance, the role of fatigue in the evaluation of demands, and the role of motivation as a factor moderating the link between task demand and effort. While focusing on auditory stimuli as contrasted to visual stimuli, the review confirmed that pupil response was sensitive to the emotional valence of auditory stimuli and that emotional stimuli evoke larger pupil responses than neutral stimuli in healthy controls. The studies examining emotional valence found some evidence that the largest pupil size was observed for aversive stimuli (Babiker, Faye, Prehn, & Malik, 2015; Burley, Gray, & Snowden, 2015; Stanners, Coulter, Swett, & Murphy, 1979). Based upon this review, the authors concluded that pupillometry was increasingly being applied in research science, and that the factors identified in the early research such as the effect of memory load, linguistic complexity, and auditory processing demands remained highly relevant and were being replicated

using more advanced methods and technologies. They concluded that the reliability and robustness of the findings suggest that “application areas of pupillometry are seemingly endless, justifying the current enthusiasm for this method” (p. 22).

Galvanic Skin Response (GSR) as a Measure of Emotional Intensity

Galvanic skin response (GSR) is considered one of the more sensitive measures of emotional arousal. It is believed to originate from the autonomic activation in the sympathetic nervous system which is associated with the activation of the sweat glands and an increase in skin conductance. Also referred to as electrodermal activity (EDA) and skin conductance (SC), GSR captures the electrical properties of the skin measured in voltage, which emanate from the surface of the skin in response to different kinds of stimuli and experiences (Travanen, Koistinen, Valkonen-Korhonen, Partanene, & Karjalainen, 2001). Emil du Bois-Reymond observed in 1849 that the human skin was active electrically and 40 years later, in 1888, Charles Féré, a French neurologist demonstrated that skin resistance activity could be changed by emotional stimulation and inhibited by drugs (Pearce, 2001, Féré, 1892). The application of EDA instruments to the study of psychology began in the early 1990s when Carl Jung published his book, *Studies in Word Analyses* (1906) in which he described the use of a meter to measure his patients’ emotional reactions to list of words, during word association. The responses he measured so impressed Jung that he is reported to have exclaimed, “[a]ha, a looking glass into the unconscious!” (Mitchell, 2015).

The use of GSR has expanded exponentially in the past fifteen years largely in the context of efforts to improve human-computer interactions, an area now referred to as affective computing (Westerink, Ouwerkerk, Overbeed, Pasveer and De Puyter, 2008). The goals of this effort are diverse and encompass an expanse of product, services and methodologies, which integrate the expertise of academia, business and technology in seeking to better understand cognitive and memory-related processes and judgements that are evoked when using certain products and engaging in certain experiences. Relevant to this area of inquiry is the understanding that in these endeavors, the user does not need to interpret or even understand their own emotions, as physiological recordings are used to collect information of reactions manifest beyond the conscious awareness of the individual. Experts in this field, however, also acknowledge that extracting meaning from these data is not always easy or straightforward.

Boucsein and Schaefer (2008) used the Japanese concept of *kansei*, or the individual’s ability for intuitively assessing the quality of art or the purity of the natural environment, to develop a physiological assessment for use in product testing. In their experiments, they used electrocardiograms, skin conductance, and the activity to three facial measures to assess reactions to industrial tensides, the effects of certain words and tactile reactions to hair products, and cross- gender reactions to the fragrances of lavender and jasmine. In all three experiments,

they found that their physiological assessments could more fully capture fine-grained differences in emotional and arousing effects of individuals in comparison to self-report, leading them to conclude that their methodology constituted an easy to apply, non-invasive, peripheral physiological measure of changes occurring in the automatic and somatic nervous system.

A different avenue for research that involves researchers from many countries focuses on determining the best ways to analyze patterning in successive galvanic skin response measurements (Guo, Li, He, Gao, Qi, Owens, 2013; Liu, Lui & Lai, 2014; Tarvainen, Koistinen, Valkonen-Korhonen, Partanen, & Karjalainen, 2001; Torres, Orozco, & Alvarez, 2013). Tarvainen et al. (2001) used principal component analysis (PCA) and regression methods to examine the GSR obtained from 20 healthy controls and 13 psychotic patients. They found that the observed degree of similarity in successive GSRs was clearly higher for healthy subjects when compared to psychotic patients, allowing them to create a valid model for discriminating the two groups. Liu, Lui & Lai (2014) sought to determine the emotional intensity of subjects exposed to happy and grief inducing videos using GSR by fitting the feature values to the in the emotional intensity values of each content viewed by their subjects. Based upon their analysis they inferred that the maximum value of happy intensity was 91, while the maximum value of grief intensity was 80. Applying their findings to the field of affective computing, they concluded that emotional intensities established by their functional relation could be used to determine and reflect emotional intensity both objectively and accurately. Torres, Orozco, & Alvarez (2013) sought to identify the most discriminating features in multimodal emotion classification using the electroencephalogram, GRS, skin temperature, blood volume pressure, electromyography, and electrooculogram signals of 32 participants as they watched 41-minute-long excerpts of music videos. Participants rated each video in terms of the levels of arousal, valence, like/dislike, dominance, and familiarity. They found that using a small subset of features, they were able to obtain 70% accuracy for arousal, and 60% accuracy from valence and some experiments. Specifically, they found that GSR was most relevant for arousal classification while the electroencephalogram was most relevant for valence of the emotions being experienced.

Guo, Li, He, Gao, Qi, Owens (2013) developed a method for processing and analyzing GSR as a single modularity for sensing human emotions. Using videos to invoke four basic categories of motions including amusement, fear, relaxation, and sadness, they collected GSR signals from four subjects. Using an SFFS-based classification that employed a tenfold cross validation strategy on the individual GSR data sets, they were able to obtain a 79.5% percent accuracy in the emotions identified across different responses by their four participants. Focusing on the potential of these process to contribute to the well-being of individuals, the authors described ways in which the proposed system could be made applicable in mobile sensing devices to help monitor the mental health functioning of individuals in real time as they moved throughout their day.

Facial Electromyography as a Measure of Emotion Valence and Arousal

In the mid-19th century, Charles Bell and G.B. Duchenne de Boulogne attempted to map out the muscles located in the human face which were associated with emotion, while Charles Darwin in 1872 wrote extensively on the evolution and biological basis of facial expressions in his book, *The Expression of Emotions in Man and Animal*. Over 100 years later, Ekman and Friesen (1978) developed the first Facial Action Coding System and Izard (1979) the Maximally Discriminative Affect Coding System, both requiring the use of extensively trained coders to detect the manifestation of emotions as expressed through movement of muscles within the human face. In 1976, Schwartz, Fair, Slat, Mandel, & Klerman conducted what has come to be known as the “classic” facial EMG study, in which they examined the activity of four facial muscles as depressed and non-depressed patients imagined a typical day in their lives. Their research demonstrated that facial muscle movement could be measured using biometric techniques, making it a topic of study that was not only less time-consuming but also more accurate (Reed, 2017).

Electromyography (EMG) refers to the recording and analysis of muscular activation using electrical signals coming from skeletal muscle contraction. Facial electromyography (fEMG) is used to measure implicit facial expressions which are often too small to be detected by conventional facial coding. This facial muscle activity is highly specialized for expression, allowing human beings to share social information with others and to communicate both verbally and nonverbally. Involuntary and unconscious expressions are controlled by the brainstem and occur spontaneously while consciously controlled and intentional facial expressions emerge from activity in the motor cortex (iMotions Facial Expression Analysis: A Complete Pocket Guide).

The iMotions software uses the facial action coding system developed by Ekman and Friesen (1978, 2002) to identify seven emotions including fear, joy, surprise, sadness, contempt, disgust, and anger, which are expressed by numerical scores for facial expressions, action units, and emotions along with the degree of confidence for each measure. The creators of the iMotions software observe that fEMG is advantageous for research and product development as it constitutes a precise and sensitive method for measuring emotional expressions, does not depend upon language or require cognitive effort or memory, occurs accurately even when subjects are instructed to inhibit their emotional expression, and is able to generate substantial data in a continuous and scalar manner.

Bradley, Codispoti, Cuthbert and Lang (2008) have researched extensively the hypothesis that human emotions are organized by underlying motivational states -- defensive and appetitive -- that have evolved over long periods of time to promote the survival of individuals and species. As part of one experiment, the researchers collected ten physiological measures of the reactions of 95 college students to a series of 72 photos made up of 18 different picture contents. These included pleasant image sets (i.e., nature, families, food, sports, adventure, attractive men, attractive women, erotic couples), two neutral image sets (i.e., household objects, mushrooms), and eight unpleasant image sets (i.e., pollution, illness, loss, accident, contamination, attacking animals, attacking

humans, mutilated bodies). They found that the electromyography (EMG) activity measured over the corrugator, zygomatic and orbicular oculi muscles of the face varied with greater corrugator activity when viewing unpleasant compared to pleasant photos; and greater zygomatic activity when viewing pleasant compared with unpleasant pictures. They interpreted these findings in line with their motivational hypothesis, observing that the strongest emotional arousal, as reflected in skin conductance responses and various aspects of the startle response, were found to occur when participants viewed pictures depicting threat, violent death, and erotica. Further, they found that reflex modulation and conductance charge varied with the level of arousal, whereas facial emotion recognition was more content specific, reflecting tactical responses to specific contexts, serving both social–instrumental and communicative functions. Based upon these findings, Bradley et al. (2008) concluded that affective responses served different functions including mobilization for action, attention, and social communication, and that they were distinguished by the motivational system being activated, the intensity of the activation, and the specific emotional content.

Westerink, van den Broek, Schut, Van Herk and Tuinenbreijer (2008) conducted research designed to improve human–computer interactions through developing means for computers to recognize and respond properly to users’ emotional states. They defined emotions as acute affective states that existed over relatively short periods of time; were related to a particular event, object or action; and were experienced in a two dimensional space made up of affective valence and arousal. Using the TMS International Porti5-16/ASD measurement system, they collected fEMG data from 24 study participants as they watched 16 film sequences found to illicit one single emotion from most viewers. They found that using the fEMG corrugator supercilii and fEMG zygomaticus, they were able to identify positive, negative, mixed and neutral emotions according to their valence with a strong and significant discriminating ability. Based upon these findings, the researchers concluded that certain statistics including the parameter skewness of the physiological signals could be used in discriminating the valence of the at least four types of emotions. They also observed that individuals had different emotional responses during the same events, objects or actions, and that measures of personality traits such as extraversion and neuroticism, could prove useful in tailoring a suitable communication strategy in human-computer interactions.

Wolf, Mass, Ingenbleek, Kiefner, Naber & Wiedemann (2005) studied the facial muscle patterns of disgust in contrast to appetite and joy using an improved facial EMG method, which was able to capture pre-visible contraction in nine facial muscles used for the study. Data collection involved having 40 research participants view photos from the IAPS study archive designed to illicit disgust, appetite, excited-joy and relaxed-joy. They found that disgust was represented by a specific facial muscle pattern involving the M corrugator and M orbicular oculi, and that it was clearly distinguishable from the facial patterns of appetite and joy. The intensity

of the disgust was found to be stronger among participants who were hungry at the time of the viewing and consistently stronger among the female research participants.

Study goals and hypothesis

In the current study, we examined eye gaze and pupil dilation, galvanic skin response (GSR), facial electromyography (FE) and self-report of a sample of young women as they viewed online material generated by jihadist, alt-right, and alt-left organizations. The pervasive online presence of these ideological organizations, coupled with their apparent efficacy in engendering interest and participation, served as the impetus for our study of the effects of propaganda on women. Our specific hypotheses included the following:

1. Responses to different types of propaganda content will differ from responses to neutral images for all participants based upon their baseline measures.
2. Based upon participant selection criteria, there will be group differences in pupil dilation and eye gaze responses to jihadist, alt-right, and alt-left propaganda.
3. Responses will vary across various propaganda content with a “shock reaction” being observed when participants view brutal and violent imagery.
4. There will be more congruence between the various neurophysiological measures than between the neurophysiological measures and the self-report responses of our subjects when viewing to jihadist, alt-right, and alt-left propaganda.

These analyses were undertaken as part of a larger project that sought to understand the radicalization of women to extremist violence and the development of a risk model for understanding the interplay between individual characteristics, social interactions and contact, and processes of action and capacity-building as they capture movement toward engagement in violent action.

Methodology

Sample. The sample was comprised of 90 women aged 18 through 35 years, who self-identified as being conservative, liberal, or Muslim. The first half of the sample participated in a series of three hour-long online search sessions and a focus group designed to capture and explain compelling images related to the radicalization of women. Permission was received from UVA’s Vice President of Technology to allow the sample to review material on both the surface and the dark web using the IP addresses located at UVA’s Institute of Law, Psychiatry, and Public Policy (ILPPP). The second half of the sample underwent a single experimental session, which involved reviewing a sample of these materials while being monitored according to eye gaze, pupil dilation, galvanic skin response, and emotional facial recognition. The experimental session involved four series of content of neutral images, alt-right, jihadist, and alt-left materials.

Data collection. The data for this study were collected using Tobii Pro X3-120 software, a laptop camera, and Shimmer3 physiological sensors. Tobii Pro X3-120 collects data from the four neuro-physiological devices approximately every eight milliseconds. During the experiment, participants viewed images on a computer in a tent-like structure with consistent ambient light being maintained throughout the four sessions. These data were integrated through iMotion software and downloaded as raw data to Excel, and then transformed to be displayed as Areas of Interest (AOIs) and heat maps to allow for visual comparisons across participants and content.

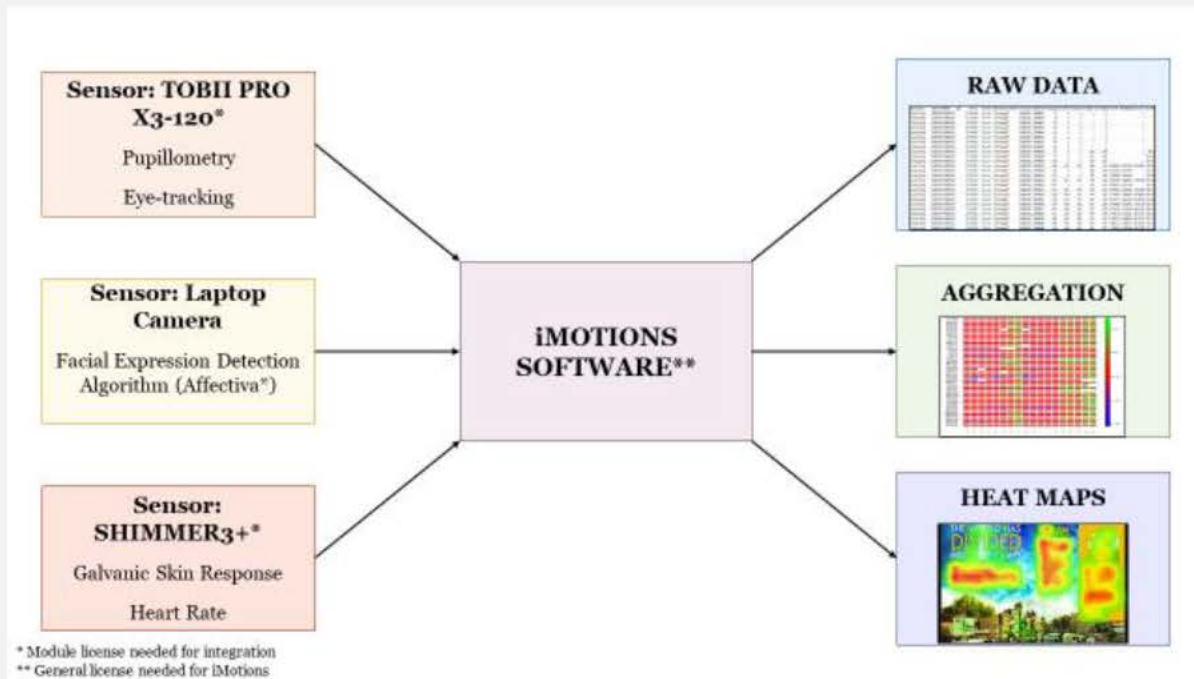


Figure 1: Data collection and integration using Tobii Pro X3-120 and iMotions software.

Measures. We used three measures to gauge the reactions of our study participants to four series of propaganda images including neutral, jihadist, alt-right and alt-left content.

Online stimuli series. Examples of the four online stimuli series with marked AOIs are presented below. The first image on the left is similar to one of the neutral photos we selected from the IAPS, which is a private database. The remaining three images are actual images used in our sessions.



Figure 2: Examples of AOIs entered post-hoc to images contained in the neutral, jihadist, alt-right and alt-left image series.

The 48 neutral images were obtained from the International Affective Picture System (IAPS) developed at the NIMH Center for the Study of Emotion and Attitude, University of Florida (Bradley & Lang, 2007; Lang, Bradley, & Cuthbert, 2008). These images are rated on dimensions of emotional valence, arousal, and dominance using the Self-Assessment Manikin (SAM), which is embedded in the LSI described below. We selected images taken from the public domain to replace two images in the alternative jihadist series and removed one image from each of the far-right and far-left series. The alternative less violent series was requested by four of our participants. Additional videos that were included in each of the three series were not included in the current analyses as they did not allow for precise measurement of pupil dilation and the review of specific areas of interest.

Pupil dilation. Pupillometry has been used in psychological and neurological research for decades, having provided insight into cognitive processes such as cognitive efforts (Graur & Siegle, 2013) and emotional arousal in response to visual and auditory stimuli (Bradley et al., 2008; Partala, Jokiniemi, & Surakka, 2000). Pupil dilation and constriction is controlled by two muscles – the dilatory and the sphincter (Steinhauer, Siegel, Condray, & Pless, 2004).

To account for preexistent individual differences in pupil size in neutral settings, researchers obtained each participant's mean pupil diameter when viewing neutral images and used these to create a pupil baseline for each participant, which was subtracted from the experimental values to normalize the relative change in pupil diameter in each of the AOIs for each participant. Finally, we normalized these changes by dividing the difference to the pupil baseline diameter.

$$\text{Normalized Pupil Change} = \frac{\text{pupil diameter} - \text{pupil baseline}}{\text{pupil baseline}}$$

We aggregated these pupil changes for each of our AOIs for each participant. A negative value represents a general pupil contraction and a positive value reflects a mean pupil dilation on a particular AOI.

Areas of Interest (AOI). To monitor and analyze eye gaze patterns, each image from each session had Areas of Interest (AOIs) marked post-hoc. These are displayed in the red boxes outlined in the four stimuli images included above. These areas were organized around general concepts, such as a block of text, a graphic, or a face. Specifically, these AOIs were selected so we could analyze how participants typically view propaganda, for example whether they looked at illustrations or titles first; whether they finished reading an entire paragraph before focusing somewhere else; what parts of the materials they focused on the most, etc.

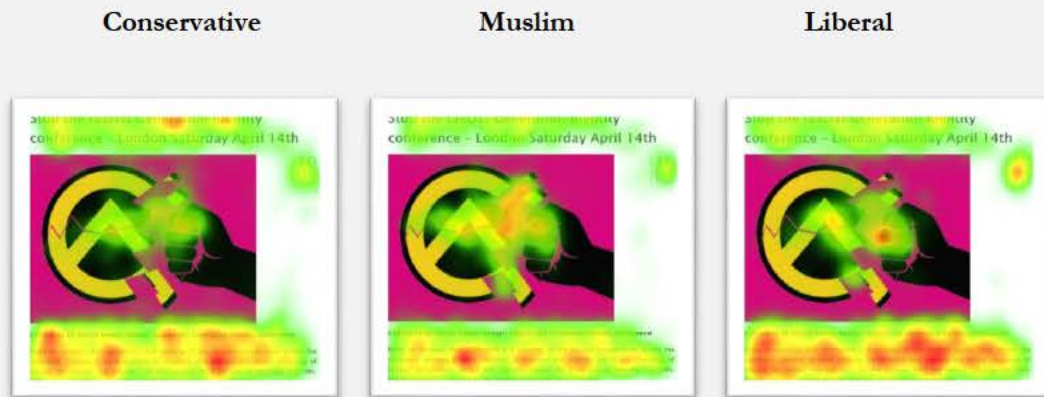


Figure 3: Examples of eye gaze to the same AOIs by three subject groups as identified when viewing propaganda from alt-left image series.

Galvanic Skin Response (GSR). We used a Shimmer GSR sensor device to collect GSR measurements from our subjects as they viewed our four series of images. A time series of skin conductance can be characterized by a slowly varying tonic activity (skin conductance level; SCL) and a fast varying phasic activity (skin conductance response, SCR). These measurements are captured in iMotions under the GSR Summary Exports category and the Times Series Data category. The GSR Summary Exports contains measures of peaks per respondent, total number of peaks for a defined time window for stimulus, and summary scores for each subject for each stimulus within the study. The GSR Time Series data contains raw sensor data and time series raw GSR, phasic data and peaks data.

Facial Electromyography (FE). The Affectiva (AFFDEX) component of iMotions uses 18 facial expressions equivalent to Action Units described by the Facial Action Coding System. Based upon this system, it computes valence and engagement, with valence reflecting the measure of how positive or negative the expression is and engagement the overall engagement or expressiveness of the participant being studied. The facial movement of each participant is recorded according to 33 facial muscles which are exported and translated into categorical emotions of joy, anger, surprise, fear, contempt, sadness, and disgust. These numerical values are used to convey the mixture of these basic seven emotions across exposure to varying stimuli.

Lab Session Inventory (LSI). We were interested in exploring potential correlations between eye gaze patterns, participants' religious/political identification, and responses of perceived emotional reactions as obtained by the LSI. The Lab Session Instrument (LSI) is a two-page self-report questionnaire that participants filled out after every material-viewing session for a total of four times. The instrument is divided into four separate measures. The first measure uses Plutchik's emotion wheel diagram, a three-dimensional cone model of emotions, proposed originally in 1958 and described more fully in 2001 (Plutchik, 2001). The wheel is based upon eight primary emotions, grouped into four pairs of polar opposites. The vertical dimensions of the cone represent the intensity of the primary emotion, while the circles group degrees of similarity among emotions (Plutchik, 2001). We asked participants to circle six emotions they experienced while viewing the material.

The second measure contained in the LSI, referred to as Propaganda Cognitions (LSI.PC), asked the participants to identify techniques conveyed in each series that appear designed to change an individual's thinking concerning their view of the world and their participation in it. Ten of these premises or functions were obtained from Ellul's text, *Propaganda: The formation of men's attitudes* (1965). Examples of these functions included content designed to provide reasons and justifications for prejudice; to provide full assurance of the righteousness of the idea or the actions being resented; and/or to dissipate a sense of individuality to create a fusion with others. These functions were collected individually and as a total of 1 through 10 for each of the four sessions.

The third measure used the Self-Assessment Manikin (SAM) developed by Bradley & Lang (2007) to measure emotional valence, arousal, and dominance. Scores were entered on a scale of 1 through 9 for each of the three dimensions.

Data analyses. Before starting the analysis, missing data were addressed using the iMotions outputs. For pupil dilation, missing data were represented as a -1 value. In these instances, we used linear interpolation to replace these missing values. Moreover, iMotions provides pupil diameter (in mm) for the left and right eyes separately. In order to obtain the pupil diameter, we obtained the mean of these two values for each raw data record. In the heat maps, we used each participant's pupil dilation while the eye gaze monitoring indicated that they were looking at a particular AOI on each image. For the Box plots, we used the mean dilation recorded for all participants when they were looking at a particular image.

