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Conceptual Model for Intentional Change in Violent Extremist Jihadist Organisations[2]

This paper explores a new approach to violent extremism through complex adaptive systems and system of systems analysis. Within both disciplines, the paper will show the simplified model developed about how violent extremist jihadist organisations learn, adapt, innovate or change in an intentional way. Because of its weakness, terrorists always look for the relative advantage and they reach it, among others, via learning, adaptation, innovation, ultimately, through intentional change. Understanding their dynamics intentional change will facilitate disrupting terrorist organisations.

Keywords: *terrorism, extremism, conflict, security, defence*

Introduction

Object of study

In the wake of the quantifiable disaster of the Afghan campaign,[3] this paper focuses on the need to address violent extremism, terrorism and insurgency in a new way. Although violent extremism, terrorism or insurgency are three different phenomena, they have a common denominator that they belong to the same category of problem.

To achieve its end, the paper delves into the need to address these problems through complex adaptive systems and system of systems analysis, ending with a conceptual model of how violent extremist jihadist organisations introduce intentional changes in the organisation in order to learn, innovate or adapt.

In accordance to system theory, terrorism can be divided into several subsystems. By identifying critical vulnerabilities in one, or several of the subsystems, the whole organisation can be nullified or rendered ineffective.

Historically, terrorism has been faced trying to attack the different subsystems, for example, by killing or imprisoning their leaders, persecuting their finances, prohibiting or countering propaganda, preventing arms trafficking, etc.[4] However, little has been

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[2] The present publication was presented in an oral form on the *II Military Science and Military Art International Conference* at the Ludovika University of Public Service, Budapest, Hungary, on 14 October 2022.

[3] The cost of the Afghan campaign has shown us that current approach to terrorism, insurgency and violent extremism is not effective. See e.g. Helman, Christopher – Tucker, Hank: The War in Afghanistan Cost America $300 Million Per Day for 20 Years, with Big Bills yet to Come. [online], Forbes, 16.08.2021. Source: forbes.com [25.04.2023].

[4] See e.g. Torres-Soriano, Manuel Ricardo (2020): Democracia vs. desinformación: Propuestas para la protección de las sociedades abiertas. *Colección Actualidad, Centro de Estudios Andaluces,* (87), 1–18.

exploited in the field of how terrorists learn, adapt and introduce changes in their organisation.

The reasons why the subsystem of intentional change has been chosen to be targeted is quadruple. First, because the previous approaches have failed. Second, this subsystem is crucial to a terrorist organisation, a violent organisation or an insurgency to survive or to be effective causing terror.[5] Third, introducing changes in their procedures terrorists make the counterterrorism effort inefficient. Forth, because the intentional change is a common factor in many other subsystems of the terrorist organisation, so targeting it, synergy can be achieved.

Therefore, if we were able to understand the dynamics of learning, adaptation and intentional change of the violent extremist organisations, it would be easier to disrupt these organisations. A better understanding would favour our access to their centre of gravity (render ineffective our countermeasures). With a holistic comprehension, the protection of our centre of gravity (our strength, e.g. combat power, precision, etc.), would be favoured too, resulting in more efficient actions.

Importance of the subject

Insurgency and terrorism studies are a field of knowledge of political, legal, economic, security, military and academic significance. This part of the Social Sciences focuses on how to prevent an actor from achieving political or other goals through the use of force or terror instead of using the channels established by democracy or other forms of government.

States governed by the rule of law legislate, allocate resources, pursue, counter, prevent and try to create resilient mechanisms to avoid the effects of terrorism and insurgency. Likewise, from the academic point of view, there is an ecosystem where scholars of the subject try to advance in the generation of knowledge to clarify and determine all the measures and actions mentioned above. This community is made up of personnel from military, security forces and bodies and a part of the academia that we could call "unofficial strategic community"[6] or "strategic studies community".[7]

In terms of political, legal and military relevance, terrorism has been a major issue. For example, after the attacks on U.S. soil on 11 September 2001, President George Washington Bush dragged more than forty countries into what he defined on 16 September 2001 as the "war against terrorism".[8] Other aspects that show the importance of this phenomenon are: the considerable effort made in terms of budget and human lives in the Afghanistan campaign, or the fact that the United Nations and the European Union, among others,

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[5] Extremist organisations are always learning from their adversaries and adapting their tactics, technics and procedures to avoid being captured, killed or dismantled, also to maintain the efficiency of their actions to continue causing terror.

