

A Socio-Cognitive Model to Countering Indoctrination Efforts

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Abstract. Indoctrination by extremist groups, characterized by psychological manipulation to impose ideologies that fuels radicalization and terrorism, poses significant global security threats to the domestic and international order. Traditional counterterrorism strategies often focus on surveillance and kinetic response, which fail to address the root cause of the indoctrination. In this study, we use an agent-based simulation to test four strategies to show that a combined socio-cognitive intervention significantly reduces indoctrination compared to standalone strategies. These findings highlight the potential of integrating socio-cognitive interventions to counterterrorism strategies. This model offers a scalable framework for counterterrorism policies that could predict and mitigate radicalization trends across diverse contexts, including online and offline extremist networks.

Keywords: Indoctrination, Psychology, Counterterrorism, Agent-Based Model, Behavior.

1 Introduction

Indoctrination, defined by the United Nations Office on Drugs and Crime (UNODC) as “the process used by violent extremist groups to impose their ideology on individuals and isolate them from competing ideas”. Indoctrination poses both domestic and international threats, leading to the rise of both home-grown violent extremist (HVEs) and foreign terrorist fighters (FTFs) [1]. These individuals radicalize locally, then either commit violence at home or join extremist groups abroad; this often manifests as lone actors in the U.S. and Europe, or as transnational networks in Syria or Iraq. Traditional methods of counterterrorism are reactive and costly, focusing on intervention after radicalization. These methods fail to address root causes.

This study uses an agent-based simulation to model indoctrination and evaluate proactive prevention, offering new counterterrorism insights. Indoctrination is a systemic issue, undermining cohesion, escalating threats, and complicating interventions across intelligence and law enforcement. Its pervasive nature requires a broader theoretical policy response, affecting global safety [1,2]. Conventional counterterrorism, focusing on kinetic response and surveillance, often overlooks cognitive, emotional and social radicalization pathways [3]. Community programs and counter narratives often lack

coordination, funding, or cultural alignment. Law enforcement agencies often lack training or tools to understand indoctrination and radicalization, becoming aware of tactics only during investigations, limiting early detection and intervention.

The paper is organized into the following sections: the relevant works, the methods of the simulation, the results and discussion, limitations of the model, and a conclusion along with possible directions to expand the research. In an effort to provide context and clarity in the discussion, we offer the definitions in Table 1 to help guide the reader.

Table 1. Key Terms for the Socio-Cognitive Model

Term	Definition
Agents	Simulated individuals: 190 locals and 10 organizers with socio-cognitive traits.
Belief Level	Measure (0–1) of extremist ideology adoption; >0.5 indicates indoctrination.
Clusters	Subgroups of ~8–9 locals in the social network, vulnerable to influence.
Cognitive Resilience	Ability to resist manipulation via critical thinking and skepticism.
Cohesion Disruption	Intervention weakening extremist group bonds to reduce indoctrination.
Combined Approach	Strategy integrating cohesion disruption and cognitive resilience enhancement.
Community Trust	Trust in community; higher trust reduces indoctrination susceptibility.
Crisis Factor	Random event (5% chance) amplifying indoctrination effects.
Indoctrination	Organizers manipulating locals to adopt extremist ideologies.
Psychological Manipulation	Organizers’ influence exploiting locals’ vulnerabilities to increase belief levels.
Social Cohesion	Strength of extremist group bonds, amplifying indoctrination.

2 Relevant Works

Methods of indoctrination can best be explained by the coercive indoctrination pyramid and the FBI’s radicalization model. The coercive indoctrination pyramid illustrates steps such as love-bombing, guilt manipulation, and eventual identity control. This concept closely parallels the FBI’s radicalization model developed by the National Institute of Justice (NIJ). However, the two frameworks differ in emphasis and scope. Both models describe a gradual process through which individuals are psychologically conditioned, starting with welcoming engagement and culminating in the erosion of personal autonomy.

The NIJ/FBI model consists of four main stages:

1. Pre-radicalization- An individual experiences grievances, identity confusion, or exposure to extremist narratives.
2. Self-identification- The individual explores ideology and finds persona. Meaning in a particular cause.
3. Indoctrination- beliefs are solidified and bonds within the group are formed.
4. Action or jihadization- The individual moves towards operational behavior or violence [4,5].

This model is utilized by federal agencies, including the FBI and DHS, to understand how individuals transition from ideological curiosity to violent extremism.

In contrast, the coercive indoctrination pyramid provides a more detailed account of the emotional and interpersonal methods used by cults, trafficking networks, or high control groups. It includes tactics such as withholding affection, implementing reward and punishment cycles, and gradually replacing the individual's core identity with that of the group [6,7].

3 Method

To investigate socio-cognitive interventions for preventing indoctrination, we developed an agent-based model simulating 200 agents (190 locals, 10 extremist organizers) over 30 timesteps, representing months. An agent-based model is a computational modeling approach that simulates the actions and interactions of autonomous agents within a defined environment [8]. The model captures dynamic belief propagation influenced by psychological manipulation, social cohesion, and cognitive resilience, with crises amplifying radicalization (5% probability per timestep). Four strategies were tested: no intervention, cohesion disruption, cognitive resilience development, and a combined approach. Interventions were applied every two timesteps after timestep 5, targeting extremist group cohesion and individual critical thinking. Figure 1 models how the simulation works.