When analyzing differences in the participants' responses as measured by our various neuropsychological measures across participant groups, we used the Kruskal-Wallis H non-parametric test as the data did not reflect a normal distribution of the residuals. The Kruskal-Wallis H test is used when tests are being used to assess for significant differences on a continuous variable by a categorical independent variable with two or more groups.

When analyzing the LSI data, we used the Analysis of Variance (ANOVA) with repeated measures with Greenhouse-Geisser correction. Repeated measure designs are popular as they allow a subject to serve as their own control. This improves the precision of the experiment by reducing the size of the error variance on many of the F-tests. The Greenhouse-Geisser is used to assess the change in a continuous outcome as the assumption of sphericity is generally violated for this type of within-subjects analysis. If sphericity is violated the p values need to be adjusted upwards.

Empirical Findings Concerning Eye Gaze and Pupil Dilation

In response to the first hypothesis, we sought to examine if our study participants responded differently as measured by changes in pupil dilation to different images associated with online propaganda of various types. These data are presented below as summarized for pupil responses to the multiple AOIs in the three images series including jihadist, far-right and far-left materials.

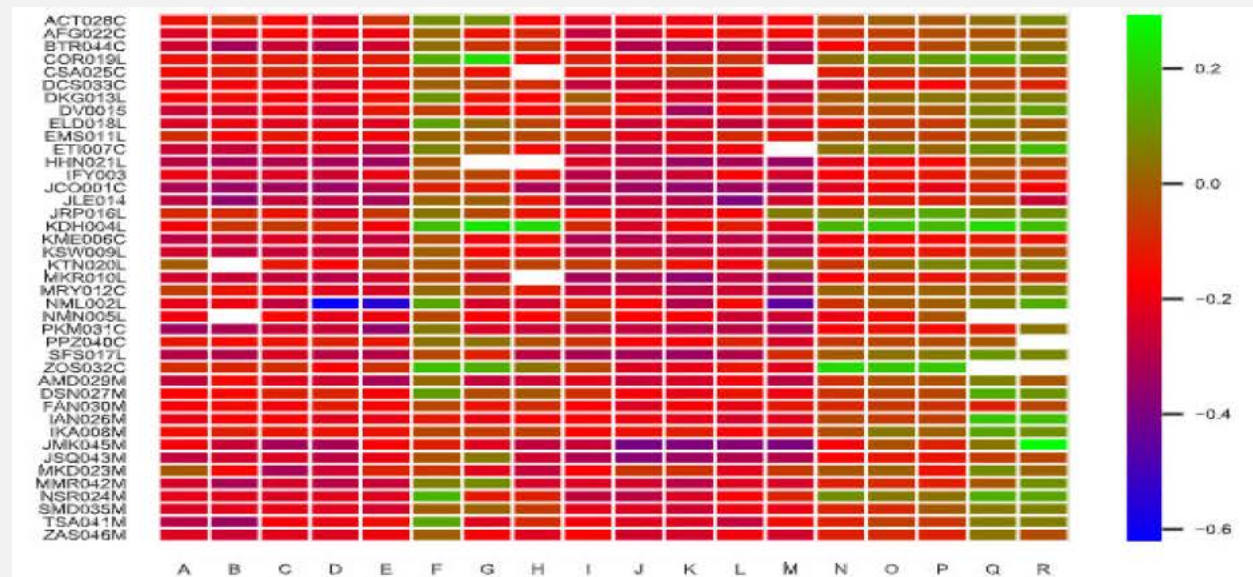


Figure 4: Heat maps displaying dilation responses to 18 AOIs contained in the jihadist image series.

As indicated above, the 41 study participants were found to respond differently to the 18 AOIs identified in the jihadist series, with there being increased dilation across the AOIs marked as F, G, and H and again for AOIs N, O, P, Q, and R. The areas marked in white indicate times series in which the participants' eyes were closed, these again being overrepresented for the same AOIs in the series. The green shaded images upon visual examination were found in the first instance (F) to reflect a change from a bright image with no text to an almost black image with small text. The images contained in series at the end (N, O, P, Q, R) included three images of Allen Henning being decapitated with the last displaying his head lying on the abdomen of his dead body.

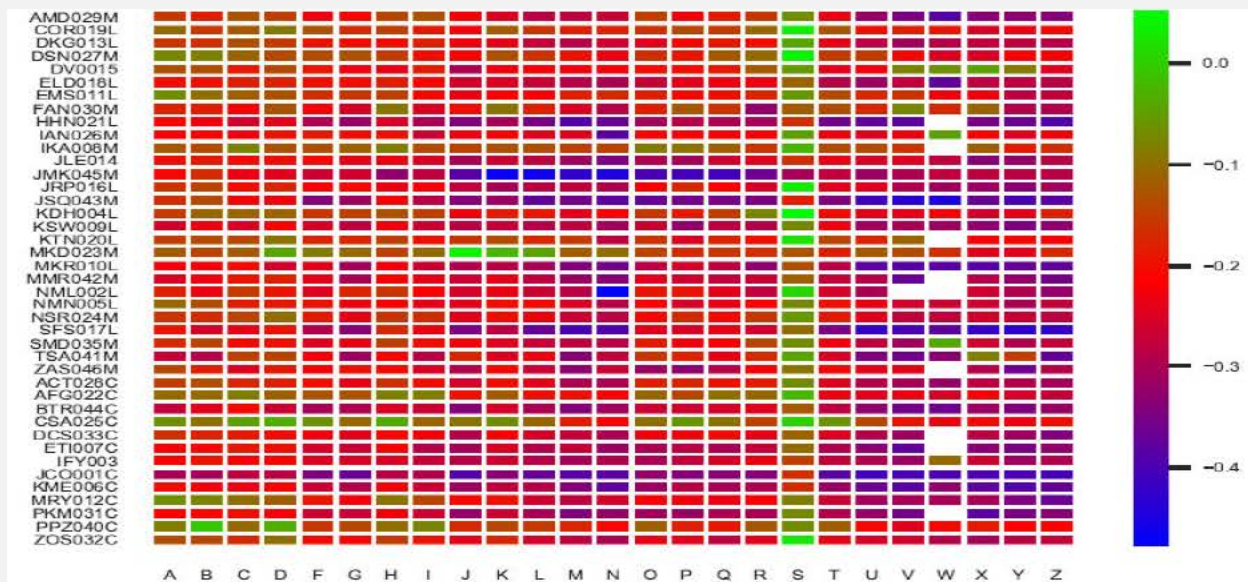


Figure 5: Heat maps displaying dilation responses to 25 AOIs contained in the far-right image series.

As indicated in Table 5, the images of greatest dilation indicated by the most intense green shading occur on AOI S, which contains the image of an African-American man hanging during a lynching circa 1920. The less pronounced green shading in the first five AOIs: A, B, C, D contains the image of the Loyal White Knights, with a sketch of an individual shrouded in white with an inscription of the “Ku Klux Klan Wants you!”

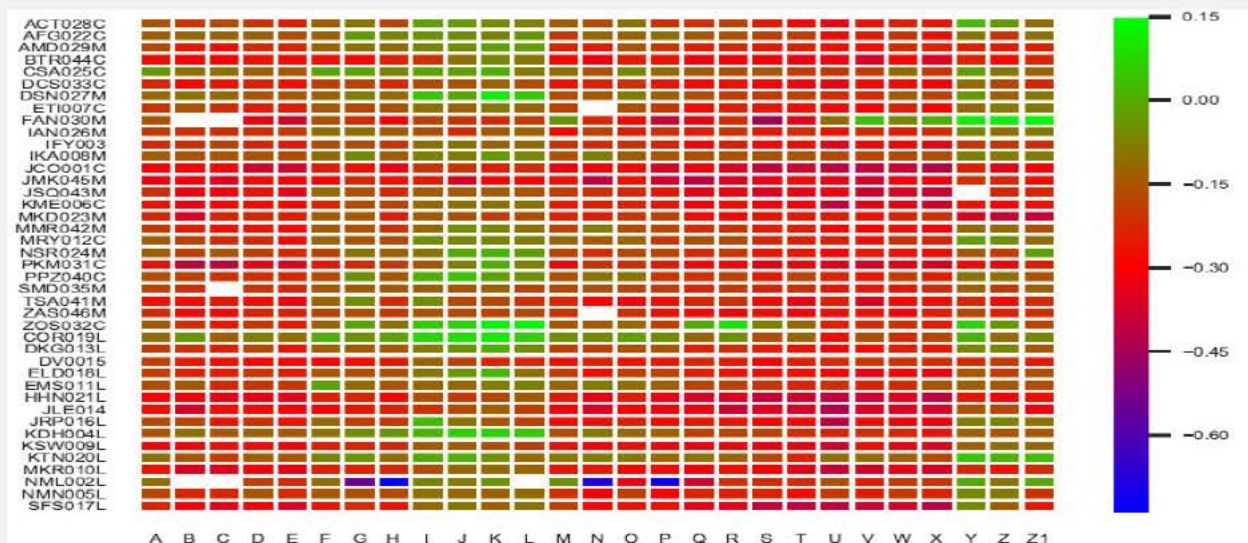


Figure 6: Heat maps displaying dilation responses to 26 AOIs contained in the far-left image series.

In the far-left materials, we found two areas of maximum dilation, the first reflecting AOI I, J, K, L, which was a dark image of antifascist marchers, and the second AOIs made up of V, Y, Z, Z1, which featured the fatal lighting on fire with gas of two police officers in riot gear.

To further explore differences in responses to different images as opposed to AOIs, we compared mean pupil dilation to each image of all 41 participants using the Kruskal-Wallis test. The H statistic for the jihadist images equaled 157.745 with a p value of 0.0000. The box-plot for these data based upon the six far-right images is presented below.

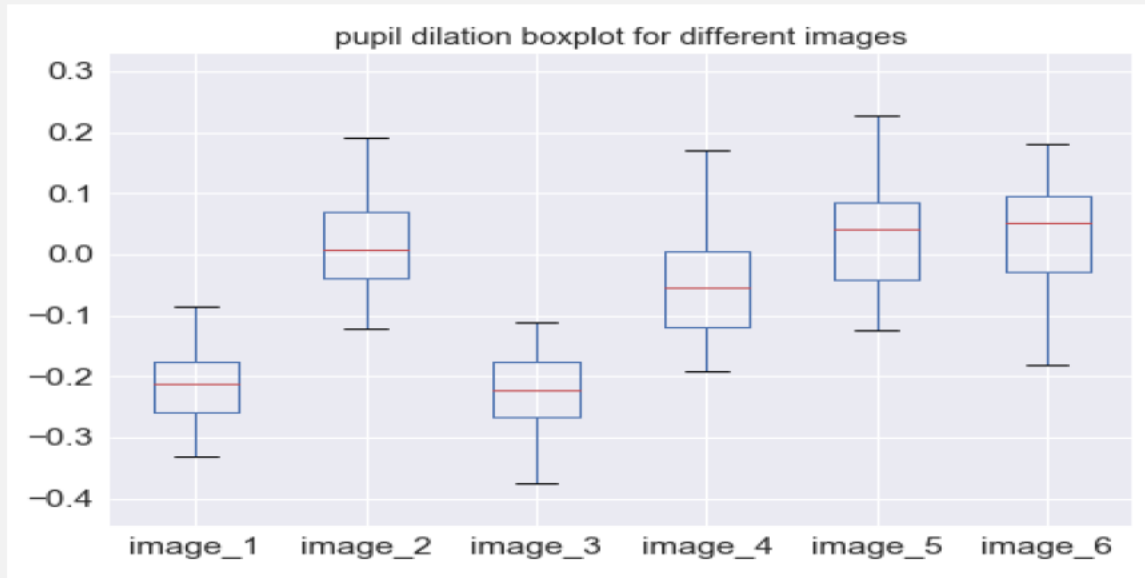


Figure 7: Mean pupil dilation and range for all participants to six jihadist images.

These findings demonstrate that there is a significant difference between pupil response to different images among our participants, with image_1 and image_3 having lower pupil dilation distribution compared to others. Both images were complicated and busy in content displaying various photos and images with different text content, several different colors, and in both images, crowds and congested traffic.

When the alt-right images were examined, they demonstrated a significant participant response to image six as compared to the other seven images.

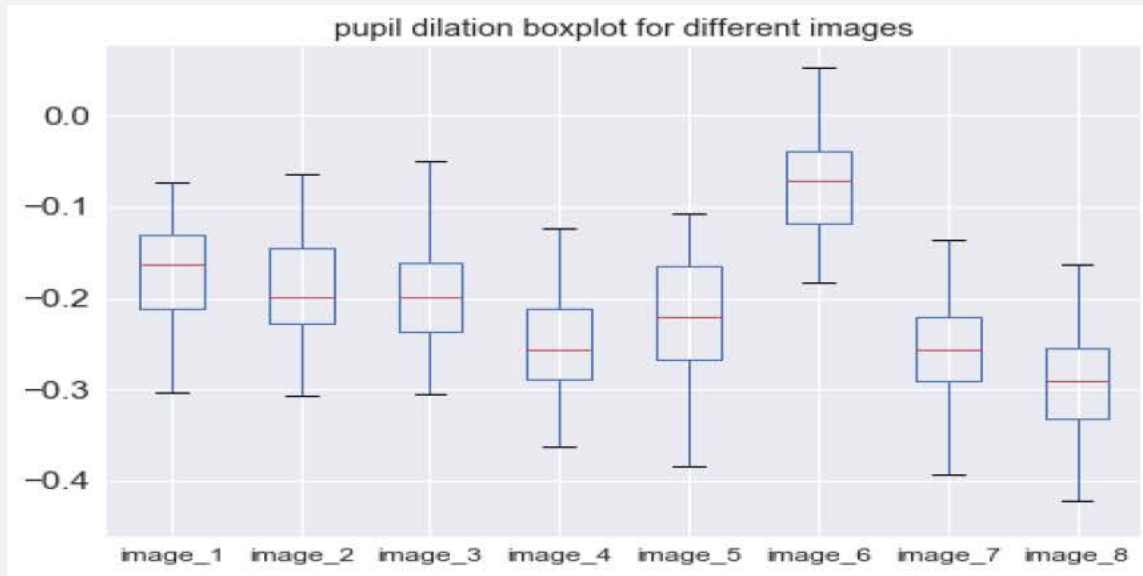


Figure 8: Mean pupil dilation and range for all participants to eight far-right images.

These data indicate that there is a significant difference between pupil response to different images among our subjects. Image 6, which contains a black and white photo of an African-American man being hung from a tree branch circa 1920, has a greater pupil dilation response compared to the other seven images.

The H value for the far-left images was 104.955 with a p value of 0.0000000000. This variation occurred across the different images. Image 7 indicated a larger range than the other images. Image 7 involved a march with a large banner stating, “THE ONLY GOOD FASCIST IS A DEAD ONE!”

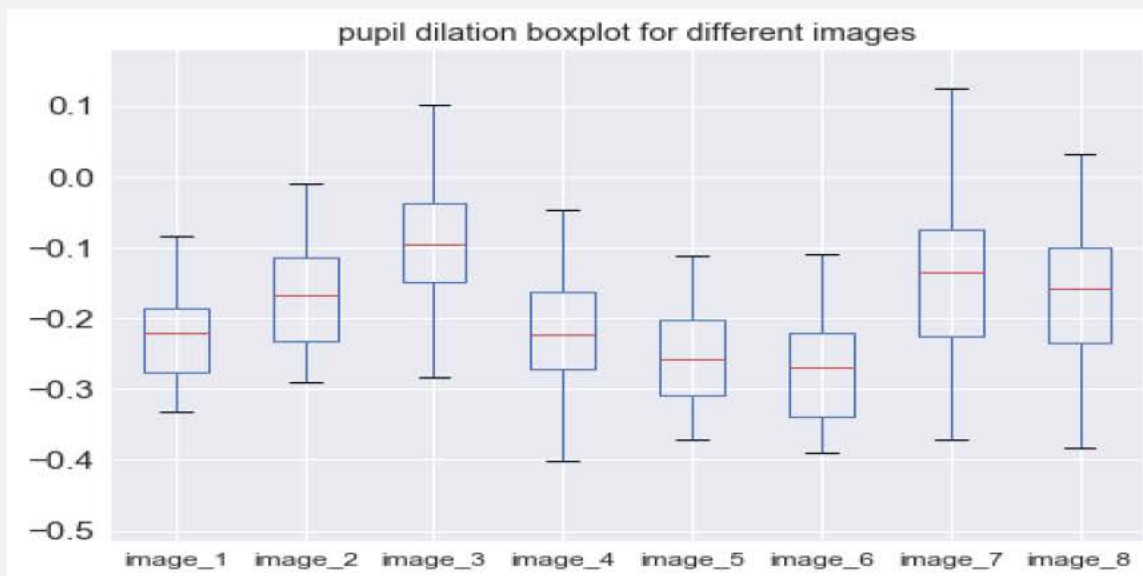


Figure 9: Mean pupil dilation and range for all participants to eight far-left images.

To explore hypothesis two, we explored whether selection criteria (conservative, liberal and Muslim) resulted in group differences in pupil dilation and eye gaze responses to jihadist, alt-right, and alt-left propaganda. Based upon our initial findings, we chose the most violent image contained in each of the image series as illustrated below. These comparisons examined differences between Muslim and non-Muslim, conservative and non-conservative, and liberal and non-liberal participants.

When these data were examined using the Wilcoxon signed-rank test, they did not reach a p level of significance although their p values were 0.079, 0.189 and 0.120 respectively, possibly indicating trends that might be significant if examined in a larger sample.

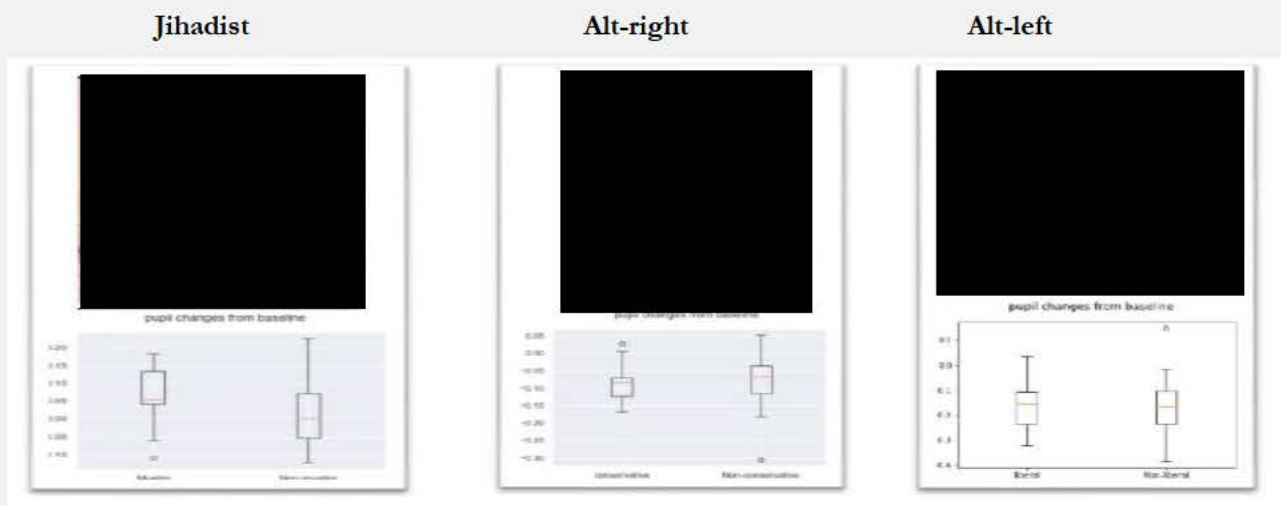


Figure 10: Box plot of pupil dilation mean and range demonstrated by Muslim and non-Muslim, conservative and non-conservative, and liberal and non-liberal participants to images.

Empirical Findings Concerning Galvanic Skin Response (GSR)

To further explore the first hypothesis, we examined the mean GSR responses of our 41 study participants as they viewed the same three series of images involving jihadist, alt-right, and far-left propaganda. The GSR measures of reactions to the six jihadist images are displayed on the following page.

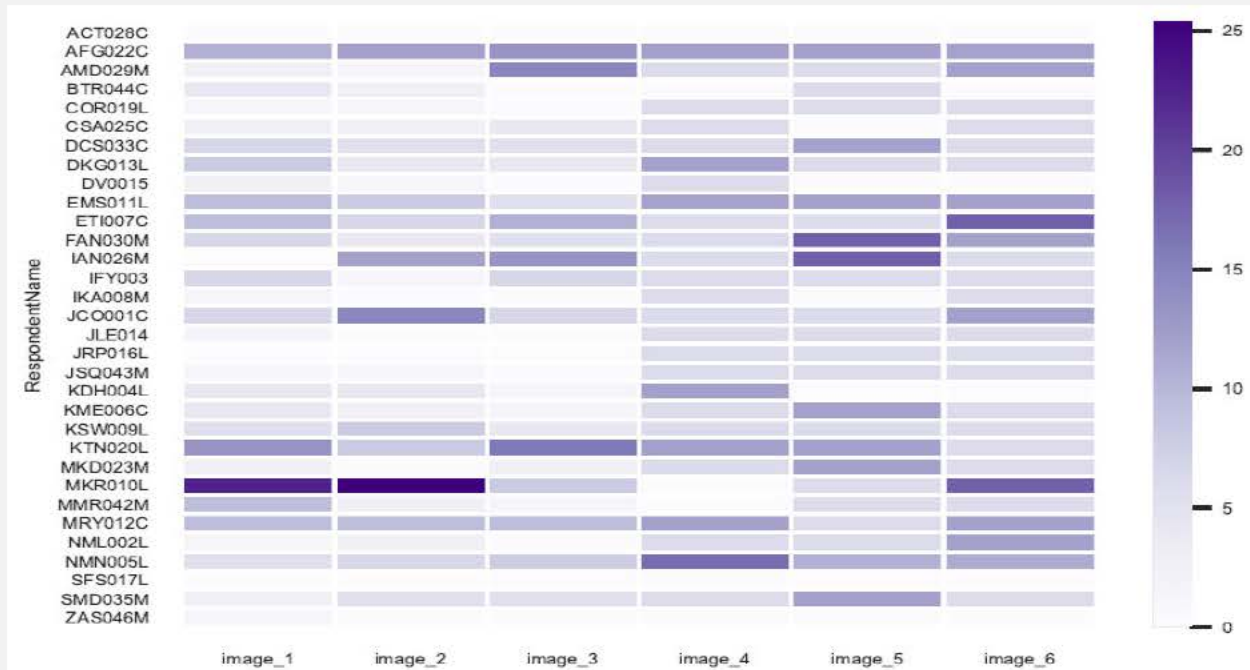


Figure 11: Heat maps of GSR Summary Scores for all participants to six jihadist images.

As indicated above, the 41 study participants were again found to respond more actively to the three images of Allen Henning being decapitated with the last displaying his head lying on the abdomen of his body.

These are presented below.