[6] Gray, Colin S. (1982): *Strategic Studies and Public Policy. The American Experience.* Lexington: University Press of Kentucky. 2.

[7] Freedman, Lawrence (2002): Conclusion: The Future of Strategic Studies. In Baylis, John – Wirtz, James J. – Gray, Colin S. (eds.): *Strategy in the Contemporary World. An Introduction to Strategic Studies.* Oxford: Oxford University Press. 357.

[8] Later the name was changed to "war on terror" and then to "global war on terror".

have developed strategies against terrorism and violent radicalisation.[9] The creation of an illegal detention centre like the one in Guantanamo, or the comprehensive reorganisation of the security agencies in the United States of America and many other countries after the terrorist attacks of 2001 are two more examples of the relevance of the subject.

From an academic point of view, the subject is also very relevant. The governments of many countries have been releasing appropriations to promote research in this field, joint work agreements have been established with numerous universities, too. The agreement reached between the U.S. Department of Homeland Security and the University of Maryland to maintain the Global Terrorism Database; or the common practice of intelligence services to incorporate civilian personnel from academia in their intelligence centres exemplify the aforementioned.

The outlook of the impact of terrorism in economy cannot be ignored or underestimated.[10] Terrorism destroys infrastructure and industrial fabric, by creating insecurity it causes market prices to oscillate and be uncertain, discourages capital investment, harms tourism and trade among other factors. 2014 was, according to the 2019 Global Terrorism Index, the year with the highest economic impact of terrorism on the world economy in the last 20 years, reaching a record US$ 111 billion.

Methodology and analytical strategy

This research is part of a much larger project which is the validation via quantitative testing of a complex computable model based on complex adaptive systems theory to provide predictions and metrics for counterterrorism and counterinsurgency policies and strategies.

Being the initial part of the abovementioned project, the methods employed have mostly been qualitative. As a result of the research question, why are we not as good as we should be in countering violent extremism, terrorism or insurgency? First, a study of the specialised literature has been done. Second, interviews with NATO constituent nations' experts on the subject has been held. Third, after having found that a new approach is needed, a process of analysis, synthesis, comparison, induction, deduction and new interviews with experts has been done to obtain the conceptual model that could explain the intentional change in the violent extremist organisations.

At the beginning of the research, a systematic bibliographic search was carried out according to the criteria of quality, reproducibility, completeness and depth. For this purpose, multidisciplinary and disciplinary scientific databases were used, as well as other databases and search engines.[11]

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[9] See e.g. the United Nations Global Counter-Terrorism Strategy, the National Counter-Terrorism Strategy of the Government of Spain or the EU Counter Terrorism Strategy.

[10] Much of the impact of terrorism can be gleaned from the Global Terrorism Index issued in March 2022 by the Institute for Economics and Peace.

[11] As for the main ones: ProQuest, Scopus, Criminal Justice Database, National Criminal Justice Reference Service among others. As secondary ones, e.g. Eureka database from Pablo de Olavide University and Google Academics.

The experts interviewed belong to four main areas: the Spanish academia, the Spanish intelligence community, European academia and other experts of NATO intelligence community. For reasons of operational security, the name of the experts will remain stored with the proper information security measures; need to know and security clearance will be two prerequisites for access to that list.

The conceptual model presented in this paper has been the starting point for the quantitative–qualitative research. First, developing the complex adaptive model and then testing this model with the data available from the Global Terrorism Database of the Maryland University and with other databases the ownership of which belongs to the NATO nations.

Of the need to approach the problem of terrorism in a new way

The method of planning, decision-making and problem-solving adopted by NATO is fundamentally based on causality and is designed to deal with simple or complicated- linear problems,[12] that are the ones which require observation, categorisation and response and observation, analysis and response cycles respectively.