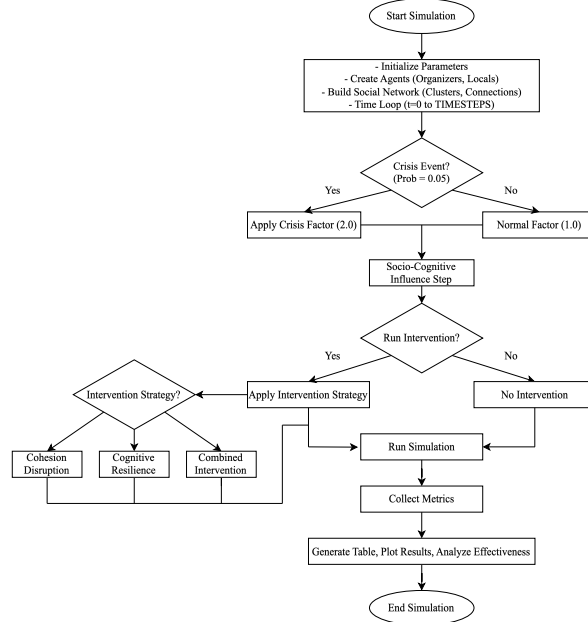


Fig. 1. System diagram of simulation algorithm.

Each agent was assigned a set of attributes: belief level, cognitive resilience, community trust, social cohesion, influence power, manipulation skill, and counter-narrative exposure. Table 2 shows the distribution of these stats. For future use, each attribute can be changed to adapt to the circumstance the model is attempting to reflect.

Table 2. Key attributes of agents and external influences.

Attribute	Locals (190)	Organizers (10)	External Influence
Belief Level	0.0	1.0	Not Applicable ^c
Cognitive Resilience	[0.05, 0.95] ^a	[0.05, 0.95] ^a	Not Applicable ^c
Community Trust	[0.05, 0.95] ^a	[0.05, 0.95] ^a	Not Applicable ^c
Social Cohesion	[0.05, 0.95] ^a	[0.05, 0.95] ^a	Not Applicable ^c
Influence Power	0.1	0.5	Not Applicable ^c
Manipulation Skill	0.2	0.8	Not Applicable ^c
Counter-Narrative Exposure	0.0 ^b	0.0 ^b	Increased by Interventions
Crisis Effect	Not Applicable	Not Applicable	Amplifies Influence ^c

^a Initialized with lognormal distributions, clipped to [0.05, 0.95].

^b Increases to 1.0 with interventions (e.g., cohesion disruption).

^c Not Needed for the external influence

^d Represents external events amplifying radicalization.

Table 3 outlines the weights assigned to different socio-cognitive factors that determine how vulnerable individuals are to the influence of extremist organizers in the simulation. Each component reflects psychological and social characteristics that make someone more likely to be radicalized.

Table 3. Vulnerability score components.

Component	Weight
Low Psychological State	0.4
Social Identity Need	0.3
Low Community Trust	0.2
Confirmation Bias	0.1

4 Results and Discussion

Table 4 illustrates the simulation outcomes, showing the number of indoctrinated individuals, average cognitive resilience, community trust, and extremist group cohesion over time. Figure 2 summarizes the final outcomes on a graph. All strategies showed an initial rise in indoctrination, but the combined approach was most effective, reducing indoctrinated individuals by 32.8% compared to the baseline. Cohesion disruption alone increased radicalization risk by reducing skepticism, while cognitive resilience development improved community trust but had limited impact on cohesion. The combined approach synergistically mitigated indoctrination by balancing reduced group cohesion with enhanced critical thinking, maintaining higher community trust (0.71 vs. 0.54 baseline).

Table 4. Initial and final socio-cognitive attributes across 10 simulations for (I) nial and (F) inal rounded up.

Strategy	Cognitive Resilience			Community Trust			Social Cohesion		
	I	F	%	I	F	%	I	F	%
No Intervention	0.54	0.54	0.0	0.62	0.55	0.54	0.53	0.56	4.55
Cohesion Disruption	0.54	0.54	0.0	0.63	0.62	0.54	0.53	0.47	-10.64
Cognitive Resilience	0.54	0.70	30.72	0.61	0.68	0.70	0.52	0.62	19.64
Combined Approaches	0.54	0.71	30.27	0.62	0.76	0.71	0.53	0.42	-22.2

Values are on a 0-to-1 scale, average across 190 locals. Percentage changes are calculated as ((Final- Initial) / Initial) x 100.