Figure 12: Beheading of journalist Allen Henning by an IS executioner

When viewing these images, the majority of participants responded with higher GSR Summary Scores, these reflecting the mean number of GSR peaks experienced by the subjects while watching these images. More peaks in GRS are interpreted as reflecting higher rates of arousal in the autonomic activation of the sympathetic nervous system which is associated with the activation of the sweat glands and an increase in skin conductance.

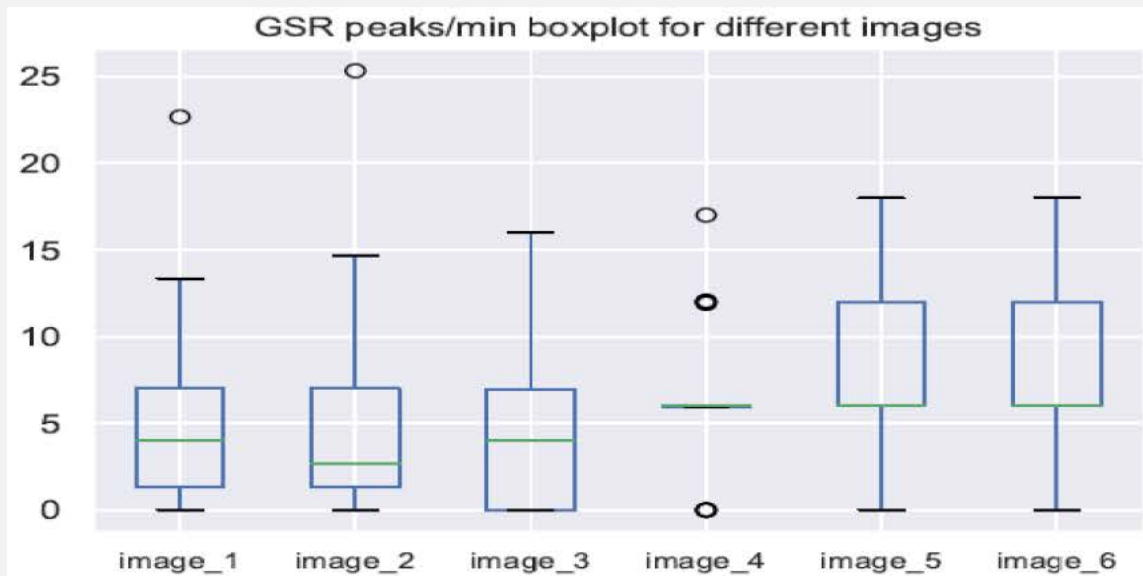


Figure 13: Mode GRS Summary Scores for participants when viewing six jihadist images.

These same responses are represented in the Boxplots above in Figure 13. As can be seen, the GSR response of the 41 participants differed in two ways when viewing the three lethal jihadist images. First, the participants demonstrated a higher median number of peaks in the GRS responses. Second, the variance or range across 41 participants to the three jihadist images was not normally distributed but rather highly skewed with only one participant demonstrating a GRS Summary Score that was lower than the most frequent Summary Score.



Figure 14: Heat maps of GSR Summary Scores for all participants to eight far-right images.

As can be seen above, the GRS responses of the 41 subjects to the eight far-right images were found to be more varied across the 41 participants. However, there were also more diminished reactions indicated by almost purely white bars in Figure 14, suggesting patterns of extremely low GSR arousal. These patterns are conveyed more clearly in the boxplots below.

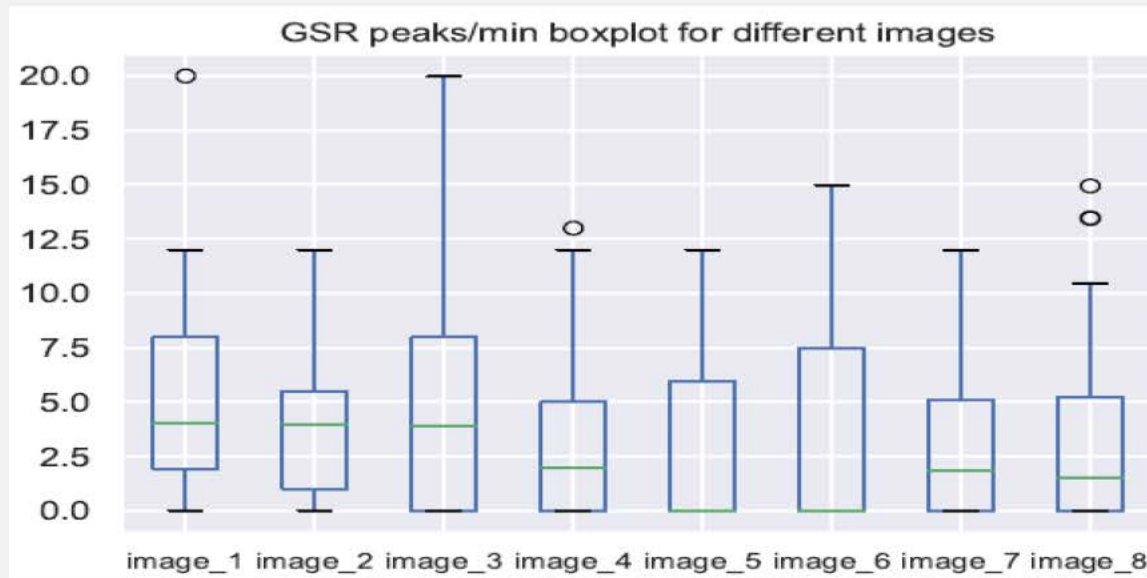


Figure 15: Mode GRS Summary Scores and range for participants when viewing eight alt-right images.

As seen in Figure 15, there were again two images in the alt-right series that differed from the others in the series, with images five and six evoking a severely diminished GRS Summary Score for at least half of the participants. However, of the remaining half of the sample, the range remained relatively normal and comparable to the other eight images. The two images that evoked a score equal to 0 for half of the participants are presented below.

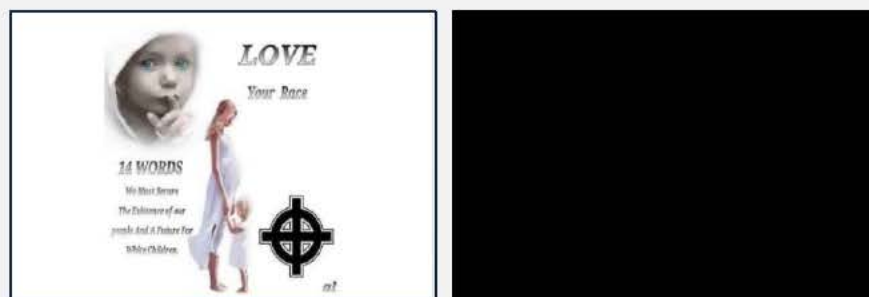


Figure 16: Two alt-right images evoking unilateral response distribution.

Both images are designed to be racially provocative with the first representing the birth of a white child and the second the death of a black man. The facial emotion recognition data that follows later in the report indicates

that these two images evoked higher levels of fear and anger in the participants, suggesting that images of birth and death may cause a suspension of GSR response in some individuals. This response might be akin to becoming “frozen” when unexpectedly presented with primal images, possibly representing a physiological defense mechanism designed to protect at least some individuals from deeply disturbing content and experiences.



Figure 17: Heat maps of GSR Summary Scores for all participants to eight far-left images.

As indicated, the far-left images evoked the most unreactive of GSR responses when compared to the two other image series. However, as reflected below on the boxplots, there were two images that again were associated with a unilateral distribution of GSR Summary Scores.

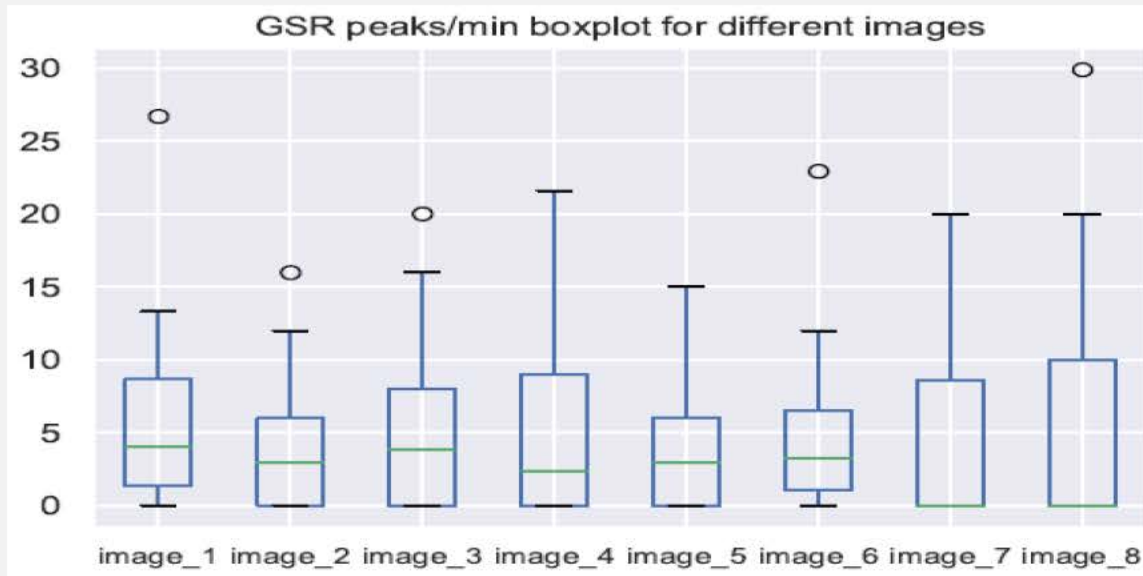


Figure 18: Mode GRS and range for all participants to eight far-left images

The two images that evoked these responses, i.e., images 7 and 8, are displayed below.



Figure 19: Two far-left images evoking bilateral GSR responses with limited variance

As with the alt-right images, these two images again referenced death and a person being fatally injured. Such findings may be further support for some type of suspension or immobilization response in some subjects when faced with images of death. Such a response appears to be an either/or type of response with some subjects being inhibited in their response and others significantly aroused by it.

Empirical Findings Concerning Facial Electromyography (*FE*).

The FE results summarized on the following page in Figure 20 reflected the facial emotions captured by the WebCam as the study participants viewed the six images in the jihadist series.

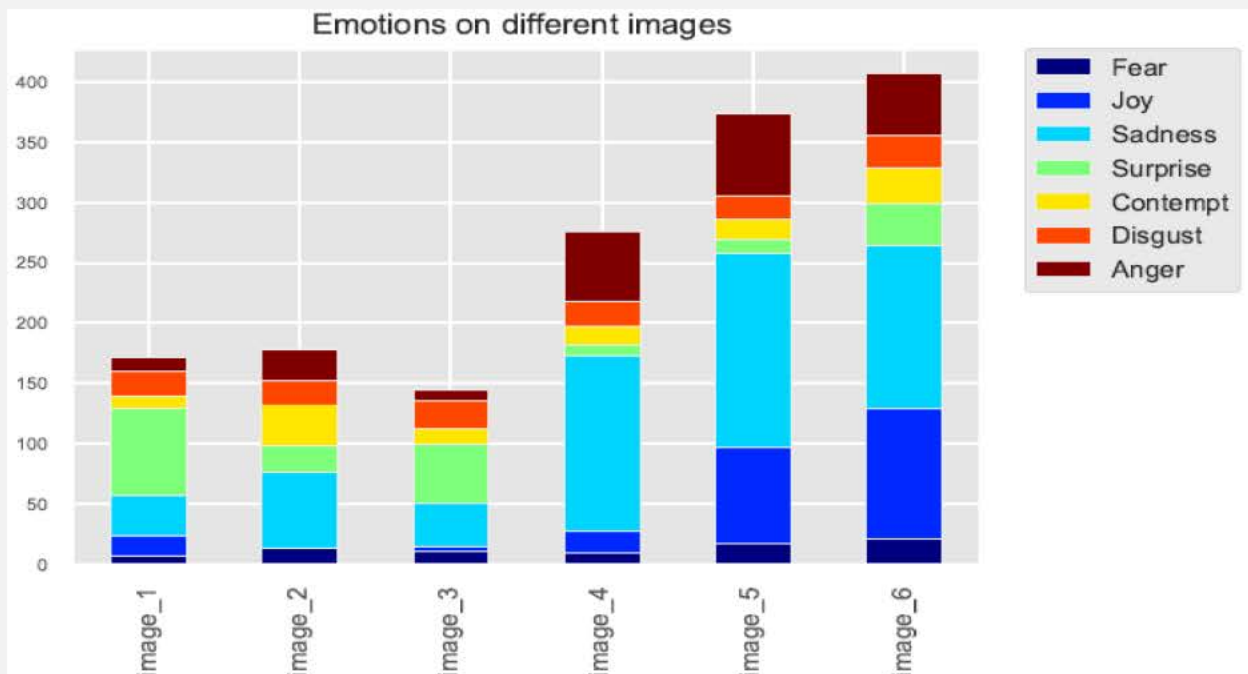


Figure 20: FE mean responses of study participants to jihadist images

As illustrated, each of the six images evoked a combination of different emotions across the different participants with the three last images, again reflecting an exaggerated response by the study participants. The first three images were characterized primarily by a combination of surprise, sadness and varying degrees of contempt. The last three images, which reflected the decapitation of a journalist, contained a much larger component of sadness and an increase in the amount of anger being experienced by the participant.. Unexpectedly, the final three images that were gruesome in nature also elicited an increasingly higher degree of joy than the earlier images.

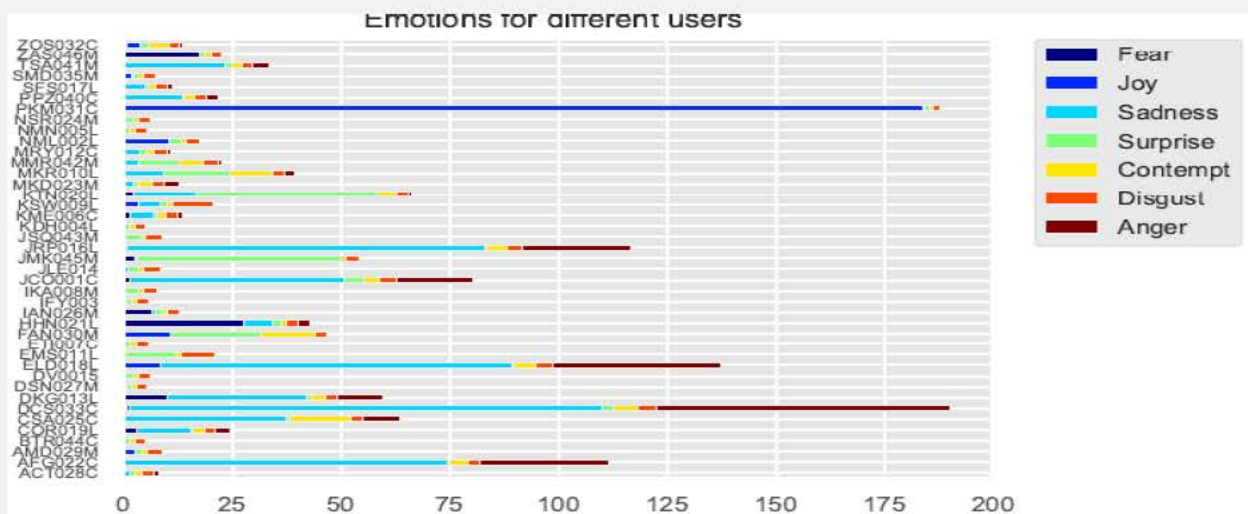


Figure 21: Individual participants' responses to the six jihadist images

Figure 21 illustrates both the individual differences in facial emotions demonstrated by some of the participants, along with the tendency for most participants to have rather muted responses to all six jihadist images. Unexpectedly, one participant experienced primarily joy as she viewed all six jihadist images with this reaction being unabated when viewing the decapitation event. This particular participant self-identified as being conservative in her political identification. The other two emotions evoked increasingly over the series of images by a number of the participants involved sadness and anger. All of the participants that demonstrated a rather diminished emotional response were uniquely characterized by the feeling of disgust suggesting that this emotion may have served to constrict other emotional responses to the material they were viewing.

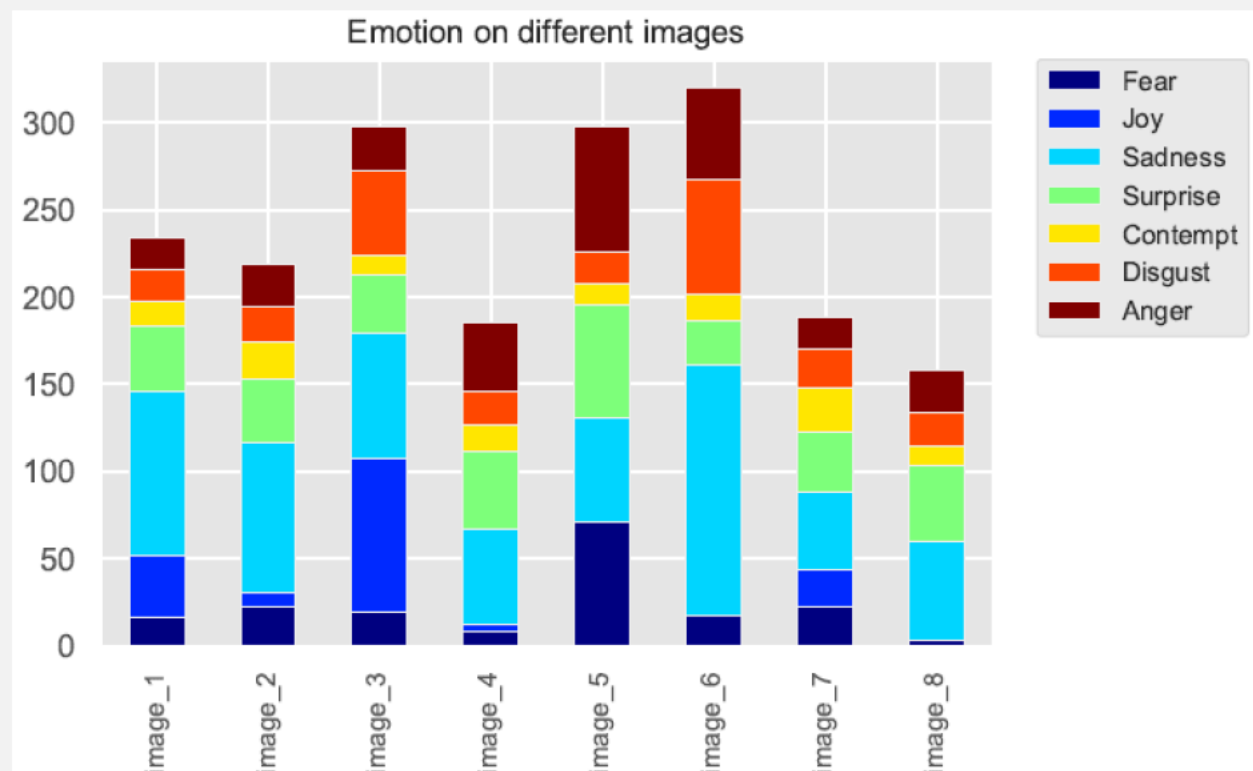


Figure 22: : FE mean responses of study participants to far-right images

As found with our other biometric measures, images 5 and 6 continued to evoke higher levels of arousal than most of the other images, although not necessarily different degrees of valence in terms of the emotions that were being expressed by the participants. Image six which involve the hanging African-American man generated strong feelings of sadness by the participants along with disgust and anger. Image five of the pregnant White woman generated more surprise among the participants but also higher levels of anger, apparently in response to the racial significance of the image. Image 3 in the series included a collage of very successful white man who were recognized by major newspapers and television channels with this particular image evoking the greatest amount of joy from the participants when compared to the other images and also a strong sense of sadness. Image 7 which was rather constricted in level of arousal but the most balanced in terms of the seven emotions that were evoked was made up of a simple white page with four paragraphs articulating the

importance of various ultraconservative and far-right beliefs. This finding could suggest that the effort required to read all the print on the page may have served to modulate or suppress the emotions that the participants were experiencing in response to these ideas.

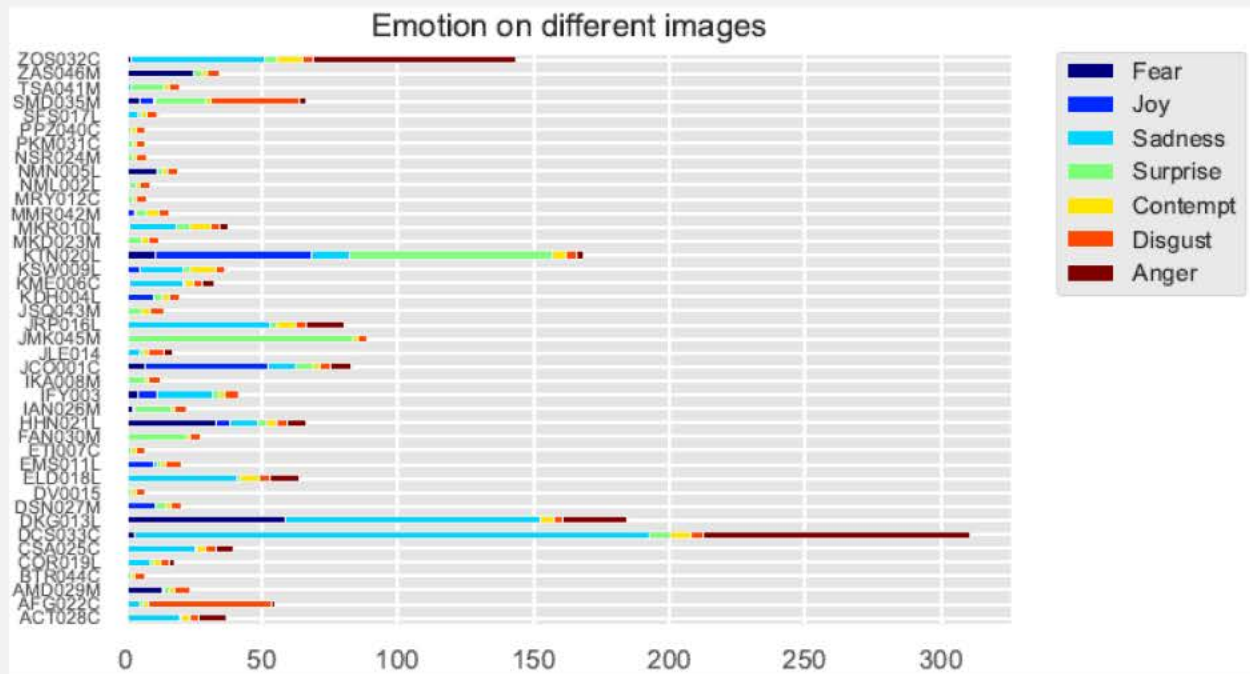


Figure 23: Individual participants' responses to the eight far-right images

The individual responses of the participants to the eight far-left images were generally more muted in terms of participant-specific arousal level with only three participants manifesting higher levels of arousal to specific images in the series. These more exaggerated responses were made up of feelings of surprise, sadness and anger. Participants demonstrating the lowest level of arousal to these images tended to be characterized by a muted pairing of feelings of surprise and disgust.