NATO's approach to planning, decision-making and problem-solving works very well when faced with simple and complicated problems such as conventional combat. However, terrorism, insurgency or violent extremism fall into the category of so-called interactively complex nonlinear problems.

The boundaries between simple and complicated, and complicated and complex system titles are sometimes blurred,[13] as it can be seen in Figure 1. Although the difference between one type of problem and the other may seem a minor issue, it is not. On the contrary, it is one of the causes of the failure of the Iraq and Afghanistan campaigns, and one of the causes that policies and strategies fail to address terrorism and insurgency.

The epistemological and gnoseological problem behind this taxonomy has its origins in the inability of Physics and Mathematics to explain complex problems such as the "three-body problem" enunciated by Isaac Newton in his famous *Principia*.[14] If even today there is still a part of the academic world that does not fully understand these problems, strategic and security studies are also still at an early stage.

[12] In order to delve into the subject, see or analyse the NATO Comprehensive Operational Planning Directive, COPD; the Allied Joint Doctrine for Planning Operations, AJP-5; and the Allied Tactical Planning for Land Operations, APP-28.

[13] Klir, George J. – Yuan, Bo eds. (1996): *Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems. Selected Papers by Lotfi A. Zadeh.* Singapore: World Scientific.

[14] Newton, Isaac (1687): *Philosophiae Naturalis Principia Mathematica.* London: Knight and Compton.

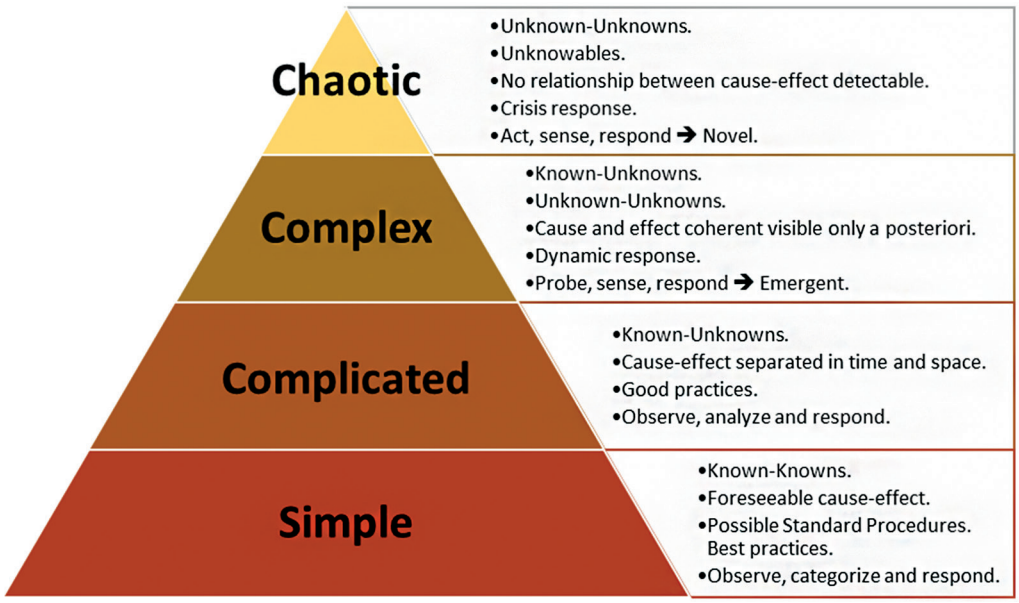

Figure 1: Categories and types of systems

Note: The figure shows causality, disorder, type of information available or lack thereof, as well as the preferred/proposed sequence of action in each of the four environments or type of problems.

Source: Compiled by the author based on Dave Snowden's Cynefin model.