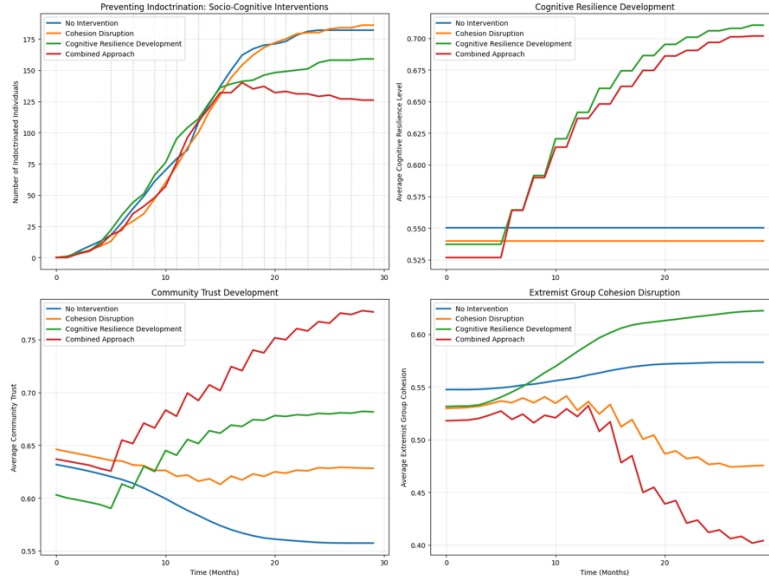


Fig. 2. Sample simulation results.

Across 10 simulations, cohesion disruption and cognitive resilience saw minimal reductions from the baseline compared to the combined approach. Table 5 shows the final numbers of Figure 2.

Table 5. Final Indoctrinated Average Totals by Strategy across 10 simulations (rounded up).

Strategy	Indoctrinated			
	Initial	Final	Reduction From Baseline	Effectiveness % from Baseline
No Intervention	0	177	0.0	0.000
Cohesion Disruption	0	176	0.8	0.002
Cognitive Resilience	0	173	4.4	0.021
Combined Approaches	0	119	58.3	0.328

Four intervention strategies were used in the simulation—no intervention, cohesion disruption, cognitive resilience development, and a combined approach. The combined approach demonstrated superior performance, achieving a 32.8% reduction in indoctrinated individuals compared to the baseline. On the other hand, cohesion disruption alone increased radicalization risk by reducing skepticism and amplifying social identity needs. Cognitive resilience development on its own allowed the extremist group’s cohesion to increase drastically compared to the baseline. The simulation accurately captured the systemic nature of indoctrination, showing that influence cannot be eliminated but can be reduced through a combined intervention approach.

5 Limitations

The simulation model, while effective in demonstrating the impact of socio-cognitive interventions on indoctrination, is limited by its reliance on simplified social network structures and limited historical data. Additionally, the simulation model is limited due to the lack of religion as a primary motivator for indoctrination. Groups, such as Al-Shabaab in Somalia, exploit clan loyalties and religious institutions—reportedly running madrassas attended by over 60% of rural youth in some areas to embed their ideology. Similarly, Iranian backed groups in Iraq invoke cultural martyrdom and tribal allegiances, with 70% of recruits citing religious narratives as the primary motivator. Yet, counter-radicalization models often lack integration of such sociocultural variables: only 22% of current models include context-specific cultural factors, risking skewed analysis and ineffective interventions [9].

QAnon and Atomwaffen are not organizations but ideological movements. They frequently indoctrinate individuals using similar tactics, though neither cites religion as their primary motivation. QAnon uses gamified belief systems and conspiracy narratives to immerse followers. It exploits emotional vulnerability, fear of elites, and online echo chambers to radicalized individuals [10]. Atomwaffen Division is a neo-Nazi acceleration group that radicalized members via online platforms and glorified mass violence. It used decentralized propaganda, extremist literature, and private online forums to build commitment and suppress dissent [11].

The special groups operating in the Middle East and Africa as well as US based domestic terror groups pose a threat, however the limited data available further limits the simulation model capabilities. Due to this, the model cannot yet fully capture real-world complexities, such as unique group characteristics. Future research should focus on refining parameters through empirical validation and modeling cross-platform radicalization dynamics. Together, it would help the model enhance its predictive accuracy and scalability.

6 Conclusion

Overall, the simulation shows promise for predicting the impact of intervention approaches to strategies against indoctrination. Further research may enhance the precision of the simulation, however, as presented, it accurately captured the relative effectiveness of combined socio-cognitive interventions in reducing indoctrination levels. The model successfully predicted that a combined approach, integrating cohesion disruption and cognitive resilience development, outperforms standalone strategies, achieving a 32.8% reduction in indoctrinated individuals compared to the baseline. This provides researchers the ability to synergize interventions without being overwhelmed by the complexity of socio-cognitive dynamics.

Future research and in-depth analysis should be focused on each parameter of the simulation. Each parameter's contribution to indoctrination dynamics provides opportunities to make strategic adjustments to increase the accuracy of future tests. Overall,

this study has demonstrated that modeling and simulating socio-cognitive interventions for countering indoctrination is feasible.

As the model is refined and calibrated, its use may be extended to predict broader radicalization trends beyond indoctrination. Other potential applications include simulating sequential intervention strategies and their long-term effects across diverse populations. Further advancing this model would enable the recreation of radicalization processes, assess community vulnerabilities, and give a new tool to agencies looking to stop radical indoctrination.

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