The far-left images displayed below were unique in their varied responses and lack of apparent association with the pupil dilation and GSR measures. As illustrated above, while image seven and eight created relatively high levels of arousal, this level of arousal was not greater than images one, three and four which had not been distinct when viewed through the lens of our other biometric measures. Image one in particular evoked the strongest surprise reaction by the participants. It involved photographs and text that had to do with the demonstration against the release of a white supremacist from prison. Similarly images two and three galvanized around meetings and demonstrations that were designed to root out fascism and create an antifascist resistance movement. There also appeared to be more surprise in response to these images and again an increase in sadness and anger when the participants were viewing the march with the images suggesting that "the only good fascist was a dead one" followed by images of a burning police officer.

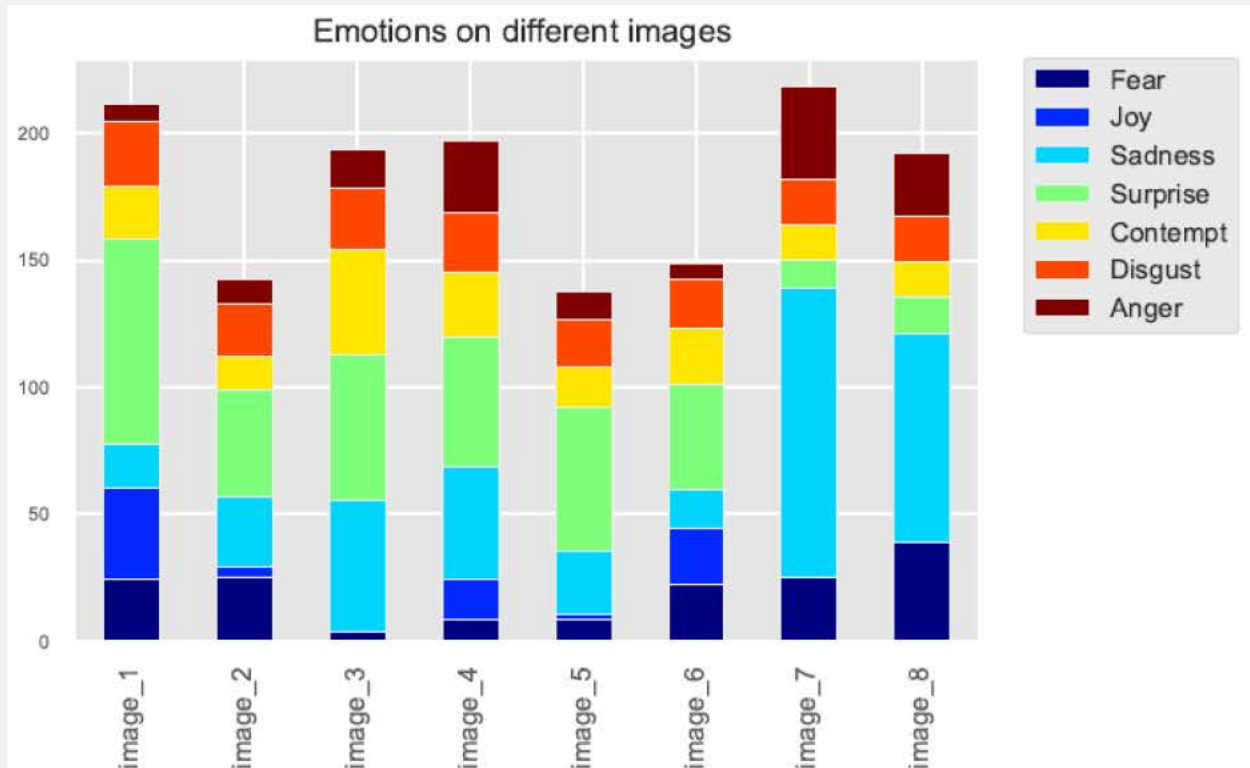


Figure 24: FE mean responses of study participants to far-left images

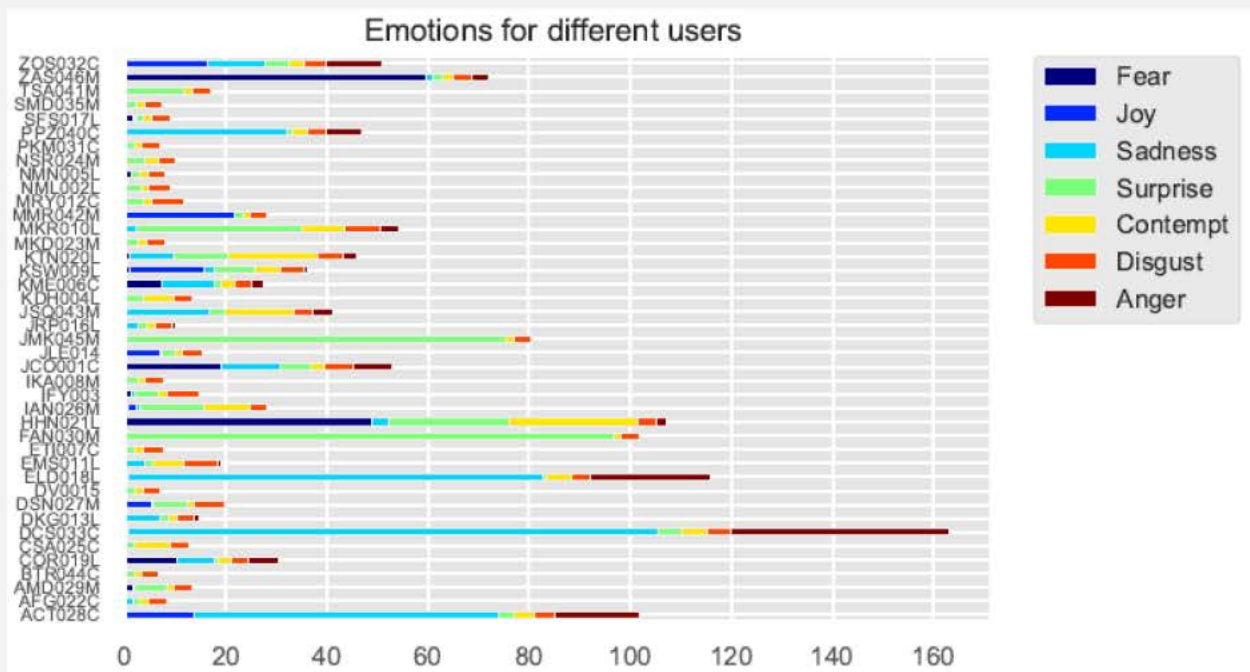


Figure 25: Individual participants' responses to the eight far-left images

The far-left images evoked the greatest amount of arousal across the various participants and arousal that was very varied in the combination of emotions experienced by each individual. One participant found these images to be more frightening than the others and had a much greater fear response in response to them. There was also a greater element of surprise when viewed across the different participants. Once again, individuals with the most muted responses all consistently experience some degree of disgust, again suggesting that it serves some type of shock or immobilization in the emotional reactions that are expressed proximate to it. As with the other images, references to death in the images of individuals being injured and possibly murdered evoke strong feelings of sadness and to a somewhat lesser extent feelings of anger.

Research Findings Concerning Self-report on the LSI

We used the LSI to examine the self-reported responses of the three participant groups (conservative, liberal and Muslim) for the four series of propaganda (neutral, jihadist, far-right and far-left). Table 7 summarizes image and group differences reported on emotions captured on the Plutchik's Emotion Color Wheel.

Table 7
Plutchik's Emotion Color Wheel Responses across Neutral, Jihadist, Far-Right, and Far-Left Images

Participant Group	Emotion Type	Image Type				Total
		Neutral	Jihad	Far-Right	Far-Left	
Muslim	Intense	3	18	25	8	54
	Complex	12	15	8	22	57
Conservative	Intense	2	17	28	12	59
	Complex	5	15	10	20	50
Liberal	Intense	2	19	28	5	54
	Complex	4	17	13	13	47

Using Analysis of Variance (ANOVA) with repeated measures with Greenhouse-Geisser correction, the mean scores for total number of Intense Emotions selected were significantly different between at least one image type ($F(2.572,113.180)=33.743$, $p<0.001$). Based on the pairwise comparisons, we can see that there is a significant difference between all four groups with sessions 1 and 4 $p<0.05$ and all other comparisons ($p<0.001$). Without a Greenhouse-Geisser correction, the mean scores for Complex Emotions selected were significantly different for at least one image type as well ($F(3,132)=10.670$, $p<0.001$). Based on the pairwise comparisons, there was a significant difference in total number of complex emotions selected for sessions 1 and 2, 1 and 4, and 3 and 4. There was not a significant difference between sessions 2 and 3, 2 and 4, 1 and 3.

Using one-way between subjects ANOVA, we compared participant grouping on the number of intense and complex emotions selected during inter-session surveys. There was not a significant effect of participant grouping on the number of either intense or complex emotions selected for the three different groups.

Table 8
Ellul's Propaganda Cognitions across Neutral, Far-Right, Jihadist and Far-Left Images

Participant Group	Descriptive Statistics	Image Type				
		Neutral	Jihadist	Far-Right	Far-Left	Total
Muslim	Mean	1.67	3.93	3.67	4.80	3.52
	Range	0-5	1-8	1-8	2-9	0-9
Conservative	Mean	1.60	5.00	4.67	6.00	4.32
	Range	0-5	2-8	0-9	1-10	0-10
Liberal	Mean	1.47	5.40	5.87	5.20	4.48
	Range	0-5	1-8	2-10	3-9	0-10

Using Analysis of Variance (ANOVA) with repeated measures with Greenhouse-Geisser correction, the mean scores for total number of Propaganda Cognitions selected were significantly different between at least one image type ($F(2.531,111.367)=46.064, p<0.001$). Based on the pairwise comparisons, we can see that there is a significant difference between sessions 1 and 2, 1 and 3, 1 and 4 ($p<0.001$) and no significant difference between sessions 2 and 3, 2 and 4.

Using one-way between subjects ANOVA, we compared participant grouping on the number of propaganda cognitions selected during inter-session surveys. There was not a significant effect of participant grouping on the number of propaganda cognitions selected for the three different groups ($F(2,177)=2.410, p=0.093$).

Table 9
Self-Assessment Manikin across Neutral, Far-Right, Jihadist, and Far-Left Images

		Image Type				
Manikin	Descriptive Statistic	Neutral	Jihadist	Far-right	Far-Left	Total
Muslim						
Emotion	Mean	4.8	1.6	1.33	5.33	2.07
	Range	3-6	1-3	1-3	3-9	1-9
Arousal	Mean	3.07	7.67	8.27	6.8	2.37
	Range	1-6	6-9	7-9	4-9	1-9
Dominance	Mean	5.33	4.93	3.07	5.73	2.18
	Range	3-9	1-9	1-9	3-9	1-9
Conservative						
Emotion	Mean	5.2	2.27	1.67	2.93	1.78
	Range	2-7	1-4	1-3	1-6	1-7
Arousal	Mean	2.93	7.00	8.00	6.67	2.53
	Range	1-8	4-9	6-9	2-9	1-9
Dominance	Mean	5.8	5.33	5.13	5.93	2.35
	Range	2-9	1-9	1-8	1-9	1-9
Liberal						
Emotion	Mean	5.33	2.2	1.6	4.53	3.42
	Range	4-7	1-4	1-4	2-7	1-7
Arousal	Mean	3.67	7.2	8.2	6.6	6.42
	Range	1-7	5-9	6-9	4-9	1-9
Dominance	Mean	5.53	5.67	5.00	5.27	5.37
	Range	1-9	1-9	1-9	2-8	1-9

Using Analysis of Variance (ANOVA) with repeated measures with Greenhouse-Geisser correction, the mean scores for sum Emotion Manikins selected over the different sessions were significantly different between at least one image type ($F(1.690, 74.362)=98.335, p<0.001$). Based on the pairwise comparisons, we can see that there is a significant difference between all four groups, except for sessions 1 and 4. Similarly, the mean scores for Arousal Manikins were significantly different for at least one image type ($F(1.895, 83.372)=134.610, p<0.001$). Based on the pairwise comparisons, we can see that there is significant difference between all four groups. Lastly, without a Greenhouse-Geisser correction, the mean scores for Dominance Manikin were significantly different for at least one image type ($F(3, 132)=5.967, p<0.001$). Based on the pairwise comparisons, we can see that only sessions 1 and 3, 2 and 3, and 3 and 4 were significantly different.

Using one-way between subjects ANOVA, we compared participant grouping on the sum Emotions Manikins selected for Emotion, Arousal, and Dominance categories selected during inter-session surveys. There was not a significant effect of participant grouping on any of the Manikins selected for the three different groups. Emotion: ($F(2,177)=0.666, p=0.515$) Arousal: ($F(2,177)=0.293, p=0.746$) Dominance: ($F(2,177)=1.973, p=0.142$)

Finally, to explore the differences in conscious and unconscious reactions to our three series of propaganda, we conducted three sets of correlational analyses to determine if the conscious responses reported on the three LSI measures predicted the mean pupil dilation for each participant to these same series of images, this being assumed to reflect more of their unconscious response to the same material.

In the first set of analyses, correlations were examined between mean pupil dilation for the three sessions and the color wheel emotions, measured by number of intense and number of complex emotions reported by the participants. For each of the three series of propaganda, the mean pupil dilation was not significantly related to the number of intense and number of complex emotions. Each of the correlations were nonsignificant and near zero.

Table 10
Relationship Between Average Pupil Dilation for the Three Sessions and Color Wheel Emotions.

	Far-right		Far-left		Jihadist	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Intense Emotions	-0.012	0.884	-0.066	0.404	-0.013	0.871
Complex Emotions	-0.019	0.808	0.037	0.646	0.007	0.930

Notes. N = 160. *r* = Pearson's *r*. Mean pupil dilation measured for the three propaganda series: far-right, far-left, and jihadist. Color wheel emotions defined as the number of intense and number of complex emotions reported.

In the second set of analyses, correlations were examined between mean pupil dilation for the three sessions and the number of propaganda cognitions reported. For each of the three series of propaganda, the mean pupil

dilation was not significantly related to the number of propaganda cognitions reported, although it began to reach significance for the far-left and Jihadist image series.

Table 11

Relationship Between Average Pupil Dilation for the Three Sessions and Number of Propaganda Cognitions.

	Far-Right		Far-Left		Jihadist	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Propaganda Cognitions	0.081	0.300	0.151	0.054	0.135	0.086

Notes. *N* = 160. *r* = Pearson's *r*. Mean pupil dilation measured for the three propaganda series: far-right, far-left, and jihadist. Propaganda cognitions = the sum of propaganda cognitions reported by each participant.

In the third set of analyses, correlations were examined between mean pupil dilation for the three sessions and each of the SAM scales (emotional valence, level of stimulation, and dominance) For each of the three series of propaganda, the mean pupil dilation was not significantly related to the three SAM scales. Each of the correlations were nonsignificant and near zero.

Table 12

Relationship Between Average Pupil Dilation for the Three Sessions and Self-Assessment Manikin (SAM) Emotional Valence, Level of Stimulation, and Dominance.

	Far-Right		Far-Left		Jihadist	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Emotional Valence	−0.021	0.788	0.016	0.839	−0.002	0.977
Level of Stimulation	0.015	0.846	−0.057	0.465	−0.038	0.630
Dominance	0.062	0.431	0.070	0.373	0.057	0.472

Notes. *N* = 164. *r* = Pearson's *r*. Average pupil dilation measured for the three propaganda series: far-right, far-left, and jihadist. SAM = Self-Assessment Manikin (Bradley & Lang (2007), measured by emotional valence, level of stimulation (arousal), and dominance.

Conclusions

Most broadly, our findings demonstrate that pupil dilation, galvanic skin response, and facial electromyography can be used as measures of emotional valence and responsivity to different types of propaganda and that these emotional responses vary based upon the content of the images being viewed by the participants. As indicated, these differences appear to be more related to the content of the image than to at least some characteristics of the participants viewing it, and therefore argue for discernible patterns regarding types of propaganda that could be explored further scientifically. While much has been written about the effects of propaganda from a philosophical, sociological, and theological point of view, little has been done to examine the effects of these types of communication empirically, particularly pertaining to how they are received and processed neurobiologically by the person viewing or encountering it. This type of scientific study could significantly inform educational and development efforts, particularly for those who are increasingly required to monitor this type of content and create counter-narratives to it.

Of particular interest was the finding that images of lethal violence and extreme brutality tended to generate states of maximum pupil dilation across our three study groups, regardless of whether the image was associated with jihadist, far-right, or far-left propaganda. In the jihadist series, these images involved the decapitation of a well-known Western journalist; in the alt-right series, the lynching of an African-American man sometime in the 1920s; and in the far-left images, the burning alive of a policeman dressed in riot gear. These findings bring to mind the “shock response” observed by Hess in 1965 when his participants viewed images of dead soldiers on the battlefield, piles of corpses in a concentration camp, and the bodies of murdered gangsters. Moreover, while these types of brutal images have routinely been associated with the propaganda strategy of the IS, we also rather unexpectedly found them to be present – albeit with less frequency and staged fan-fare – by the other extremist groups that were identified in our study. These reactions call into question the assertion made by Winter (2015) that the brutal violence used by the IS State was a “red herring” which diverted the public’s attention away from the more powerful themes of brutality, mercy, victimhood, war, belonging, and utopianism within the organization.

The responses that were collected of GSR indicated, however, that in contrast to the dilation effect found generally in response to the brutal images, approximately one half of the participants experienced a heightened CSR response to the brutal images, while the other half experienced a profound shutting down of GSR reactions to them. This finding appears to be indicative of a defensive response captured in the electrical conductance of the skin, operative in some participants and not others, to protect against the forced realization of the possibility and reality of one human being decapitating by another. This patterns lends credence, at least for some individuals, of the motivation thesis of Bradley et al. (2008) which argues that emotions are organized by underlying defensive and appetitive motivational states designed evolutionarily to promote the survival of individuals and species. According to Bradley et al. (2008), these reactions serve different functions depending on the motivational system being activated, the intensity of the activation, and the specific emotional content.

The fEMG data obtained through the iMotions software captured these same responses with the individual differences associated with them. As seen in Figure 21, one individual demonstrated high levels of arousal to all of the jihadist images, but with a singular valence of joy regardless of the level of brutality being viewed in the series of six images. Five other participants also demonstrated higher than average levels of arousal to the six images but in contrast demonstrated facial expression demonstrative of sadness and anger. All of the participants with blunted emotional responsivity were characterized by a combination of sadness and disgust, with the disgust seeming to inhibit or impede further emotional response. The strongest emotional responses both in terms of responsivity and valence were obtained in response to the far-left images with all seven emotional reactions being elicited including anger, disgust, contempt, surprise, sadness, joy and fear; and the individual responses appearing varied in content and degree in a manner suggestive of a normal distribution.

When viewed together, the three measures used in our study -- pupil dilation, GSR and fEMG – indicated that images of brutality and death evoked significantly different responses from most of our participants, but that there were individual differences across all of these images and some variability across the three measures. The images of pregnancy and infants also evoked stronger than average reactions at least as measured by GSR. Despite this variability, the commonality of the responses to images of brutal violence suggest that they may serve a common but largely unrecognized role in many types of propaganda, serving to arouse the organism in such a way as to make the individual more susceptible to internalizing ideological ideas temporally or conceptually associated with it. The process of radicalization can occur swiftly and with the vehemence that is often surprising to those observing it, and it is possible that these images play a role in short-circuiting a more rational assessment of ideas while prompting a more visceral response to them. If this is the case, our findings suggest that this “aperture effect” occurs on an unconscious level and is not discernible to the individuals experiencing it. Obviously, while this type of “aperture effect” would not argue for our use of brutal images against others, this type of response, if verified by further research, could play an influential role in educating the media and informing the public of the effects of certain types of propaganda on processes occurring in their automatic nervous system, which by their very nature, remain unconscious to the individual experiencing them.

We were also interested in comparing the autonomic responses of our participants as measured by pupil dilation to their self-report as measured on the LSI across the three propaganda series. When these were compared using Plutchik’s Emotion Color Wheel, Ellul’s functional analyses of propaganda in his book, *Propaganda: The formation of men’s attitudes* (1965), and Bradley and Lang’s (2007) SAM manikin, we found that there were few significant correlations between the reactions demonstrated by the women to the jihadist, far-right and far-left. The correlations for the two measures of self-reported emotions were close to 0, although the correlations concerning Ellul’s cognitive perceptions of the effect of the propaganda on the individual experiencing it, was significant for the far-left images and close to significance for the jihadist images. These differences suggest a different processing of responses by the individual when the requirement is cognitive rather than emotional in nature. Interpreted broadly, these findings are congruent with the idea that we human beings are more conscious of our cognitive reactions than we are of our emotional reactions when they occur beneath a certain threshold.

The importance of this type of research is reflected in recent efforts to delimit the types of propaganda that can be distributed online. Maddox (2019) has written recently that one of the most consequential events in the Information Warfare occurred on February 3, 2015. Muath Safi Yousef al-Kasasbeh, a Jordanian fighter pilot had been shot down near Raqqa, and after he was widely featured in their Dabiq magazine, the IS launched a Twitter campaign under the hashtag #SuggestAWayToKillTheJordanianPilotBig. The responses to this posting

were broad and prompted the burning of Lieutenant al-Kasasbeh alive in a cage while being watched by cleanly uniformed IS militants. The release of this video in February 2015 resulted in a ten-fold increase in the month afterwards by pro-IS supporters and was associated with the IS capture of Tikrit one month later. The power of this online event galvanized policy-makers within the government, practitioners in the Information Operations community, and private social media companies and led to a meeting of the Global Coalition Against IS Communications Working Group in October 2015. Over the next two years, Twitter suspended 1,200,000 accounts for violation related to the promotion of terrorism. More recently, attention has been directed to the efforts of the Russian Research Agency (IRA), where it was found that the IRA had posted 6,000 Instagram, 4,000 Facebook and 59,000 Twitter posts per month leading to interactions with 30,000,000 users through 2015 to 2017. Similarly, in May 2019, two investigations confirmed that millions of Americans and Europeans had been exposed to far-right propaganda and fake news on Facebook (Gladstone, 2019). Facebook removed 77 pages and 230 accounts with 32 million followers in France, Germany, the United Kingdom, Italy, Spain, and Poland after the activist group, Avaaz, reported their activities. The pages were connected to far-right groups and political parties and were viewed more than a billion times, generating 67 million comments, likes, and shares in a three-month period. Postings on Gab – a social media platform similar to Twitter but primarily used by alt-right groups – in June 2018 led to the arrest of a British teenager, where the police found in his residence bomb-making instructions, a “white-resistant” manual, and instructional propaganda on conducting Islamic terrorist attacks (Weber, 2018). Clearly, taking down these images and using content moderation techniques according to Section 230 of the U.S. Code 47 has served to delimit some of this content, but the role of education and scientific study as it might inform the practice of the consumption of this information will inevitably play a role in personal decision-making over generations as contrasted to governmental control and responses by the major online companies.