As a nonlinear problem, the object of study presents some extraordinary challenges, such as, for example, the requirement of an appropriate measurement instrument for the independent variables. The *non-linearity* of the problem lies in the fact that violent extremist organisations are made up of individuals and, especially those who constitute these organisations, make many of their decisions in a non-rational, i.e. emotional way (such as, for example: acts of faith, tastes, moods, etc.).[15]

When the non-linearity lies in the fact that the decisions are emotional, the conventional rules of problem-solving, such as the scientific method or the military method of problem-solving, which are normally designed to deal with problems based on causality, are affected. Nonlinear problem-solving is arduous and, in these cases, directly undermines one of the pillars of the scientific method, replicability. In fact, there is currently a growing trend in the field of security and defence operations that argues that the scientific method is not applicable to the resolution of this type of problem.[16]

The problem of non-linearity (and, therefore, of the impossibility of replicability) cannot be solved *per se,* it is, in a way, like Heisenberg's indeterminacy problem. But, the aforementioned does not imply impossibility of predictability, which means the need to employ Bayesian theories. The problem of non-linearity is overcome by making use of

[15] Other types of non-linear problems are, for example, some aspects of economics, weather forecasting or ecosystems.

[16] Guided discussions, 2018–2020 at the Marines University; Escuela de Infantería de Marina "General Albacete y Fuster"; or at the Centro Superior de Estudios de la Defensa (CESEDEN), in Spain.

probability and the Pareto principle. Unlike cause–effect relationships, it must be understood that any solution to a nonlinear problem may not happen again immediately, these outcomes are probability centric. It is not possible to be certain that the relationships discovered in the investigation will be fulfilled in one hundred percent of the cases; but, if the model and the variables that conform it are correct, this will occur in a very high percentage of events.

New methodology to solve the "operational military problem" of terrorism, insurgency and violent extremism

Considering the way we think and how human beings make decisions in the worst possible situations is a task that the military institution takes very seriously. The "operational military problem-solving process" is a term widely used in NATO doctrine and in most of the national doctrine of the most advanced countries[17] that refers to a set of actions and steps followed in order to reach the best possible solution, among all the possible ones, in a given situation.

Saving the nuclear strategy that employed game theory since the construction of the atomic weapon, first unconsciously and then deliberately, U.S. civilian academics working in defence think tanks were the first to notice the need to address insurgency and terrorism as an interactively complex and nonlinear system. Particularly noteworthy in this regard is Van Ripper's 1997 contribution[18] criticising the American mindset that relied on simple scientific solutions to complex problems of human relations.

In the aftermath of the 9/11 attacks, Smith (2001 and 2002)[19] pointed to the need for a new methodology using system dynamics to model the fight against terrorism. Smith proposed a system that would be able to support the relationships of the constituent parts of a terrorist organisation, such as the command element, operational cells, policies, communications, cultural aspects, etc.

In the specific field of terrorism, Deffuant et al. (2002)[20] were also among the first to use system dynamics. On the other hand, Raczynski (2004),[21] besides non-linearity, included among the variables of his models the possibility of the use of kinetic actions, such as, the destruction of a part of the terrorist organisation's system. Raczynski's model, however, was built in the theoretical framework, without undergoing validation with empirical data.

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[17] See NATO (2012): *Allied Command Operations Comprehensive Operations Planning Directive COPD V.2:* 4–32; U.S. Army (2014): *FM6-0 Commander and Staff Organization and Operations:* D-1.

[18] Van Riper, Paul – Scales, Robert H. Jr. (1997): Preparing for War in the 21st Century. *The US Army War College Quarterly: Parameters,* 27(3).

[19] Smith, Roger: Modeling and Simulation Adds Insight on Terrorism. [online], Signal Magazine, 01.12.2001. Source: afcea.org [01.11.2022]; Smith, Roger (2002): Counter Terrorism Simulation: A New Breed of Federation. *Simulation Interoperability Workshop,* Spring 2002.

[20] Deffuant, Guillaume et al. (2002): How Can Extremism Prevail? A Study Based on the Relative Agreement Interaction Model. *Journal of Artificial Societies and Social Simulation,* 5(4).

[21] Raczynski, Stanislaw (2004): Simulation of the Dynamic Interactions between Terror and Anti-Terror Organizational Structures. *Journal of Artificial Societies and Social Simulation,* 7(2).