The findings of our study must be assessed in view of the limitations of our study design and the data collected from it. The brightness of our testing site was controlled by placing each participant in a tent-like structure, but we did not convert our images to a grey scale to control for luminosity as we were interested in the effects of these design factors on each participant’s response to each image. We also experienced difficulties with missing data which appears to have been related to certain participants wearing glasses during the experiment, a factor that we failed to control or record through data collection. Based upon our choice of propaganda images for each series, which derived from the first stage of the study, we also did not have comparable content including humans, written words, and images of violence, thereby making our study exploratory rather than confirmatory in nature. Finally, our sample size was limited to 41 participants and involved by design only women between the ages of 18 and 35 years.

In conclusion, our study offers support for the idea of using eye gaze and pupil dilation combined with galvanic skin response and fEMG to initiate and build a research literature on the neurocognitive effects of propaganda on the human brain. While the effects of propaganda have been analyzed insightfully throughout the ages, the ways in which this effect is realized has yet to be explored using the scientific means currently available to us. The value of this type of research to the IC cannot be over-emphasized given its need to prioritize threats and as identified by the National Academies to understand the evolving ways adversaries influence the hearts and minds of others and the ways individuals are drawn into radicalization and extremism.

IMPLICATIONS FOR CRIMINAL JUSTICE POLICY AND PRACTICE IN THE UNITED STATES

Our findings have direct relevance to the various members of the intelligence community who are responsible for understanding and responding to fluctuating levels of threat manifested by individuals both within the United States and internationally. After three years of deliberation and study, the National Academies (2019) concluded in their report, *A decadal survey of the social and behavioral sciences: A research agenda for advancing intelligence analysis* that the threat being manifest through both domestic and international actors could best be addressed through close collaboration between individuals working within the social and behavioral sciences and those involved in the various intelligence agencies including federal law enforcement. This report was commissioned with federal funding to identify a ten-year agenda for the development of SBS research to support the work of intelligence and behavioral analysis analysts and to enhance national security.

The development of the Moral-Situational-Action Model of Extremist Violence (MSA-EV) provides a theory-based model that integrates the best of academic research on risk assessment and operational work on threat assessment to identify the processes through which individuals demonstrate a propensity for, immobilization towards, and the development of capacity that moves then toward increasingly high levels of risk for various forms of extremist violence. Developed on women, the MSA-EV will require replication and validation on men. However, by design it provides the type of model that can provides a systematic foundation to be used both educationally and as an operational tool for guiding the assessments that are conducted by federal law enforcement. For example, the Behavioral Analysis Unit 1, (BAU1) is mandated to provide operational services to state, local, tribal and campus law enforcement along with international agencies identified in the Five Eyes (FVEY) intelligence made up of Australia, Canada, New Zealand, the United Kingdom and United States. This work, however, while informed by research within the Bureau and by academic researchers nationally and internationally, it is largely based on operational experience and is the need of a guiding structure that is theory-based designed specifically for and validated through the operational needs of the FBI and other intelligence agencies. These needs were assimilated both in the development of and empirical study of the MSA-EV with the prior Unit Chief of the BAU 1 serving as a PI on the project and through ongoing collaboration with members of the unit throughout the development of the model and the empirical validation of it. The results

of the study will also be translated and published in the FBI Law Enforcement Bulletin to ensure its wide distribution to senior law enforcement personnel throughout the country.

Our study of the neurophysiological responses of women to various types of propaganda generated by jihadist, alt-right, and alt-left organizations was designed to provide an empirical approach to the study of propaganda. As indicated in our report, it is our hypothesis that the content of certain types of propaganda exert an effect on the person exposed to it that is both conscious and unconscious, with the latter processes being associated with the powerful and at times life-changing effect state it can have on specific individuals when paired with social interactions with others who are also supportive of it. However, up until this time, our study of propaganda has been theoretical and conceptual and while the insights that these perspectives have garnered our impressive, they have as yet failed to culminate in a methodology for studying the neuropsychology of these materials on the human brain as defined by the vulnerability of particular individuals. It is also been observed by many that currently on certain jihadist groups such as IS demonstrate a far greater sophistication at generating powerful propaganda using social media than law enforcement agencies are able to employ in counteracting it. This perceived imbalance, if real, is obviously not an necessary and enduring state of equality and it is clear that America processes the resources that would be requires to develop a sophisticated understanding of the effects of this type of content and the ways to most effectively use this type of knowledge to counteract its effect on vulnerable in and of the individuals. For example, the educational potential of informing young individuals of the effect of certain types of exposure on the conscious and unconscious processing of information in their human brain could lead to more informed decisions about the ways in which individuals respond to the multitude of images and content specific messages that are constantly bombarding them.

As indicated, it is our sense that the methodology and findings of our project has through almost serendipitous means responded directly to the challenge being identified in the by National Committee's report urging for more structured, collaborative, and sustained research collaborations between social and behavioral scientists and the intelligence community going forward for the next decade. Our project arose out of a long-standing collaboration between the FBI and the University of Virginia and in so doing it appears to have demonstrated a model for achieving research findings that hold intellectual rigor in the academic environment and operational significance for those mandated to address extremist threats both nationally and internationally,

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THE CREATION OF MUHAJIRAT IN AMERICA:

**SOCIAL MEDIA AS A PLATFORM FOR CRAFTING GENDER-SPECIFIC
INTERVENTIONS FOR THE RADICALIZATION OF WOMEN**

APPENDIX A:

**OPERATIONALIZING THEORY: A MORAL-SITUATIONAL ACTION
MODEL OF EXTREMIST VIOLENCE**

2020

Operationalizing Theory: A Moral-Situational Action Model for Extremist Violence

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Violence risk and threat assessments have coexisted for decades as mutually exclusive endeavors of academia and law enforcement. In the years following September 11th, 2001, extremist violence has demanded that law enforcement and intelligence agencies identify, prevent, and respond to potential attacks perpetrated by radicalized civilians. This challenge has highlighted the gaps in the current risk and threat assessment methodologies. We seek to inform and improve these two processes by integrating theory into this process of violence risk and threat assessment, while focusing specifically on the radicalization of women to extremist violence. We present a Moral-Situational Action model for extremist violence which seeks to integrate theoretical tenets of Situational Action Theory with practiced principles of risk and threat assessment. The goal is to provide a causative model which will guide operational analyses and empirical research concerning an individual's progressive involvement in or desistance from extremist violence. The model explores risk and protective factors as intertwined constructs on the same continuum. The model further integrates the quantitative coding of risk factors with a formulation-based outcome that includes behavior, motivation, and vulnerabilities, to assess fluctuating levels of risk, and individual-specific risk and threat management strategies. We describe the coding protocol that is being used to quantitatively examine this theory and posit that with modest revision it will be applicable to men.

Public Significance Statement

As a foundation for our empirical study of extremist violence perpetrated by women, we have formulated a theoretical model that integrates the process of risk and threat assessment with Wikström's (2004) situational action theory (SAT) of

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crime. The model posits that extremist violence emerges through a causal interplay between the propensity of the individual, their mobilization through exposure to social and cyber interactions, and the development of an action plan through the development of capacity according to different roles. We discuss the model in terms of the relevant risk and protective factors pertinent to each theoretical component of the model and describe these as reflected in the behavior of women affiliated with varying types of violent extremist organizations.

Keywords: female extremist violence, moral-situational action model, risk assessment, situational action theory, threat assessment

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The fields of violence risk and threat assessment have evolved over the past 35 years along relatively distinct trajectories, with practitioners in each arena remaining cognizant of research and writing in the field of the other, but largely separated by discipline, purpose, and the primary intent of the assessment being conducted. Violence risk assessment has emerged primarily through academic endeavors which inform clinical and forensic practice. Violence risk assessment seeks through different methods to assess the degree of risk posed by individuals either within institutional settings pretrial or postconviction or while living in the community. Threat assessment has evolved primarily in the domains of federal law enforcement and security agencies and is most often used to identify and intervene with individuals who are believed to be a threat to public figures, institutions, or specific individuals or groups within society.

These two approaches seek to inform interventions that are responsive to potential violent behavior, and have coexisted with nominal but fruitful cross-pollination over many years. Each has generated specialized shared knowledge, professional expertise, and management and action plans that are designed to lower the perceived risk of certain individuals. However, this comfortable coexistence has been challenged with the emergence of extremist violence, which since 2001 has become a reality of life in the Western world. Increasingly, lethal acts are being perpetrated by individuals in different ways for radically distinct political, social, and religious motives. To respond to this new kind of threat, law enforcement and intelligence agencies monitor large cohorts of individuals who, by definition, have no specific target as-

sociated with them. When faced with this responsibility, the value of both violence risk and threat assessment becomes apparent, but the limitations of both approaches simultaneously become discernible, prompting sincere but empirically rudderless efforts to blend together the best of both approaches to better protect the public.

These realities were at the forefront of our thinking as we began to develop the methodology for a study of the radicalization of women into violent extremist organizations. Given our experience with both academic research and operational investigations, we concluded that it was unlikely that we would be successful in unearthing an optimal set of risk or protective factors that would translate easily into management and intervention strategies for use with women. It was our impression that targeted threat assessment would also fail to capture the ambiguity of the chosen target encountered in the plotting and support activities of the women we were seeking to study.

As our reflections on the appropriate methodology continued and our sample of women grew, we found our interest piqued by a comment made by a colleague (personal communication, Randy Borum, November 2, 2017) who suggested that we think about trying to integrate theory into the process of assessment we were seeking to conceptualize. This idea resonated with our wish to integrate quantitative and qualitative data into our study of radicalized women and supported the operational goals of our research. It also provided the possibility of finding ways to integrate causal thinking into the study of risk and threat analyses as they pertained to the study of extremist violence.

With this objective in mind, we explored the criminological and psychological literature for relevant theoretical models and found in Wikström's (2004) situational action theory (SAT) of crime, the type of causal explanations that we believed could be useful in understanding the interactions of an individual with their environment as they elevated the probability of involvement in extremist violence. We also found that SAT could be mapped onto the analytic paradigm proposed by Monica Lloyd and Christopher Dean (2015) in their study of convicted terrorists and was consistent with procedures used operationally by federal law enforcement to prioritize leads and conduct investigations of specific individuals. Moreover, the multidimensional nature of the model provided an opportunity to map onto its components prior work by Randy Borum (2015), John Monahan (2012, 2015), Caroline Logan (2017), and Robert Fein and Bryan Vossekuil (2000) as their ideas have helped to inform the assessment of violent behavior. We named the paradigm a *moral-situational action (MSA) model of extremist violence* and used its structure to develop a 41-page coding instrument which is currently being used to code 300 Western women who have become involved in extremist violence over the past 50 years. This paper will not discuss findings of the aforementioned study, as it is currently underway; however, the results will be submitted for publication once they are complete. Each of the women in our database has been identified as having been actively involved in an organization that espoused and/or carried out various forms of extremist violence or had been independently violent or directly supportive of violent behavior based upon beliefs associated with an extremist ideology.

The model, as outlined paradigmatically below, was developed to serve as the theoretical foundation of the qualitative study that is currently underway and is detailed at the end of this article.

1. To integrate the theoretical tenets of SAT, which include *propensity*, *mobilization*, and *action and capacity building*, with established principles of risk and threat assessment to provide a causative model or theory, which will simultaneously guide operational analyses and empirical research.

2. Create a framework that defines and embeds protective and risk factors on each dimension of analysis ensuring that relevant interventions and management strategies emerge directly from the assessment process.
3. Promote a formulation-based outcome that incorporates behavior, motivation, and vulnerabilities, which serves as a platform for assessing fluctuating levels of risk/threat, and which directly informs individual-specific risk and threat management interventions.

The moral-situational action model (MSA) is outlined paradigmatically below (see Figure 1). MSA represents our attempt to address three significant limitations in the procedures currently used in the behavioral sciences to assess and respond to the risk of violence posed by a specific individual. As observed by Wikström (2014), current theoretical frameworks for explaining crime fail to really consider the interaction of the individual with their social environment. Second, extant risk models have traditionally generated cumulative lists of risk factors with no causal explanation of how they interact, with the use of unifying risk formulations being a significant emergent but little researched addition to this process (Hart & Logan, 2011; Logan, 2017). Third, the lack of explanatory focus restricts the clinical or investigative usefulness of most risk assessments, leaving the interventions separate from the responses that are demanded when a person is perceived to be of high risk.

Theoretical Propositions

The MSA risk model identifies three proximate causal factors for involvement in extremist violence: *propensity*, *mobilization*, and *action and capacity building*. The relationships between these three causal mechanisms are summarized below.

1. Propensity is determined by an individual's moral values and self-regulatory capabilities, which through social interactions develop into perceptions of alternatives and processes of choice, possibly prompting association and involvement with extremist violence.

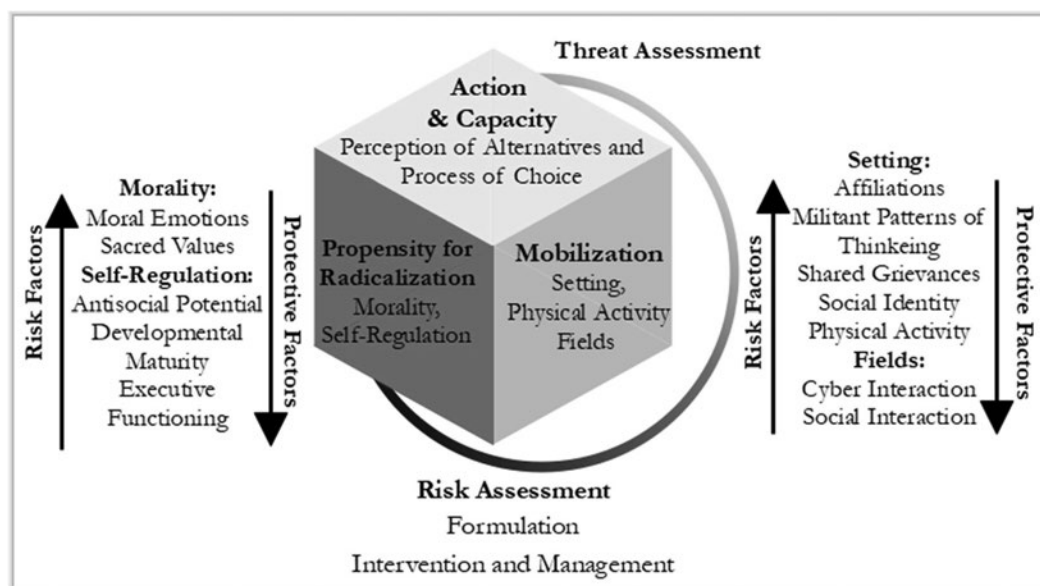


Figure 1. A Moral-situational action (MSA) model for extremist violence.

Consistent with SAT, we will be defining propensity as individual differences in perceiving alternatives and making choices in a particular setting over time. These differences are contingent upon and derive from the internal filtering effect of the individual's personal morality as reflected in their application of moral values, moral commitments, and the triggering of moral emotions and sacred values in relation to external conditions. It is further influenced by the stability and robustness of their internal self-regulatory capacities influenced by their antisocial potential, executive functioning, and psycho-social maturity which contribute to the ways in which individuals make judgments and deliberate before acting (Wikström, 2004).

2. Mobilization is prompted through the interaction of the individual with their social settings and the physical and cyber activity patterns that emerge from these interactions. The interplay between an individual's settings and activity patterns have the potential to give rise to changes in the individual's social affiliations, sense of shared grievances, militant forms of group thinking, and social identity, each of which can increase the risk for involvement in extremist violence.

Wikström (2004) defined a setting as the environment in which the individual is directly exposed and within which they react to other persons, objects, and events. Physical activity fields reflect the configuration of settings that an individual experiences during a specific period of time (Wikström, Ceccato, Hardie, & Treiber, 2010). Each of these presents the individual with different opportunities (e.g., the presence of persons, objects and events necessary for carrying out extremist actions), sources of friction (e.g., events that cause adverse reactions such as anger or irritations to other people's behavior), and monitoring (e.g., the risk of detection and intervention for unlawful actions). Together, these environmental influences can either increase or decrease the likelihood of the individual's involvement in extremist violence.

3. Action, as defined as the perpetration of or involvement with extremist violence and the capacity building that precedes and supports these actions, can emerge swiftly or more gradually, and can vary over time based the individual's evolving perceptions of alternatives and their unique processes of choice.

Wikström (2004) underscored that humans have agency and the capability to act upon their environments in a purposeful way. He asserted that action is always a result of the interaction between an individual and their settings, although at times internal personal factors or external environmental factors may exert greater hegemony on the course of action that is chosen (Wikström, 2004). Capacity building refers to an individual's ability to act and the behaviors they employ to increase this ability. For many women all involved in extremist violence, their capacity is influenced by their education, skill sets, ability to travel, ability to procreate, geographic location, and finances.

Translational work has begun to appear integrating these tenets of SAT into our understanding of extremist violence. Wikström and Bouhana (2017) recently outlined a SAT research agenda that they believe can be used to enhance various preventative interventions. Arguing that our understanding of terrorism can be enhanced by a mechanism-oriented research schema, they advocate for research that explicates three of these particular processes. These include: the psychosocial processes of moral education and cognitive nurturing relevant to why people become radicalized; the socioecological processes of population and activity segregation and differentiation relevant to the social emergence of moral contexts promoting radicalization; and the relevant processes of social and self-selection that introduce susceptible people to radicalizing moral contexts. They emphasize that knowledge is advanced when theoretical frameworks can be developed which explain causal mechanisms operating at different levels of analysis to produce the outcomes that require elucidation and understanding.

Working within the same SAT theoretical framework, Bouhana et al. (2016) have sought to explore the behavior of lone actor terrorists with a focus on how integrated scripts and subscripts can be used to identify "pinch points" where interventions can be implemented. In so doing, they offer an interesting analysis of the emergence of radicalizing environments online and provide a matrix which identifies processes of radicalization, attack preparation, and attack behavior based on an analysis of individual, situational, social ecological, and systemic factors. In so doing, they offer a compelling argu-

ment for the value of SAT in organizing evidence deserving of quantitative analyses and interpretation.

As a preliminary empirical foray into the application of SAT to this area of study, Schils and Pauwels (2016) used surveys to collect data from students aged 16 to 18 years of age to explore three testable propositions that emerge from theory. These included the possibilities that perceived injustice is positively related to political or religious violence; that social integration is negatively related to political and religious violence; and that perceptions of procedural justice, perceived alienation, and authoritarianism mediate the relationship between these two influences. Their data were cross-sectional in nature and demonstrated significant associations between these interacting causative factors. Since the publication of this study, Pauwels, Svensson, and Hirtenlehner (2018) have conducted a literature review of SAT publications, observing the need for empirical research that utilizes adult rather than adolescent samples, complimented by a deeper understanding of the construct of moral conflict, which is assumed but not quantified in extant SAT research.

Each of these recent applications of SAT to the study of extremist violence highlights the exciting integration of theory into a process of intervening with violent behavior which emerges in the context of political and religious violence perpetrated against civilian targets. Our work seeks to build upon this nascent area of study by examining the tenets of SAT from the perspectives of risk and threat assessment. We aim to better inform operational process that can be used by law enforcement and the intelligence community to prioritize cases and organize interventions with individuals believed to be at significant or imminent risk. We have chosen to develop this risk/threat paradigm using women, this being a perspective that has yet to be subjected to rigorous empirical study, and one that traditionally occurs as an afterthought to the research being conducted with violent men. Although we believe the experiential content of our paradigm will be unique to women, we anticipate that the structural and theoretical integrity of the paradigm will remain pertinent to extremist violence perpetrated by men.

Propensity for Radicalization

Morality

Wikström (2004) defined morality as an evaluative function which emerges in response to an individual's sense of what is right and what is wrong to do emotionally, cognitively, and behaviorally at different times and across different situations. It encompasses the degree to which the individual cares about doing the right thing (moral commitment), and the strength of feelings of guilt and shame (moral emotions) that are associated with not doing the right thing in a certain circumstance. Wikström (2004) posited that morality can best be understood as a "filter" which directs the person's attention to some alternative actions, and in this way, serves as a causal process linking the individual to their environment through their perceptions of alternatives and processes of choice.

Moral emotions. Haidt (2003) observed that emotions are often analyzed according to their component features, including: the presence of an eliciting event, a facial expression, a physiological change, a phenomenological experience, and a motivation or action tendency. When discussing the Levant nature of "moral emotions," he underscored the relevance of "disinterested elicitors" and their "pro-social action tendencies" (Haidt, 2003). The former term refers to the tendency of these emotions to arise in response to the interests of society or other people rather than the immediate situation and needs of the individual, with Haidt referencing the reaction we feel when faced with the image of a suffering child. The latter term encompasses the unique ability of moral emotions to evoke reactive tendencies such as revenge, affiliation, or comforting behaviors (Haidt, 2003).

According to Haidt (2003), moral emotions are pan-human products of evolution, influenced by cultural scripts and shaped by local values and meanings. Moral emotions find expression through various reactions which can differ widely, from altruism and niceness to ostracism, shaming, and even murderous revenge. Haidt (2003) grouped the primary moral emotions according to four categories including (a) the *other-condemning* family made up of contempt, anger, and disgust, (b) the *self-conscious emotions* made up of shame, embar-

rassment, and guilt, (c) the *other-suffering* family of compassion, and (d) the *other-praising* family made up of gratitude, awe and elevation. Monahan (2015) observed in his review of individual risk factors for terrorism that the study of moral emotions may have "important implication[s] for studying the violent actions in which terrorists feel morally obligated to engage" (p. 14).

Saltman and Smith (2015), in their publication *Till Martyrdom Do Us Part: Gender and the ISIS Phenomenon*, discussed the various push and pull factors that appear to impact a woman's progressive radicalization and her decision to depart her home country and travel to Syria to join Islamic State of Iraq and the Levant (ISIS). Images of violence toward women and children or the deadly aftermaths of bombings were shared and reshared on social media, giving rise to feeling of anger and frustration over international inaction leading to a binary logic in which "the good believers become the heroic forces fighting against the evil disbelievers (kuffar)" (Saltman & Smith, 2015, p. 12). These moral emotions are heightened by the posting of material such as one image shared by the Bethnal Green Trio, which went viral over a short period of time. The image showed a hunger-stricken child with the caption, "[t]he last thing a three-year-old child said before he died, 'I'm gonna tell God everything'" (Saltman & Smith, 2015, p. 12).

In her ethnographic work understanding the lives of women participating in organized hate groups, Blee (2002) similarly found powerful emotions that seemed to crystalize feeling of anger, disgust, and contempt toward immigrants, Jews, African Americans, and other sexual minority groups by women associated with different white supremacist groups. She referenced statements such as: "I am tired of having to look at disgusting homosexuals every time I leave my house," and "I am sick and tired of having the Jew-controlled government teaching my child what they want him to believe" (Blee, 2002, p. 73). Blee (2002) argued that these sentiments of anger serve to forge bonds of common hatred among individuals who might otherwise find that they have little in common.

Sacred values. In their work on this topic, Sheikh, Ginges, and Atran (2013) operationally defined sacred values as "anything that people refuse to treat as fungible with material or eco-

conomic goods, for example when people refuse to compromise over an issue regardless of the costs and benefits" (p. 12). They theorized that when sacred values are perceived as lying at the core of any conflict, the individual becomes vulnerable to becoming a "devoted actor," and from this perspective, begins to sacrifice self-interest at the expense of some higher good (Sheikh et al., 2013). The role of devoted actor manifests through a cascade of altered perceptions which include a violation of transitivity in preferences, insensitivity or reverse sensitivity to quantity, and immunity to trade-offs. This experience is coupled with a backfire effect which evokes emotions of anger, disgust, and moral outrage if material incentives or disincentives are offered to convince another individual or group to give up their sacred values. Further, it prompts a rule-bound logic which determines that a morally right action should be chosen no matter what the risk or rewards associated with it. Sheikh et al. (2013) observe, "people will burn themselves alive, kill, and risk the lives of their families and loved ones in the name of the sacred values like 'nation,' 'communism,' 'democracy,' or 'God'" (p. 12).

According to Ginges and Atran (2011), sacred values are also intimately connected with sentiments of personal and group identity. Citing the Gallup poll that found that 37% of Muslims worldwide believed that the 9/11 attacks were somewhat to completely justified, Esposito & Mogahed (2007) point out that out of these millions of individuals only a few thousand individuals are willing to become involved in acts of extremist violence. Ginges and Atran (2011) explain this vast expanse between perception and action by intergroup dynamics and the social networks that coalesce around sacred values, at times making the jihadist view of violent action a moral imperative.

The power of sacred values can be seen at the core of the decision to commit oneself to acts of self-sacrifice. Andalib Suleiman, a 17-year-old Palestinian woman, detonated an explosive device hidden under her body at the entrance of the main market in Jerusalem. At the time of her death, she belonged to Tanzim and the Al-Aqsa Martyr's Brigade. In her last video, Suleiman presented herself dressed in black and holding her *Qur'an*, saying that she was about to die as a symbol of the women's fight against occupation and to honor the memory of Wafa Idris

(who is widely regarded as the first female Palestinian suicide bomber). Reem-al-Riyadh, a mother of two toddlers, killed herself and four Israelis in a suicide bombing in 2004 propelled by her desire to "turn [her] body into deadly shrapnel against the Zionists and knock on the doors of heaven with the skulls of Zionists" (Koranteng, 2016, p. 87).

Loyalty was a sacred value in Charles Manson's infamous neo-Nazi organization, The Family of Infinite Soul, also known as "The Family." Manson assessed members' commitment levels to loyalty by asking them to participate in sexual orgies or "by asking them to die for him" (Fine, 1982, p. 49; Watson & Ray, 1978, p. 12). In the court hearing regarding the Tate and La Bianca murders, which found Charles Manson, Patricia Krenwinkel, Susan Atkins, and Leslie Van Houten guilty of first-degree murder and conspiracy to commit murder, the People quoted Manson's idea of loyalty, "[i]n order to love someone you must be willing to die for them and must be willing to kill them, too. You must be willing to have them kill you. You must be willing to experience anything for them" (*People v. Manson*, 1976). Krenwinkel, Atkins, and Van Houten demonstrated that loyalty to Manson was sacred to them by killing seven people and an unborn baby when he asked them to, to further his cause of inciting a race war.

Self-Regulation

Antisocial tendency. In the development of SAT, Wikström (2004) referred to Farrington's (1996) use of the concept of "antisocial tendency." Farrington (1996) used this term to refer to the individual's differential propensity to manifest antisocial behavior or engage in some type of crime. Farrington argued, "[e]ach individual in any environment has a certain degree of antisocial tendency that is relatively consistent over time" (pp. 277–278). According to Farrington (1996), this potential is expressed through a process of choice which emerges in response to the individual's assessment of opportunities, costs and benefits, and the subjective probabilities of different outcomes. It further is energized by factors that potentially lead to high, long-term desires for material goods, status among intimates, excitement, and sexual satisfaction. Farrington underscored, however,

that these motivations only lead to high antisocial potential if methods of satisfying them are habitually chosen, and that these choices are often associated with life situations that are limited in the life opportunity they offer the individual.

Moffitt, Caspi, Rutter, and Silva (2001) have differentiated between two types of antisocial tendency, the “life-course persistent” and the “adolescent-limited.” Based upon a 20-year longitudinal study, they found a life-course persistent pattern of chronic antisocial behavior that began early in life and which reflected inherited or acquired neuropsychological variations, initially manifested as subtle cognitive deficits, difficult temperament, or hyperactivity (Moffitt et al., 2001). This vulnerability was often combined with a pathogenic environment characterized by inadequate parenting, disrupted family bonds, and poverty which together coalesced into poor interpersonal relationships. In contrast, the adolescent-limited pattern of antisocial behavior emerged at the time of puberty among otherwise healthy adolescents and appeared to emerge in response to a sense of dysphoria related to the disparity between the youth’s biological maturation and access to mature privileges and responsibilities. During this time period, Moffitt et al. (2001) observed that it was normative for a youth’s behavior to mimic the life-course antisocial behavior of the other cohort, although their antisocial behavior was found to dissipate spontaneously as they reached adult maturity and returned gradually to a more conventional lifestyle.

The self-regulation of many jihadist and alt-right recruits is mediated in many instances by their young age. ISIS foreign fighter demographics indicate that most fighters are young and fall between the ages of 15 and 30 years (Stern & Berger, 2015). A Danish intelligence report noted that the typical age of foreign fighters in Syria was even lower, generally falling between the ages of 16 and 25 years, with the process of radicalization beginning as early as 12 years of age (Ioffe, 2015).

Herlitz (2016), in her study of agency in Swedish media portrayals of Western women joining ISIS, reported that more than 55% of the 133 articles reviewed referred to these behaviors as “shocking,” often because of the young age of the women involved. She indicated that the average age of the Western recruits was 18

to 29 years, with some articles referencing women being as young as 17 to 23 years of age. Alexander (2016) in her description of roles of women in jihadist organizations described the travel efforts of three Colorado girls aged 15, 16, and 17 years. Together, they were stopped in Germany on their way to Syria, with investigations by the FBI indicating that each had demonstrated increased radicalization online for at least a year prior to their departure.

A more long-term pattern of antisocial behavior was reflected in the behavior of Elizabeth Tyler, who assisted the Klu Klux Klan in the 1920s in becoming a mass movement. Born to an impoverished rural Georgian family, she married at the age of 15 years, and two months later gave birth to a child, with her first husband dying a few weeks later. As a young adult, she became a part of the “better babies” movement which was presented as a scientific approach to parenthood that included principles of public health and those of eugenics. She married four times and with her partner and paramour, Edward Young Clarke, “brilliantly sold the KKK to America” (Laackman, 2014). Together, they wrested control of the KKK from the original Imperial Wizard, and increased the group’s racism to include Catholics, Jews, nonwhites, Bolsheviks, and immigrants. The pair are described as “evil geniuses,” with Tyler specifically described as having great insight into the vices and frailties of men, becoming one of the richest and most powerful women in America (Laackman, 2014).

Executive functioning. According to Farrington’s (1996) theory of antisocial potential, differences also accrue as a result of differences in an individual’s executive functioning, including “impulsivity, hyperactivity, sensation seeking, risk taking, poor ability to defer gratification,” and “poor ability to manipulate abstract concepts” (Wikström, 2004, p. 12). Farrington asserted, “[i]mpulsiveness is the most crucial personality dimension that predicts antisocial behavior” (1995 p. 179; Lipsey & Derzon, 1998).

These developmental changes have been informed by neuroimaging research which demonstrates progressive changes in areas of the brain that are associated with changes in the ability of an individual to regulate their emotions and control their behavior. Based upon longitudinal studies of the brain of individuals

aged 3 through 30 years, Giedd (2008) found functional and structural increases in connectivity and integrative processing accompanied by a changing balance between limbic/subcortical and frontal lobe functions in adolescence through young adulthood. These changes encapsulated an increase in executive functioning that were expressed through an array of abilities, including attention, response inhibition, regulation of emotion, organization, and long-term planning. When discussing these developmental changes, Giedd (2008) observed that separation from the family of origin, increased risk-taking, and increased sensation-seeking have all proven highly adaptive in the history of mankind, and together guarantee that adolescence is a time of great risk and great opportunity.

Tarras-Wahlberg (2016), in her study of online ISIS propaganda, reflected on the promise of adventure that was being conveyed to young women through the accounts of women who has previously migrated to ISIS-held territories. In an article in *Dabiq* (an ISIS publication), Umm Sumayyah al-Muhajirah wrote, “[women go] through the hardship of a long journey that is also exciting and full of memories.” Saltman and Frennett (2016) described the excitement, sense of adventure, and romantic thrill that is experienced by many young women as they formulate their decision to travel to a distant foreign land. While speaking in Stockholm at an international “ideas meeting,” Lana Lokteff, a Russian American who co-runs Red Ice, an alt-right media company, similarly observed that “young women were flocking to the right because all the girls are starting to like the bad boys [who are] the nationalist[s]” (Peled, 2017).

Developmental maturity. Steinberg, Cauffman, Woolard, Graham, and Banich (2009) have studied differences in psychosocial maturity as it impacts reasoning and decision-making in high risk situations. They explored this construct using self-report measures of risk perception, sensation-seeking, impulsivity, peer influence, and future orientation. Based upon their empirical research, they concluded that “in situations that elicit impulsivity, that are typically characterized by high levels of emotional arousal or social coercion, or that do not encourage or permit consultation with an expert who is more knowledgeable or more experience, adolescences’ decision-making, at least

until they have turned 18 is likely to be less mature than adults” (Steinberg et al., 2009 p. 592). Gardner and Steinberg (2005) found that youth between the ages of 13 and 23 were more inclined than adults to take risks under the peer influence of three or more friends.

Developmental factors associated with this stage of life further increase the salience of risk taking and sensation-seeking, strengthening the compelling lure adolescents and young adults experience in response to the propaganda that is designed specifically for them online. In the manifesto *The Management of Savagery/Chaos*, Abu Bakr Naji outlined the basic tenets of militant insurgency for the Mesopotamian wing of Al-Qaeda which eventually became ISIS. In it, militants are urged to “[c]apture the rebelliousness of youth, their energy, and idealism, their readiness for self-sacrifice, while fools preach moderation (wasatiyyah), security and avoidance of risk” (Atran, 2015). In her study of female agency, Kneip (2016) argued that the motivation of women to join the Islamic State extended beyond a pure sense of religious duty and incorporated with it a wish for female empowerment and emancipation. In making this argument, she referenced the general pull toward radicalization that characterized all youth, as a way of trying to escape the society and roles they lived in, testing and trespassing boundaries, in the process of a process she referred to as “self-finding” (Kneip, 2016, p. 92).

Young age and developmental immaturity have also been associated with racist and white nationalist groups. Suggs and Emerson (2017) posited that young people turn to neo-Nazi or Klan factions because they perceive themselves as having few options. Specifically, “[f]inding young adulthood a big, empty place, they are readily radicalized by hate groups that offer a sense of identity and belonging” (Suggs & Emerson, 2017). Blee (2018) reported that the women who are especially active in neo-Nazi groups, particularly the racist skinheads, tend to be younger and less bound by the male—exclusive doctrines of earlier racist movement. These groups are violently racist and anti-Semitic and are modeled on earlier groups in England and Canada. They espouse beliefs that white Europeans can be traced back to the lost Tribes of Israel, with Jews being the offspring of Satan with Eve, and non-Whites being “mud

People” who were created before Adam and Eve.

Mobilization

Social Setting

When discussing the concept of social setting specifically in the context of SAT, Wikström et al. (2010) defined a setting as any aspect of the environment that an individual can experience using their various senses. According to SAT, an individual’s propensity for perpetrating a criminal act is activated by their interactions with other individuals who prompt or energize a change in their perceptions and experiences, potentially leading to choices that include criminal behavior, or in our model, involvement in extremist violence.

Affiliations. Monahan (2015) wrote that individuals who are involved with violent extremism tend to associate with other people who are involved with violent extremism. He identified four types of affiliations that might be relevant in a radical context, including family, romantic partners, friends, and fellow members of virtual communities (Monahan, 2015). Within each, Monahan proposes that two issues might be particularly salient: how interpersonally close the subject feels to the person with whom the subject has a relationship, and whether the person with whom the subject has relationship condones extremist violence.

Saltman and Frennett (2016) reflected on the rewards in life that are offered to jihadist women including a sense of belonging and sisterhood. A special kind of camaraderie is offered to young women and contrasted to the “fake and surface-level relationships” that are available to women living in the West (Fink, Zeiger, & Bhulai, 2016, p. 149). The imposition of the constraints of Shariah law are also presented as empowering to women, offering them an alternative to being sexualized and objectified, and exalting them as the mothers to the next generation and the guardians of the ISIS ideology. Tarras-Wahlberg (2016) in her publication, *Promises of Paradise? A Study on Official ISIS Propaganda Targeting Women*, cited Abu Bakr al-Baghdadi, who during the month of Ramadan in 2014 gave a speech emphasizing that all Muslims belonged in and were welcomed in the state that was being created by

ISIS at that time. Tarras-Wahlberg (2016) observed, “ISIS is portrayed as an inclusive community” (p. 29).

In addition to the four types of affiliations discussed by Monahan (2015), Benotman and Malik (2016) explored the role of children in the Islamic State and estimated that approximately 31,000 women were impregnated by jihadists in Syria and Iraq from 2014 through 2017. Children born to these unions were often trained in an extremist ideology and the dynamics of warfare. Similarly, Blee (2002) found that children born into racist groups participated in activities from a young age and provided the instance of a girl six years of age who was responsible for writing recruitment propaganda targeting her peers, which was distributed by other children for the Klu Klux Klan.

Group grievances. Monahan (2015) explored the roles of personal and group grievances in the radicalization of individuals to the tenets and goals of extremism. Citing the work of McCauley and Moskaleiko (2011), he reflected on the mutuality that can occur between these two different experiences of injustice. As observed by McCauley and Moskaleiko (2011), “[p]ersonal grievances can lead an individual to seek out and cooperate with others feeling anger towards the same perpetrator; the personal then becomes political. Group grievance can lead to involvement in conflicts with the government and police that are experienced as unjustified repression; the political then becomes personal” (pp. 214–215). Meloy and Gill (2016) refer to the synthesis of personal grievances with moral outrage, with these experiences constituting a combination of personal life experiences and specific historical, religious, and political events.

In the publication *Caliphette: Women and the Appeal of the Islamic State*, Rafiq and Malik (2015) explained that many Muslim women in Britain feel isolated, are not integrated, suffer from identity crises, and express a range of grievances including anti-Muslim hatred, gender inequality, and a lack of representation, all of which contribute to their vulnerability which can be exploited in the radicalization process. Winter (2015a), in his discussion of the virtual caliphate, also underscored the importance of the narrative of victimhood that is intrinsic to the propaganda of all jihadist groups; it asserts that Sunni Muslims are victimized as part of a

perceived global war on Islam. This narrative is often used as part of the propaganda to unite the binary opposites of victimhood and retributive violence (Winter, 2015a).

From the perspective of the alt-right, Legro (2017) described a comparably fundamental grievance, one that emanates from the impassioned belief that its members are fighting a war for the soul of Western civilization, a battle designed to save the White race from destruction. This fear has emerged in response to what members perceive as “anti-white sentiment” in America, a perception that has given rise to a conspiracy theory according to which “the establishment” is out to oppress, minimize and silence White people (Legro, 2017). Based upon interviews with women prominent with the alt-right, Darby (2017) concluded that some of the women associated with the movement considered a move to Washington as an opportunity to assert themselves in the political arena, whereas others wished to engage in and support a literal race war in America.

Social identity. Monahan (2015) discussed the concept of “fused identity” and its possible relationship to extremism. He referenced the work of Swann, Jetten, Gómez, Whitehouse, and Bastian (2012) who have identified the concept and its emergence when people experience “a visceral feeling of oneness with the group” (p. 441). These authors described it as being a “psychological pathway through which large aggregates of strangers are transformed into ‘family members’ for whom some individuals will make extreme sacrifices” (Swann et al., 2014, p. 925).

Borum (2015) defined identity as comprising core beliefs by which a person defines himself or herself and which often include a mix of individualistic attributes and group-referenced identifications. He observed that one relevant component of the construct is the extent to which an individual’s sense of grievance is central to his or her identity (Borum, 2015). Borum (2015) hypothesized that an aggrieved identity often reflects a pervasive attachment or possible preoccupation with the idea that the individual has been wronged personally, or as part of a collective that has been wronged politically or historically.

Rafiq and Malik (2015) observed that new recruits to violent and nonviolent extremist

groups generally arrive at this position after an identity crisis of some sort in their lives. In the West, this can derive from grievances including both personal sentiments of anti-Muslim hatred, racism, or bullying; and social or cultural experiences of marginalization or dislocation, which are sharpened by a prevalence of conspiracy theories and a generalized dissatisfaction with democracy. They assert that radicalization and recruitment to all forms of extremism, from far right to religious, emerge through a combination of grievance, mobilization, and ideology (Rafiq & Malik, 2015).

According to Legro (2017), the women of the alt-right share a common sense of grievance at the way that modern Western society castigates traditional wives and mothers and view feminism as the “spawn of washed-up, Marxist, lesbian and/or Jewish women . . . [w]ho have perverted the natural gender order by convincing women to be more like men and men to be more like women.” Advocates of this position believe that the natural order embodies biological, predetermined symbiotic differences between the genders according to which men are strong and assertive, women are soft and emotional, and that harmony in the family and society is achieved when men are allowed to lead, and women follow, while providing men with support and counsel.

Collective cognitive structure. Borum (2015) suggested that despite differences in ideologies, extremist ideologies share a common cognitive structure which is both rigid and overly attached to a specific set of ideas. Citing the work of Strozier, Terman, Jones, and Boyd (2010), he referenced a “fundamentalist mindset” which is characterized by five primary characteristics: dualistic thinking with a Manichaeian ideas about the idea of right and wrong, paranoia associated with hypersensitivity to humiliation and other threats to self-esteem, an apocalyptic orientation which includes a narrative of personal and global history, relationship with charismatic leadership, and a totalizing conversion experience, which is transformative and comprehensive, and according to which a new self takes form as an old sense of self “is discarded as despised.” (p. 40). Borum (2015) suggested that this way of thinking serves to stimulate a worldview that is compatible with the ideol-

ogies and actions of many different types of extremist groups.

In her work, [Blee \(2018\)](#) underscored the importance of women activists creating a rational basis for their involvement in organized racism through the retrospective construction of an experience of dramatic personal transformation. She observed that in the life stories of her research subjects, accounts of personal transformation typically took the form of a conversion story which was similar in structure to those described by those converting to a religion, sobriety, or feminism ([Blee, 2018](#)). The content of these narratives was found to consistently converge on a personal passage from racial naïveté to racist enlightenment. She also reflected on the paranoid-tinged worldview that permeated many white supremacist groups according to which Jewish conspirators are trying to manipulate white individuals and people of color for their own benefit ([Blee, 2018](#)). In this context, she referenced the slogan of many white supremacist groups, known as the “14 words,” which are, “[w]e must secure the existence of our people and a future for white children” ([Blee, 2018](#), p. 81).

Militant patterns of thinking. [Saucier, Akers, Shen-Miller, Knezevic, and Stankov \(2009\)](#) described certain patterns of thinking which they believe are pan-cultural and reflective of a *militant extremist mindset* which can develop across a diverse range of regions, religions, and political orientations. They posited that the mindset is characterized by a “zealous adherence to a set of beliefs and values, with a combination of two key features; advocacy of measures beyond the norm (i.e., extremism) and intention and willingness to resort to violence (i.e. militancy)” ([Saucier et al., 2009](#), p. 256). Based upon extracted statements from written material produced by extremist groups from seven regions of the world, [Saucier et al. \(2009\)](#) enumerated 16 themes which can be assembled into a coherent and compelling narrative that is consistently observed across different militant extremist groups.

- The necessity of unconventional and extreme measures.
- Use of tactics that have the function to absolve one of responsibility for the bad consequences of the violence one is advocating or carrying out.

- Prominent mixture of military terminology into areas of discourse where it is otherwise rarely found.
- Perception that the ability of the group to reach its rightful position is being tragically obstructed.
- Glorifying the past in reference to one’s group.
- Utopianizing the idea of a future paradise or at least “the promise of a long and glorious future.”
- Catastrophize with the perception that great calamities have occurred, or are occurring, or will occur.
- Anticipation of supernatural interventions to help support one’s efforts.
- A prerogative to annihilate evil and or purify the world entirely from evil.
- The glorification of dying for a cause.
- The duty and obligation to kill, or to make offensive war.
- Machiavellianism in service of the sacred with an acceptance of immoral ends if necessary to assure the success of a cause.
- An elevation of intolerance, vengeance, and warlikeness into virtues.
- Dehumanizing or demonizing the opponent.
- Experiencing or perceiving the modern world as a disaster for humanity.
- Believing that civil government is illegitimate ([Saucier et al., 2009](#)).

In discussing the role of ideology in extremism, [Monahan \(2015\)](#) observed that three of the risk factors included in his paradigm—ideology, affiliations, and grievances—have been combined by [Kruglanski, Chen, Dechesne, Fishman, and Orehek \(2009\)](#) into the concept of a “significance quest” that is undertaken by suicidal terrorists and has been applied to research concerning the radicalization of incarcerated individuals by [Dugas and Kruglanski \(2014\)](#).

[Winter \(2015a\)](#), in his analysis of the Islamic State’s propaganda strategy, observed that although brutality is the most prominent of the narratives used in the West, utopianism is by far the most important narrative for the Islamic State’s propagandists. He observed that it is the organization’s utopian offer that is most alluring to recruits and concludes that “unless we understand what makes up this utopia, any at-

tempt to challenge the idea is doomed to failure” (p. 6).

Blee (2002) also recognized the draw of utopianism motivating women to participate in violent racist groups; she cited an interview she conducted with a neo-Nazi woman in which the woman stated, “I would like to live in an all-Aryan homeland on this continent. I hope I do live to see it. That is without a doubt my greatest wish for the future” (p. 82). These sentiments have found expression among many associated with white nationalism who have relocated to states in the Pacific Northwest, an effort referred to as the Great Northwestern Territorial Imperative. This search for utopian alternative reflects the wish to establish an all-white Aryan paradise which would then allow the members to secede from the United States (Blee, 2018; Blee, 2002).

Mechanism of Activity Fields

Wikström et al. (2010) used the term activity field to refer to a person’s exposure to different settings during a specific time period. They have studied this construct using a space-time budget which examines hourly information covering a 4-day period including the subject’s geographical location, the place or location, with whom the subject was interacting, and his main activity during this interaction (Wikström et al., 2010).

Social interactions. Monahan (2015) referenced the research of Sageman (2008) who found that 70% of individuals who join Al-Qaeda do so with friends, whereas an additional 20% join in association with members of their family. He also referenced the research of Atran (2008) which found that friends become kin as they marry the siblings and cousins of their friends (Monahan, 2015). This power of group dynamics has been demonstrated in multiple studies conducted and published by Ginges, Hansen, and Nurenzayan in 2009, each of which explored the relationship of parochial altruism to religious practice and attendance at collective religious services. In two of these studies, Ginges, Hansen, and Norenzayan (2009) found that the frequency with which Palestinian Muslims attended mosque, but not their frequency of prayer, predicted their support of suicide or martyrdom attacks. In their study of Israeli Jews, they found that using priming questions

concerning attendance at synagogue, but not prayer to God, increased the likelihood that Jewish Israeli settlers would express the belief that the suicide attack against Muslims at prayer in the Cave of the Patriarchs in 1994 was “extremely heroic” (Ginges et al., 2009).