Dombroski (2002),[22] Carley (2004)[23] and Anderson (2006)[24] complemented their predecessors using agent-based models or employing system dynamics techniques to model other particular aspects of terrorism.

Kaminskiy and Ayyub (2006)[25] developed simple models for calculating the cost-efficiency of terrorist policies, based on the cost per disabled terrorist cell as a function of time. When combined with a certain level of acceptable risk in relation to terrorist actions, the parameter was intended to make a timely decision on the need to revise the policies employed.

Leweling and Sieber[26] explored in January 2007 the dynamics of systems for dealing with violent non-state actors. Specifically, the authors presented a model built with stock and flow diagrams in such a way that future researchers could take advantage of automated information systems to empirically ground and refine the model, using particular case studies and phenomena of interest.

The inflexion point was reached with Chamberlain also in 2007,[27] who presented a set of six models, based on system dynamics, demonstrating that it was possible to model and make predictions, with an acceptable degree of success, on terrorism. Almost in parallel,[28] U.S. academics and the strategy and tactics departments of military schools were engaged in a heated debate about the adequacy of the current decision-making, problem-solving and planning processes for dealing with complex problems. Europe was, in this subject, far behind of U.S. community.

In any case, at that time the military establishment was not ready to abandon a system that had been proven in combat and that for complicated and linear problems had worked exceptionally well. The Iraq and Afghanistan campaigns tried to change the ways and means of their strategies by sending more force to theatres of operations and a false improvement was achieved. Despite the above, the debate in the academies and military and security schools did not cease. The level of dispute and disagreement among experts' idea on how to deal with complex problems was paradigmatically reflected in the highest military doctrine, which is historically significant:

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[22] Dombroski, Matthew J. – Carley, Kathleen M. (2002): NETEST: Estimating a Terrorist Network's Structure – Graduate student best paper award, CASOS 2002 Conference. *Computational & Mathematical Organization Theory,* 8(3), 235–241.

[23] Carley, Kathleen M. (2004): *Estimating Vulnerabilities in Large Covert Networks.* Carnegie Mellon University Pittsburgh, PA, Institute for Software Research International.

[24] Anderson, Edward G. Jr. (2006): *A Preliminary System Dynamics Model of Insurgency Management: The Anglo–Irish War of 1916–21 as a Case Study.* University of Texas.

[25] Kaminskiy, Mark P. – Ayyub, Bilal M. (2006): Terrorist population dynamics model. *Risk Analysis,* 26(3), 747–752.

[26] Leweling, Tara – Sieber, Otto: *Using Systems Dynamics to Explore Effects of Counterterrorism Policy.* [online], 40th Annual Hawaii International Conference on System Sciences (HICSS'07), 2007. Source: ieeexplore.ieee.org [04.12.2022].

[27] Chamberlain, Todd (2007): Systems Dynamics Model of al-Qa'ida and United States "Competition". *Journal of Homeland Security and Emergency Management,* 4(3).

[28] See Van Riper, Paul (2009): *An Introduction to System Theory and Decision-Making.* E(C) 2510 ANX A. U.S. Marine Corps University. See also Franke, Volker (2011): Decision-Making under Uncertainty: Using Case Studies for Teaching Strategy in Complex Environments. *Journal of Military and Strategic Studies,* 13(2).

> *"Ill-structured" are complex, nonlinear, and dynamic; making them the most difficult to understand and solve. Unlike well- or medium-structured problems, leaders disagree about how to solve ill-structured problems, what the end state should be, and whether the desired end state is even achievable.*[29]

The fiasco of the Afghanistan campaign highlighted the need for a definitive change in approach. After 20 years of violent conflict involving more than 40 nationalities, hundreds of thousands displaced, tens of thousands killed and wounded and trillions of dollars spent, the U.S. and NATO have left Afghanistan in worse conditions than at the beginning of the conflict.