Blee (2002) found that her participants most commonly were introduced to their respective extremist groups via their familial and social networks. Specifically, she cited that, “clubs of gun owners, survivalist networks, or some hardcore music scenes, have a greater chance of meeting racist activists” who then may recruit them into their hate groups (p. 29). Blee (2002) expressed that having relationships with people with extreme ideologies does not necessarily determine whether a person will join a hate group, but that it is important to consider that each person will vary in their levels of receptivity to hearing the extreme and racist ideas expressed by their affiliates.

Cyber interactions. Winter (2015a) in *The Virtual “Caliphate:” Understanding Islamic State’s Propaganda Strategy*, reflected on the powerful role that social media plays in promulgating the brand or propaganda machine of the Islamic State. He suggested that social media is the “optimal vehicle” for promoting these types of messages throughout the world, observing that it creates a type of symbiosis where there is no clear division between the audience and the producer (Winter, 2015a). This type of relationship not only catalyzes a sense of dependence of the recipient on the propagandist but “also has the potential to launch them into an active role” (Winter, 2015a, p. 15). Referencing Jacques Ellul’s (1973) work on the nature of propaganda, Winter reflected on the use of paired opposites in the creation of propaganda, noting that their manipulations through different venues is used to train, channel, and orient recipients eventually “activat[ing] an individual’s participation in the transmission of ideas while they remain under the illusion of independent thought” (Winter, 2015a, p. 15).

Women play a significant role in the transmission of the Islamic State content through their contributions to a constant stream of content that beguiles the individual and contributes to “the rigorous, exciting, active expression of the ideas that they already hold” (Winter, 2015a, p. 16). Manrique et al. (2016), in their analyses of individuals on the

global social media outlet VKontakte, found that women who decided to follow a pro-ISIS group page demonstrated superior network connectivity when compared with men and did so in such a way that benefited the underlying system's robustness and survival. Suggs and Emerson (2017) observed that whereas "old-school" Klan members were content with passing out flyers, and that skinheads might seek recruits by instigating a brawl at a club, younger extremists primarily identified potential members on websites and through social media. This involves crude video games on racist sites, along with memes and trolls on sites such as 4chan, 8chan, and Reddit. Another online approach has been institutionalized by Lana Lokteff, an endorser of the alt-right movement, who serves as the host of radio 3Fourteen, where she offers political and social commentary that focuses on European identity and culture. Recent shows have included European cooking and philosophy; advice for young women who want to live a feminine life; the surrendered wife: stop nagging and controlling; and women against Islamization of Europe (<https://redice.tv/radio-3fourteen>).

Action and Capacity Building

Mechanism of Perceptions of Alternatives

Wikström (2004) defined perception as an experience-based interpretation of information received from the senses which links an individual to his or her environment. He emphasized that perception is selective as no one can take in the full complexity of any single environment and attention can be given only to specific aspects of the environment which are personally found to be compelling.

Rafiq and Malik (2015) observe that propagandists seek to convince young women that their lives in the Western world leave them at risk of called falling into *kufr* (disbelief) and that feminism—the Western model for women, has failed and that the only solution to this is *hijra* (migration). In the document *Women of the Islamic state: A Manifesto on Women by the Al-khanssaa Brigade* (Winter, 2015b), the writers emphasize the failure of the Western model for modern women. This perspective underscores the differences between men and

women and suggests that harmony is best achieved by embracing these differences fully in all aspects of family life and the larger society. Women are described as having heavenly attributes of sedentariness, stillness, and stability, whereas men are described as being opposite in nature and being inclined to movement and flux. From this perspective, the fundamental function for women is in the home with her husband and children where they are able to profoundly impact all aspects of society through the careful tending of children or "cubs" according to the teaching embedded in the Qur'ān. (translation from Arabic by Charlie Winter; Winter, 2015b).

Similarly, Flavia Dzodan, the Netherlands-based originator of "intersectional feminism," has argued that many women in the alt-right view themselves as part of a repurposing and expansion of white feminism to explicitly support white supremacy. This perspective applauds the differences between men and women and suggests that both genders create greater harmony and unity when they stop fighting nature and allow their biological differences to determine their roles in a relationship. From this perspective, as observed by Peled (2017), quoting woman who identifies with the alt-right blogger, "just like race is real, biology is real." In line with this philosophy, many women associated with the far right see their most important roles as being behind the scenes, focused on the family in the home and in perpetrating the White race by having babies and inculcating them with a certain *Zeitgeist*. Davenport, an alt right blogger, told the *Economist* (Davenport, 2017), "[t]here is nothing that has made me feel more empowered in my life than supporting and being supported by a strong man."

Mechanism Concerning Processes of Choice

According to Wikström (2004), a process of choice is activated based upon the individual's perception of different alternatives for action. This involves an evaluation of perceived action alternatives which consist of a conscious process of judgments, deliberations, discounting, and decisions, and is undoubtedly impacted by unconscious processes that by definition are not directly available to the individual being influenced by them. Based upon a close analysis of the Islamic State's official propaganda and the

communications of unofficial proselytizers, Rafiq and Malik (2015) identified four promises—empowerment, deliverance, participation, and piety—that are central to the appeal of the Islamic State’s caliphate to women. The promise of empowerment prompts women to believe that joining the organization will reverse the ills that they face in their ordinary life and will allow them to defiantly take charge of their lives. Both Arabic and English language messaging conveys that “in the shadow of the caliphate, fear is replaced with security, alienation with belonging, and uncertainty with certitude” (p. 22). Through living in the Islamic State’s caliphate and supporting its jihad by marrying a fighter, women are led to believe that they can emancipate themselves and fully participate in the creation of a new way of life. They are urged to join the jihad through the promise of being part of something bigger than themselves, something that is allegedly divinely mandated. According to Rafiq and Malik (2015), piety is offered through the ability the organization had developed to ascribe everything it does to scripture, “couch[ing] all of its actions, especially the abhorrent, within a repeating religious framework” (p. 370).

Miller, in his article “Lipstick Fascism” (Miller, 2017), examined the beliefs of women associated with the extremist right, observing that as a group they were unified by the rejection of what he refers to as “cultural Marxism,” a political stance which they associate with race-mixing, feminism, and hedonism. By embracing a positive view of traditional gender roles and old-fashioned ideals of beauty, these women seek to promote the midcentury ideal of the all-white nuclear family. As observed by Lokteff, “European nationalists in the alt-right are very attractive, very sexy bunch. It’s a eugenic process. Matches are being made left and right of beautiful couples. Now it’s time to procreate” (Miller, 2017). Moreover, women are urged to “nurture their femininity,” with Lokteff arguing that it is their greatest asset and their main weapon “in the brutal competition which constitutes natural selection and . . . [their] primary strength in their interactions with men” (Miller, 2017). Miller (2017) concluded that the group views immigration as a form of white genocide with Muslim immigrants being “incoming invaders” who have no

respect for white women and are responsible for in an ever-growing rate of migrant violence against women. To combat this problem, women are urged to prepare for a race war to protect their country which men had built for them over the past centuries (Miller, 2017).

Mechanism of Capacity Building

Lloyd and Dean (2015) noted that capability emerged in their paradigm from the finding that many terrorist offenses had failed or been sublethal in their impact because of the perpetrator’s lack of capability to carry out a terrorist act. Lack of capacity could consist of lack of personal resources such as finance, knowledge, skills, or resilience or lack of access to resources for terrorism such as social capital or networking ability. Capacity can be assessed based upon the efforts of an individual to obtain the information, knowledge, or skill necessary to become a member of an extremist organization or perpetrate a terrorist crime. This might include the review of documents made available by specific extremist organizations which provide descriptions of various methods for inflicting lethal violence on civilian targets.

Articles in the publications of ISIS (*Dabiq*, *Rumiyah*) and al-Qaeda (*Inspire*) explain the optimal use of vehicles in the plotting of terrorist attacks (Inspire 2, 2010; Rumiyah 3, 2016; Rumiyah 9, 2017), offer instruction for ensuring that a knife attack will be lethal (Rumiyah 2, 2016; Rumiyah 4, 2016), instructions on how to create various types of bombs, incendiary devices, and improvised grenades (Inspire 1, 2010; Inspire 6, 2011; Inspire 8, 2011; Inspire 9, 2012; Inspire 12, 2014; Inspire 13, 2014; Inspire 15, 2016; Rumiyah 5, 2017), other improvised devices/methods to attach vehicles and trains (Inspire 10, 2013; Inspire 17, 2017), strategies for assassination operations (Inspire 14, 2015; Inspire 15, 2016), and offer advice on how best to handle one’s internal emotions including fear and doubt prior to the execution of a terrorist plot. Similarly, aspiring neo-Nazis also post capacity-building videos discussing topics such as, “The Truth About Jews—by Evalion” (Aeric Ravenwolf, 2016) and “Evalion: How To Identify a Feminist” (Legion of Archangel Michael, 2016). Even when the original content is removed by the platform, it often is reposted by

sympathizers as was the case with these two referenced videos.

According to SAT, the risk of extremist violence should also contain an assessment of the individual's activity fields as it reflects their progressive development of capacity. For example, court documents outlining the criminal complaint against Enrique Marquez, Jr., an accomplice in the San Bernardino attack perpetrated by Tashfeen Malik and her husband, Syed Rizwan Farook, in 2015, indicated that plans for mass violence began four years prior to its execution. Court documents stated, "Marquez and Farook discussed using firearms and explosives to attack Riverside Community College ("RCC") and State Route 91 ("SR-01"; *U.S.A. v. Marquez, Jr.*, 2015). Additionally, Marquez and Farook took steps to carry out their plans by purchasing firearms, ammunition, and other tactical gear, as well as going to local firing ranges (*U.S.A. v. Marquez, Jr.*, 2015). Marquez told investigators that "he and Farook specifically discussed attacking the library or cafeteria area of the RCC. . . . because they wanted to maximize casualties" (*U.S.A. v. Marquez, Jr.*, 2015). In reference to the State Route 91 plot, Marquez and Farook selected a particular stretch of highway "because of the locations lack of exits . . . [which] would increase the number of targets in the eastbound lanes during afternoon rush hour traffic" (*U.S.A. v. Marquez, Jr.*, 2015).

Action roles. Based upon an in-depth review of 25 cases involving American female jihadists identified from 2011 through 2016, who lived in 14 different states, and ranged in age from 15 to 44 years, Alexander (2016) posited three overlapping categories of actors including plotters, supporters, and travelers. When referring to the plotters, she referenced three women who were directly involved in designing or carrying out violent domestic attacks in America: Asia Siddiqui, Noelle Velentzas, and Tasheen Malik (Alexander, 2016). Siddiqui and Velentzas were arrested in Queens, NY, for conspiring to prepare an explosive device that was to be detonated in a terrorist attack on the United States. Malik was one of two perpetrators of December, 2015, attacks in San Bernardino, with her discussion of martyrdom with her husband beginning as early as 2013, and her actions later being used in *Dabiq* to recruit men into participating in violent jihad.

Comparable behavior has been observed among women involved in domestic extremist plots. Sharon Renee Barefoot was indicted in 2005 for conspiring to possess and sell stolen fire arms, possessing stolen firearms, and murder (Southern Poverty Law Center, 2007; United States Attorney's Office, 2006). Barefoot, acting with seven others including her husband, planned the murder of a fellow Klansmember, of a rival chapter, for knowing "too much" about Barefoot's husband's idea to detonate a 50-lb. bomb in a local sheriff's office. Rebecca Rubin, an environmental and animal rights extremist, pleaded guilty in 2013 to several conspiracy and arson charges for lighting a ski resort and two government-owned horse corrals on fire and attempting to burn down a lumber mill (MacQueen, 2013). In total, Rubin helped the Earth Liberation Front and the Animal Liberation Front cause approximately \$48 million worth of damages (MacQueen, 2013).

According to Alexander (2016), the supporters group consisted of women varying widely in their activities, which ranged from posting propaganda to sending tactical gear abroad. The 10 women she identified in this category were involved in transferring funds to individuals involved with the Taliban, Al-Qaeda, ISIS, and Al-Shabaab, assisting in the purchase of plane tickets for others to travel to join in the activities of one of these organizations, buying U.S. military uniforms, surplus gear, combats boots, rifle scopes, and other weapons supplies to send to "foreign freedom fighters" in Syria, and posting the names of three federal employees with their locations and phone numbers with the notation "Wanted Killed" (Alexander, 2016). Alexander (2016) wrote that this category reflects a low threshold for participation and can involve women who work independently or who coordinate schemes with larger clusters and networks.

Alexander (2016) included 12 young women in her third group who traveled or attempted to travel to international locations to participate in jihadist group activities directly. Some of these women were stopped prior to reaching their location for entering Syria, others have been killed after their arrival in the area, whereas others are believed to have survived, remaining active in developing propaganda for dissemination and fulfilling their roles as wives and mothers. Another example, sympathetic with the

neo-Nazi ideology, involved Erica Chase, who purchased a firearm and traveled from Indiana to Massachusetts to execute a plan with her romantic partner, which involved stealing missing children's identities, producing and spending counterfeit money, and making bombs for terrorist activities (Southern Poverty Law Center, 2002, p. 10).

Risk Formulation

Borum (2015) discussed the role of risk factors in providing a foundation upon which an evaluator can compile a sufficient fund of relevant information to develop a formulation describing the nature and likelihood of an individual's risk for extremist violence given certain situational circumstances. When assessing the risk for extremist violence, Borum (2015) suggested that the formulation proceed through four stages including a behavioral history analysis, a motivational analysis, a vulnerability analyses, and a formulation analysis.

- Behavioral history analysis: The key objective of this step involves the identification of critical events or behaviors in an individual's history that suggest movement toward involvement in terrorism. Borum (2015) recommended constructing a timeline with process/phase markers or inflection points, noting each as a significant time segment.
- Motivational analysis: In this stage of the analyses, the evaluator seeks to identify the push-pull factors that appear to have contributed to the individual's decision to become involved in extremist violence (Horgan, 2005). Borum (2015) identified six motivational clusters which can be considered as part of this assessment, including status-related, identity-related, thrill related, revenge related, material-related, and affiliation-related incentives or stimuli for action group.
- Vulnerability analysis: This segment of the analysis focuses on the key vulnerabilities—internal or situational—of an individual which may have increased the salience of various push and pull factors heightening the probability that the individual would decide to commit to a pathway to extremist violence. He references Horgan

(2005) who described vulnerabilities as factors that might prompt increased engagement with others, including: a piqued sense of injustice, a loss that prompts a desperate need for interpersonal belonging, or a crisis that disrupts the individual's sense of self.

- Formulation analysis: At this stage, Borum (2015) recommended that the various formulations be assembled to explore plausible explanations for the individual's behavior. In developing this formulation, Borum (2015) emphasized the importance of "fit" and "relevance" and how well the formulation "grabs the attention," makes sense, and resonates with the individuals involved in the assessment.

Borum (2015) also referenced the work of Hart and Logan (2011) who suggested that scenario planning might prove a useful tool for linking formulations to possible outcomes. They (Hart & Logan, 2011) identified four basic types of scenario planning, including: a "flat trajectory scenario" which assumes the individual will repeat what he or she has done in the past, perhaps in a similar way and for similar reasons; the "better case scenario" in which the individual no longer engages in and perhaps avoids the adverse behaviors that have plagued them in the past; the "worst-case scenario" in which the individual has becomes more involved or engaged in more serious or direct action; and the "sideways trajectory scenario" in which the person continues past involvement but in a different way than before, not necessarily reflecting an escalation or worsening, but perhaps a change in the role, methods, or nature of the activity.

Protective Risk Factors

In the current study, we will be using the methodology recommended by Stouthamer-Loeber, Loeber, Wei, Farrington, and Wikström (2002), which suggested that risk and protective factors be identified and rated as opposite poles of the same variable, allowing a variable to exert a risk effect for one individual and a protective effect for another, depending on whether the individual scores closer to one or the other pole on the variable.

This approach is illustrated in [Saucier et al. \(2009\)](#) work which described “antithetical thinking to militant extremism.” Such an antithetical pattern of thought would include the following:

(a) moderation and working through the system, without resorting to extreme measures; (b) taking responsibility for the consequences of all of one’s actions; (c) an avoidance of military terminology outside of narrow military contexts; (d) no perception that one’s group is being obstructed in an important way; (e) a recognition that the past was far from ideal; (f) no desire for a utopia or paradise in the future; (g) refraining from framing events in terms of catastrophes and calamities; (h) no expectation of supernatural intervention or commands; (i) no driving need to annihilate evil or purify the world; (j) no perception of glory in dying for a cause; (k) the perception that killing and attacking is not a duty, but more a source of shame; (l) an adherence to moral and ethical rules even in the service of sacred things; (m) vilification of intolerance, vengeance, and war-likeness; (n) never dehumanizing or demonizing another person; (o) a perception that modernity has at least some good points; and (p) a perception that the civil political order is at least partially legitimate ([Saucier et al., 2009](#), p. 265).

As reflected in each of these, the risk factor is immediately paired with a perspective that negates its intensity, contextualizes it into a more moderate stance, or directly contradicts the premises upon which an absolute idea or premise is being expressed. This approach ensures that there is a close and consistent reflective mirroring of ideas in terms of those that can energize an individual to participate in violence and the antidotes to these which can minimize or eradicate this potential.

Emerging Research

The theoretical paradigm that has been described in this article has been translated into an empirical coding instrument which captures information pertinent to each of the constructs identified in our model. Each is coded as to its role as a risk, protective, or combined factor in the life of each woman. The sample itself is made up of 300 western living women involved in extremist violence over the past 50 years. The coding is being conducted based upon the total-

ity of information that has been collected concerning each woman from government, court, law enforcement, online, and social media sources. Permission was obtained from the University of Virginia to use the deep and dark web for a review of relevant information. Following the coding of each of the individual variables, a formulation is constructed by the coder using detailed guidelines to structure the content, order and synthesis of the most important information. More than 200 of the 300 cases have been coded, data entry has begun, and empirical findings are anticipated by the summer of 2019.

Conclusions

Our development of the MSA risk model for extremist violence has emerged as a research and operational platform for understanding the radicalization and mobilization to action of women involved in ideologically diverse extremist organizations. Our goal is to maintain a closeness of fit between the research conducted by academics and the operational needs of those in federal and international law enforcement to better promote the translation of knowledge from one to the other. There are many barriers to the fruitful collaboration between these two entities, including a lack of familiarity with methods and goals, exclusionary realities of classification criteria necessarily maintained by our federal government and international governmental entities, and differing ideas about what should determine the research priorities of various professional groups with radically different needs and expectations. Our current model represents a first step in defining a model that captures investigative processes used by federal law enforcement, is enhanced by a conceptual framework of constructs developed in academia, and with full-hearted recognition of the interaction of the individual with their environment as a stage upon which observable behavior unfolds.

In naming our paradigm, we struggled with nomenclature fearing that a name including the term “moral” might be misconstrued as a misguided affirmation of the “morality” often expressed by individuals who are of the greatest danger to others. However, we also came to believe that the understanding of extremist violence by its very nature needed to recognize and capture the individual’s perception or experi-

ence of morality and the powerful changes that are associated with the worldview that defines the activities of all extremist organizations world-wide. This approach requires the “stepping into” the experience of those who have become immersed in an extremist point of view and are poised to take action based upon it, as contrasted to a more distanced examination of this phenomenon “from the outside” as a purely political or religious abnormality with a purely evil intent and purpose. Our inclusion of moral emotions and sacred values as dominant elements of the individual’s preexistent propensity for radicalization reflects the power we attribute to these intense forms of human perception and experience.

We further decided to position our risk model on the criminological situational action theory of Wikström (2004) because of its central recognition of the interaction of the individual and his or her setting as a basis for all forms of human behavior. This melding of the individual with others reflects an obvious reality that thus far has been absent in our development of risk paradigms for violent behavior. This limitation has not been as recognizable when the focus of study has been specifically on individuals with various forms of mental illness or serious patterns of past criminal behavior. However, when applied to those who become involved in religious, political, or racial violence, the lack of any social mooring becomes palpable, making it clear that the conduit to action is embedded in the social milieu which is transformative in the mobilization to action.

We conclude that the inclusion of a clinical formulation is necessary to capture the multifaceted and interactive elements of the individual’s experience as it relates to extremist violence. While use of purely clinical judgment to assess violence risk prior to 1981 demonstrated negligible or nonexistence predictive success, the evolution of personality, structured professional judgment, or actuarial methods of violence risk assessment has also reached a plateau in its accuracy. Moreover, these methods continue to be lacking in their relevance to the interventions needed to manage an individual’s potential for violence. It is our impression that Hart and Logan’s (2011) scenario planning offers a useful integrative technique for using pattern recognition and anticipatory planning to more accurately capture the possible trajectories

of an individual’s behavior at some time in the future.

We chose to build upon Stouthamer-Loeber et al.’s (2002) definitions of risk and protective factors which identify each being the opposite ends of the same continuum or dimension of behavior. This approach points directly at the direction of desired change and ensures that each risk factor will be afforded its rightful position in a management plan. This provides a more textured management stance than the existent risk paradigms which either ignore the relevance of protective factors or tack these on to the end of an assessment process apparently assuming that the one could and will be used to influence the other. Moreover, this dual-direction definition intrinsically links assessment to management and does so across all relevant factors included in a paradigm.

We offer this model not as a chiseled final product but rather as a thought-provoking integration of risk and protective factors within a causal framework that identifies operative mechanisms that directly link the individual with their social setting as these interactions influence their progressive involvement in extremist violence. Obviously, our model will need to be validated through research with both genders and across different extremist groups. However, at its core it seeks to welcome theory into the heart of violence risk assessment and argues that the identification of causal mechanisms holds more potential for understanding this phenomenon than does the more traditional approach of counting, countering, and structurally analyzing a finite number of risk variables embedded solely in the individual.

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THE CREATION OF MUHAJIRAT IN AMERICA:

**SOCIAL MEDIA AS A PLATFORM FOR CRAFTING GENDER-SPECIFIC
INTERVENTIONS FOR THE RADICALIZATION OF WOMEN**

APPENDIX B:

**FROM VIDEOS TO URL'S: A MULTI-BROWSER GUIDE TO
EXTRACT USER'S BEHAVIOR WITH OPTICAL CHARACTER
RECOGNITION**

2020

From Videos to URLs: A Multi-Browser Guide To Extract User's Behavior with Optical Character Recognition

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Abstract. Tracking users' activities on the World Wide Web (WWW) allows researchers to analyze each user's internet behavior as time passes and for the amount of time spent on a particular domain. This analysis can be used in research design, as researchers may access to their participant's behaviors while browsing the web. Web search behavior has been a subject of interest because of its real-world applications in marketing, digital advertisement, and identifying potential threats online. In this paper, we present an image-processing based method to extract domains which are visited by a participant over multiple browsers during a lab session. This method could provide another way to collect users' activities during an online session given that the session recorder collected the data. The method can also be used to collect the textual content of web-pages that an individual visits for later analysis⁵.

Keywords: Web search, User behavior, Image processing, Optical character recognition

1 Introduction

Since the invention of World Wide Web (WWW) in the 1980s by Tim Berners-Lee, the internet has continued to impact our society, culture, and everyday life activities. Given the explosive increase in information on internet, it has become the first resource people turn to when seeking information. One side effect of using the web for information retrieval is that looking at users' behavior patterns on the internet opens up doors to understanding their interests. Researchers work to leverage this insight to improve multiple facets of user experiences over the web. Areas such as designing interfaces, marketing, and digital advertisement are directly benefited from such research.

Furthermore, it is also of interest to understand how people surf the internet and the pathways that lead them to specific places. One such places is the

⁵ Code is shared as an open source tool at <https://github.com/XXXX/XXXX>

dark web where illegal activities including promoting terrorism and other cyber crimes have been spreading [18]. In order to use the dark web, Tor, a special browser is needed which provides access to dark web content anonymously using multiple nodes which reroute the connection. In our study, the usual scenario of information retrieval via the internet and dark web consists of the user beginning their search by accessing a regular internet browser, and then switching to the dark web using Tor. This process may repeat multiple times until the user finds the information they are seeking. Understanding the time spent on each domain in this circumstance is not a trivial task. However, given that this is a research experiment, one could use videos of these online search sessions which recorded the whole screen during the interaction. To accomplish this, we utilized a general framework that took a stream of screen images and outputs the domain or URL visited in that frame regardless of the type of browser (internet or Tor). These URLs were collected for each user and are able to be analyzed separately.

The purpose of this paper is to demonstrate an image-based approach that can be used in other scenarios where multiple browsers are working in parallel, given that the computer screen has been recorded. Such conditions might be suitable for research conducted in controlled environments, such as online searching sessions in a lab. Moreover, since the screen has been recorded, other analysis can be done using the same approach. As an example, one can analyze the textual content of web pages by using optical character recognition and the technique provided in this paper. The method that is described in this paper is fully open-source and available to use for similar tasks.

This paper is structured as follows. In Section 2 we discuss related work for tracking users' activities on the web as well as image processing techniques specifically, optical character recognition (ORC). Section 3 describes our implementation in details. Subsequently, in Section 4, we present the result of this approach. Finally, in Section 5 we discuss possible improvement to this approach and provide our concluding remarks.

2 Related Work

As mentioned before, users' interactions with materials on the internet reveal details related to the individuals' interests. Since the early days of internet, researchers have been using this insight to try to understand online user behaviour. [7]. Discovering user patterns by mining web usage behaviors has been addressed by Srivastava, et al [19]. Specifically, web search patterns have been investigated extensively by researchers [10] [15] [9]. The result of this scholarship has provided ways for improving search engine rankings, advertisement placements, and search engine performance [1] [4]. At an upper level, this research relies on log-files of user interactions which are gathered from the client or server side. Usual approaches include the use of add-ons such as Firefox Slogger or déjàclick (which rely on the browser history log files) or standalone software such as Track4Win which tracks internet usage and computer activities. Although these tools might provide insights of user activities, they cannot be used

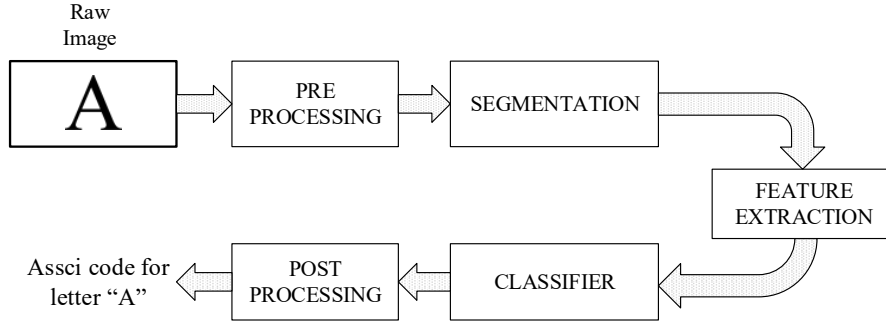


Fig. 1: Structure of OCR system

in every situation we might encounter during experiments with users. As an example, most add-ons are specific for a browser and a different browser, like Tor, would not allow add-on installation. Similarly as its name suggests, Track4Win is mostly suitable for machines with Windows as their operating system. Alternatively however, one can design the experiment such that they record the interaction of users with Internet using a video recorder such as OBS studio for windows machines or built-in quick-time screen recorders. In such scenarios, these videos combined with image processing tools and Optical Character Recognition (OCR) techniques can work to extract user interactions with internet, regardless of the browser and operating systems.

A major cornerstone of the previously mentioned approach is Optical Character Recognition. OCR is used in many practical applications such as scanners in ATMs and office scanning machines which use OCR to understand characters [13]. OCR will be referred to either as off-line (where the writing or printing is completed) or as on-line (where character recognition will be performed simultaneously with writing). Different tasks such as hand-writing recognition or hand-written script verification may be performed with OCR techniques. However in this work, we focused on character recognition in a printed text as it is in url field of a browser.

Figure 1 shows the structure of an OCR system. Pre-processing usually includes steps such as binarization, noise removal, and skew detection [8]. Next, segmentation will be performed to deconstruct an image into lines or characters. Feature extraction is another important step in OCR structure and different approaches have been suggested to perform this task [11]. Finally the most important step is classification of the character with high accuracy. Traditionally, this has been done by template matching or correlation-based techniques [8]. Other researchers have presented techniques such as fast tree-based clustering, HMM based on combination of frequency and time domain, and K- Nearest

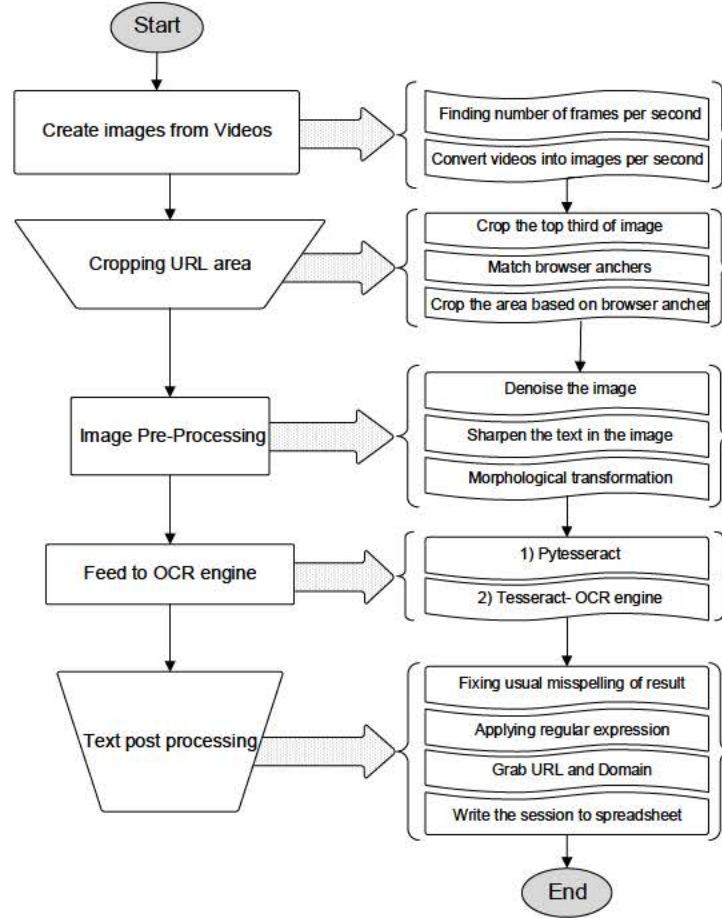


Fig. 2: General preview of the our implementation steps

Neighbours for classification task [3]. Moreover, other machine learning classifiers for this step have also gained a lot of attention. In recent years, Support Vector Machines (SVM) have been used as powerful classifiers at the last part of an OCR system [20]. Also, Artificial Neural Network (ANN) has been used due to its high tolerance for noise provided correct features [2]. As one can see, we used tesseract OCR which uses a two-step process for classification with an adaptive classifier to perform the recognition.

We will describe the structure of this open-source OCR along with other necessary steps such as image pre-processing and target selection with template matching in the next section.

3 Method

In this section, we discuss the implementation of URL retrieval using OCR, which has been used for this work. First, we describe the general idea and its steps. Later each step will be explained in more detail. The approach we used in this work relies on screen recording of a user’s interaction with multiple browsers. Therefore, the input to the pipeline is a video recording or consecutive screen shots of a computer screen. Free tools such as OBS studio (Windows) and Build-in quick player (Mac) are able to record computer screens as users are interacting with their machines. Also, software such as PC screen capture captures screen shots per second of the online searching sessions of an experimental study. Figure 2 shows the general picture of our implementation structure and steps. The rest of this section describes each of steps shown in Figure 2.

3.1 Extracting Images

In order to retrieve the URLs, first we needed to convert videos into images taken per second. One could easily calculate the correct number of images to generate by considering the frame per second (fps) rate at which the video is recorded. In this work, python Open CV library (CV2) was used to convert the videos to images. The last step was to crop these images so that the template matching method would have a lower chance of picking an area by mistake. We made the assumption that at any given time the URL text field area would be in the top one third of each screen shot. Therefore, we could crop the top 1/3 of images and discard the rest safely.

3.2 Template matching

After retrieving the images per second, we needed to narrow down and specify the URL area for future steps. Our thinking was that doing so would both make it easier for the OCR engine to convert characters into text in less time and produce less noisy data from which to grab URLs and domains later on. Consequently, we needed to define specific anchors around the URL text field which could be detected with template matching algorithms [5]. These templates were carefully selected based on the type of browser used for interaction. Python Open CV includes 6 types of template matching algorithms. In this work, we used the TM_CCOEFF_NORMED method to perform the template matching using a threshold of 80% for maximum value of the match. This threshold might need to be altered for other applications depending on the quality of images and fine tuning may be needed to get the best results. Considering the source image as I and Template image as T and Result matrix as R , normalized correlation coefficient matching can be computed by equation 1.

$$R(x, y) = \frac{\sum_{x', y'} (T'(x', y') \cdot I'(x + x', y + y'))}{Z(x, y)} \quad (1)$$

Where

$$T'(x', y') = T(x', y') - \frac{1}{(w \cdot h) \cdot \sum_{x'', y''} T(x'', y'')} \quad (2)$$

$$I'(x + x', y + y') = I(x + x', y + y') - \frac{1}{(w \cdot h) \cdot \sum_{x'', y''} I(x + x'', y + y'')} \quad (3)$$

$$Z(x, y) = \sqrt{\sum_{x', y'} T'(x', y')^2 \cdot \sum_{x', y'} I'(x + x', y + y')^2} \quad (4)$$

w and h are the width and height of the template image and Z addresses the normalization part of this algorithm. Finding a match will provide the height of the anchor which corresponds to the upper corner of browser text field. Using the height of the best match and width of template, we can crop an image such that mostly only the address bar remains. The resulting cropped image undergoes several image processing techniques which will be described in the following section.

3.3 Image pre-processing

Depending on the quality of video or screen shots taken during a session, the browser text field may require pre-processing. The process used in this implementation is as follows:

1. Convert RGB images to gray scale images. Different algorithms exist to convert an RGB image into its corresponding gray scale one. The average method simply averages over all three channels values while the lightness method averages only maximum and minimum vales of all channels. Open CV library uses the luminosity averaging technique where specific weights would be applied to each channel as given by equation 5

$$\text{Gray scale value : } Y = 0.299 \cdot R + 0.587 \cdot G + 0.114 \cdot B \quad (5)$$

2. Re-scaling image to a bigger size. Although we cannot change the quality of pictures, this step increases the number of pixels and thus makes it possible to improve the result by using other image processing filters. Our experiments showed that re-sizing the image three times of the original yielded the best results.
3. De-noise the resulting images. De-noising images is a significant task in image processing and different algorithms has been proposed to effectively perform the task. One can separate these algorithms into three main categories: special domain methods, transform domain methods, and learning based methods [16]. We used the Non-local Means Denoising algorithm which comes in the same library to have a consistent implementation purely in python. The

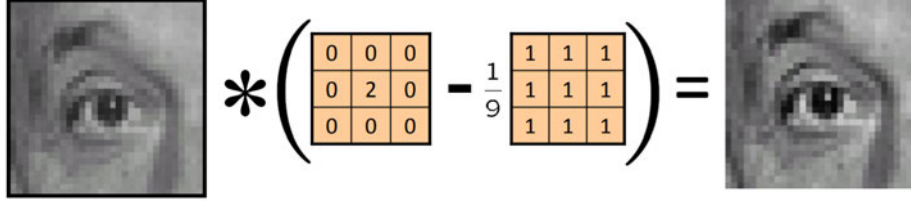


Fig. 3: Example of applying kernel filter to achieve sharpened image [12]

algorithm works by considering a noisy image $v = \{v_i | i \in \Omega\}$, the result intensity of a pixel u_i can be computed by weighted average of neighboring pixels within certain neighborhood I of that pixel.

$$u_i = \sum_{j \in I} \omega(i, j) v_j \quad (6)$$

where these weights can be computed by equation 7.

$$\omega(i, j) = \frac{1}{\sum_j \omega(i, j)} \exp \left(-\frac{\|v_{N_i} - v_{N_j}\|_{2,a}^2}{h^2} \right) \quad (7)$$

such that N_i refers to the patch size centered at i and a represents the standard deviation of a gaussian kernel [6]. Generally, the method averages over all similar pixels and the similarity is measured by comparing patches of the same size around pixels in the search window. To perform denoising in this work, patch size and search windows of 7 and 21 has been selected respectively. These parameters along with filter strength of 10 produced the best result for our experiments.

4. Sharpen the final images. To perform sharpening, kernel 2D filter was used. This kernel goes over the original image pixels applying it on windows around that pixel. Figure 3 shows an example of this process. To perform the sharpening in this work, we applied a 5X5 Gaussian kernel similar to the above picture. Performing the last two steps improves the shape and contrast of the characters with its white surrounding and thus improving the accuracy of OCR engine output.

3.4 Optical Character Recognition

The main technology used to find URLs and domains visited by a user is Optical Character Recognition (OCR). Different OCR engines are available but in order to have a consistent open-source solution, we chose to work with Tesseract-OCR as the main engine for character recognition. Tesseract is an open-source OCR engine written in C and C++ in Google [17]. Despite being open-source, Tesseract

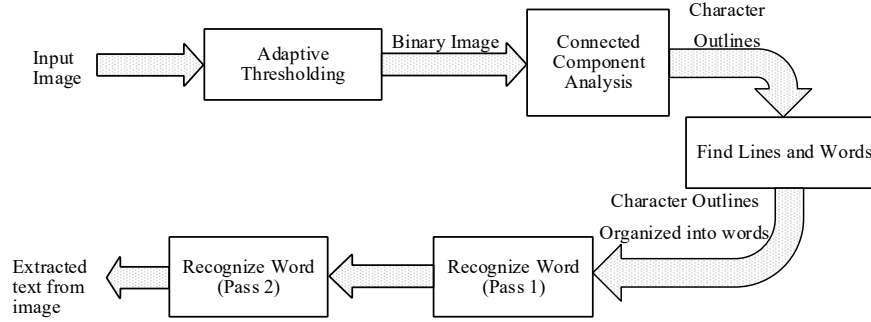


Fig. 4: Architecture of Tesseract OCR

performs well even in comparison with commercial OCR engines such as Transym OCR [14]. Moreover, there exists a python wrapper library "pytesseract" which provides direct access to this engine in python. As a result, the implementation will be completely in python. Tesseract OCR architecture will be briefly explained here.

Figure 4 shows Tesseract architecture and steps that were performed. As a first step, the image was converted to a binary image by applying an adaptive threshold. Next, using connect component analysis, character outlines were extracted. The outlines then were converted into Blobs which themselves were converted into text lines. Text lines were analyzed for fixed patches and broken down into words using character spacing. Words were further broken into character cells immediately and proportional text was broken using definite space and fuzzy space. Tesseract uses a 2-stage word recognition at the end to improve its result. The satisfactory result of the first pass was given to a classifier as training data to increase the result accuracy.

3.5 Text Post Processing

OCR engines try to convert any visual clue in the given image into a character. This leads to unwanted characters appearing in the results. For example, websites that use Hypertext Transfer Protocol Secure (HTTPS) usually include a lock sign in the browser next to their URL text field. Other cases include when the browser is not in full-screen mode and thus, the computer desktop's texts or other browsers' texts might be fed into OCR. OCR tries to convert these shapes into characters that will affect the result. Thus, we needed to use post processing on the result of OCR engine. Regular expressions (Regex) is a powerful tool that took care of these cases. Python regular expression library (re module) provided us access to this tool. Regex can also be used to fix typos and unify the results (e.g., dropping www from the URL if it exists, etc).

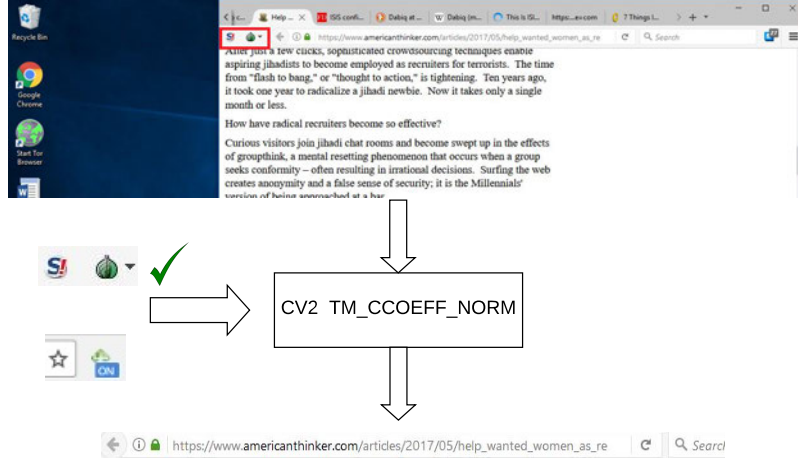


Fig. 5: Template matching with anchors specified to Tor and Chrome

4 Experimental results

We used the above mentioned approach on the results of a lab experiment where participants were instructed to look at sensitive topics in order to investigate the pathways they used to find their topic of interest, given their religious and political backgrounds. Due to the nature of experiment, participants were given the chance to use a regular web browser or Tor browser to perform their search (all sessions were conducted in a secure research lab). A video (or consecutive screen shots) were recorded from each computer screen during the online search sessions. These videos were stored for later analysis after the session.

Following the steps explained in section 3, we created a set of images and cropped the top 1/3 of the image. In the experiments we ran, the user could either use Google Chrome or Tor for browsing the web, we defined the anchors for these two browsers as shown in Figure 5. We used the onion shape in the Tor browser and one extension added to Chrome browser. Depending on the match, the URL text field will be cropped from the image. The text field was gray-scaled, re-sized, de-noised, and finally sharpened. The final result was fed into Tesseract OCR to extract the text. Figure 6 shows an example of detecting a domain. Finally, text post-processing was performed on the output as needed. Collecting the aggregated results of images, we were able to understand which domains participants spent most of their time on, as can be seen in figure 7.

Using this process, we can investigate the paths each participant took during their interaction with the internet regardless of the type of browser they chose to

use. Figure 8 shows a visualization of the same user path along with the duration of the experiment that had passed. This visualization helps to understand where a particular participant starts and ends, given their interests and backgrounds. Although, OCR results are impressive, they are not always accurate. However, in the application of this experiment, we found that frames with a non-perfect domain name could usually be converted to the correct domain name. This is due to the fact that noises on the frame pictures during the experiment would not always remain the same. Therefore, for the most part the correct domain name would be produced and similar domain names read not perfectly could be converted to the correct one.

5 Conclusion and Future works

This paper presents a different approach for tracking user behaviours as they interact with the World Wide Web (WWW). We used image processing methods along with an OCR engine (tesseract-OCR) to extract URLs and domains visited by a participant in a session. This was particularly difficult due to the nature of these experiments where each participant was allowed to use multiple browsers (Chrome or Tor) as the web browsing tool and could switch between them at will. The computer screen and audio recording during the interaction session was kept for separate analysis later on. To extract visited domains, we converted videos into consecutive images (if needed) and cropped only the URL area of each browser using template matching. The resulting area went into image pre-processing and then fed into the OCR engine and finally using regular expressions, we extracted the URL and domain within each image.

With very few exceptions, by using this method we were able to collect correct URLs and track the path a participant took during the experiment. This was mainly due to the quality of videos and images causing some noise into pictures that was extremely difficult to remove. However, since most of these pictures were taken consecutively, one could find the correct domain by checking other very similar results extracted from other frames. As for future research, one could try to automate such cases as well. This could be done by sending requests to these domains and replace the similar non-perfect results with domains that correctly return the requests. Moreover, this approach could be used to extract the content

Original Image	
Denoised Image	
Sharpened Image	
Output	

Fig. 6: Image processing steps illustration used to improve results

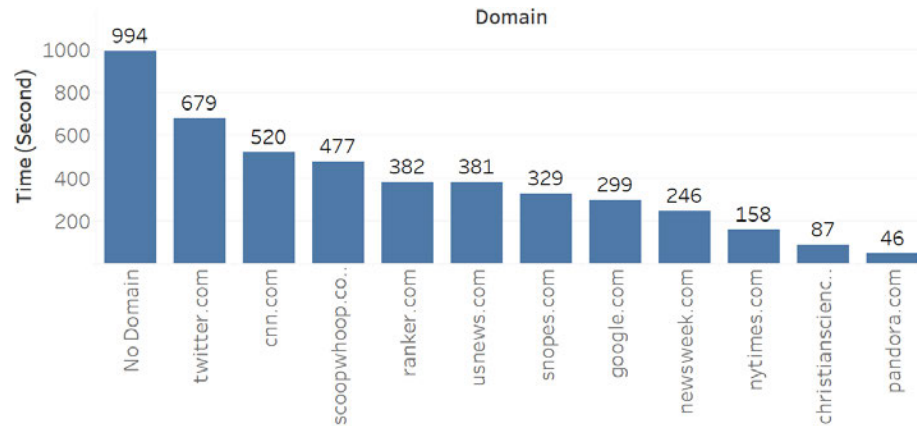


Fig. 7: Distribution of domains and the time (in second) which a participant has spent on each domain

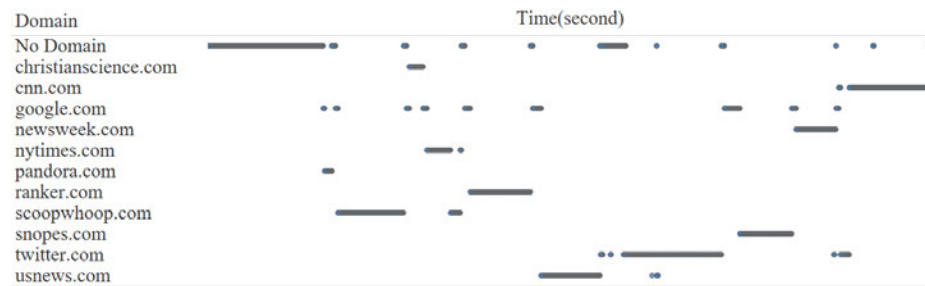


Fig. 8: The path that the participant took in the same experiment. Horizontal axes represent the time passed of the session

of a web page as well as the advertisements around the page depending on their importance in experiments. Lastly, this methodology could aid in the effort for machines to learn how to identify users' patterns of behaviour online and respond to potential online threats.

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