Currently, all U.S. military schools of thought and some of the combatant commands such as the U.S. Special Operations Command (SOCOM) are working on incorporating into their decision-making, problem-solving and planning processes the approach that considers terrorism, insurgency or violent extremism as nonlinear complex interactive problems. In Europe, progress on this point is still much slower, for example, in Spain the only service that is working on adapting this approach is the Marine Corps School General Albacete y Fuster.

In this way, many of the ones who fight terrorism, insurgency or violent extremism are beginning to realise that the tools they need to handle such phenomena must take into account that these problems have many non-homogeneous parts. These parts are interrelated and it is not possible to act on one without influencing the others. Besides, they must be capable to deal with multi-causal polemology, which does not follow the cause–effect relationship always and at all times, meaning that the same stimulus can have very different reactions in an actor or system of actors. Thus, a transdisciplinary[30] and multilevel approach is necessary to address these three problems properly.

The multidisciplinary approach to the problem is not sufficient and this is an aspect that has not yet been fully internalised or operationalised either in NATO or in Europe.[31] The intricacies of the situation are that in interactively complex nonlinear environments, what each of the disciplines contributes cannot be treated in isolation from what the rest of the others disciplines contribute, because the constituent parts are interrelated and when one of them is acted upon, the rest of the parts are affected or destabilised. Consensus is needed in decision-making, problem-solving and planning processes.

The number of possibilities that arise from the combination of all the variables that affect the subject of terrorism is enormous, as it can be seen in the figure below. The circumstance that these factors are interrelated and cannot be addressed separately is what makes the multidisciplinary approach necessary.

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[29] U.S. Army 2014: 4-1.

[30] Transdisciplinarity is understood as when several disciplines work in a coordinated and subsidiary manner to provide a holistic solution, as opposed to multidisciplinary, which simply means that there are several disciplines working together.

[31] Regardless of whether or not European foreign policy has a real vocation for intervention. See e.g. Gil, Luis V. Pérez (2021): La Unión Política Europea y las grandes potencias en un sistema internacional complejo e inestable. *bie3: Boletín IEEE,* (22), 895–912.

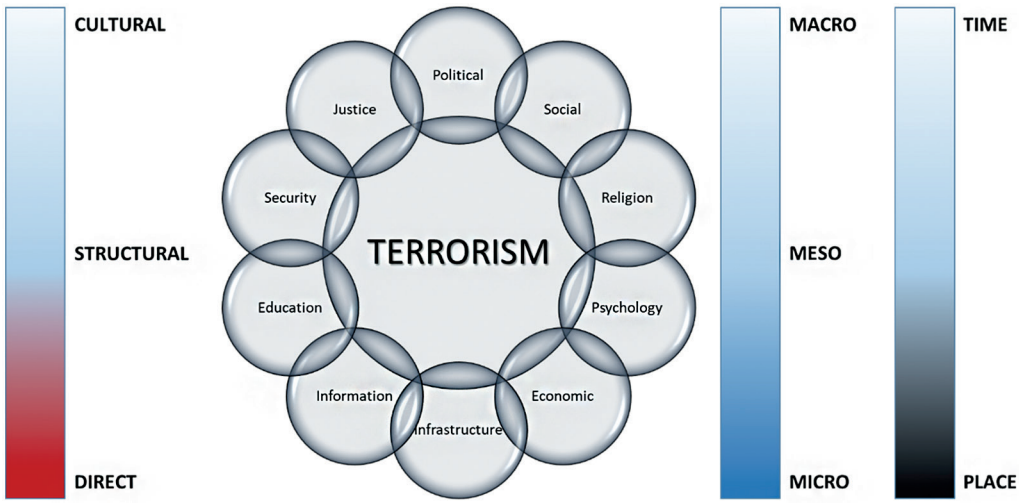

Figure 2: Interrelations of the disciplines, levels and dimension that directly affect terrorism

Note: The figure does not intent to be exhaustive in the number of elements that affect terrorism, insurgency or violent extremism. There are millions of combinations of these elements.

Source: Compiled by the author.

General system theory includes, among others, system dynamics, game theory and complex adaptive systems. Complex adaptive systems have been used in engineering, medicine, biology and other disciplines; not very well known in Security Studies is still one of the most suitable tools for approaching terrorism, insurgency or violent extremism.

Human ability to deal with complex systems is limited. We need specific training and help when dealing with complex systems. Human beings generally tend to oversimplify its analyses of complex systems and models. We have a habit of using intuition instead of the right models and verifiable data, and we tend to apply reductionism, often assigning single causes for any unwanted outputs.

The essence of complex adaptive systems is interdisciplinary and falls on the fact that it is capable of managing a sufficiently large number of elements with rich interactions, linear and nonlinear; besides any of the interactions can feedback and not exclusively with immediate neighbours. Complex adaptive systems are not limited to the definition of the system boundaries and are also able to manage responses to physical stimuli when they happen locally. In addition, complex adaptive systems are disposed to evolution and can operate under far from equilibrium conditions. Finally, this approach takes into account that the overall behaviour of the system is not predicted by the behaviour of the individual elements.

The term complex adaptive systems (CAS) was introduced by the Santa Fe Interdisciplinary Institute, notably by John H. Holland and Murray Gell-Mann at the

beginning of the 1990s.[32] Curiously, instead of being Political Science, International Relations or Security Studies it is the branches of engineering, modelling and mathematics the ones who took the initiative of linking CAS with security, terrorism, insurgency and violent extremism. Nowadays, it is becoming more and more established and there is less and less modesty in talking about this type of approach in the academic world.

Ahmed et al. (2005),[33] from the Egyptian academia, somewhat unknown and underestimated in the view of many occidentals, but coming from a country with a long tradition in the fight against terrorism, developed a very interesting document, ahead of its time, which concluded the need and appropriateness of using complex adaptive systems to deal with terrorism.

Yin Shan and Yang (2008)[34] published a research document on CAS applications to counter terrorism. Also, in 2008 LeBaron[35] pointed the relationship between CAS and terrorism. The approach of hybrid warfare in urban environments by Moffat et al. (2011) stands out. The doctoral thesis by Harwood (2017) reach the conclusion that some NATO SOPs should be changed because they are not suitable for nonlinear interactively complex problems. Finally, one of the most recent research publications is about how resilience, security and CAS are interrelated in Cameroon.[36]

To conclude this point, it should be noted that complex adaptive systems involve mathematical algorithms, artificial intelligences and modelling. There are two types of models; the first one is a simplification of reality that is made to better understand the dynamics of a complicated or complex system; the second one is a comprehensive model that allows you to quantify dynamics of the relationships by reducing it to mathematical equations that can be computed and thus predictions obtained. The first model is the one that will be presented at the end of this paper and validated or refuted in a further quantitative research paper.

Systems-of-systems-based simplified model of intentional change in violent extremist jihadist organisations

NATO and Western nations have traditionally employed systems of systems in targeting. Sometimes, it is not necessary to destroy an entire system, just disrupting a critical constituent part is enough to disable it.

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[32] Holland, John H. (1992): Complex Adaptive Systems. *Daedalus,* 121(1), 17–30; Gell-Mann, Murray (1994): Complex Adaptive Systems. In Cowan, George A. – Pines, David – Meltzer, David (eds.): *Complexity. Metaphors, Models and Reality.* Mexico: Addison-Wesley. 17–45.

[33] Ahmed, E. M. E. Sayed E. – Elgazzar, Ahmed S. – Hegazi, Ahmed Sadek (2005): On Complex Adaptive Systems and Terrorism. *Physics Letters A,* 337(1–2), 127–129.

[34] Shan, Yin – Yang, Ang eds. (2008): *Applications of Complex Adaptive Systems.* Hershey: IGI Global.

[35] LeBaron, Blake (2008): Review of *Complex Adaptive Systems: An Introduction to Computational Models of Social Life* by John H. Miller and Scott E. Page. *Journal of Economic Literature,* 46(2), 427–429.

[36] Lekunze, Manu (2019): *Complex Adaptive Systems, Resilience and Security in Cameroon.* London – New York: Routledge.

Terrorism can be divided into several subsystems. Historically, terrorism has been faced trying to attack the different subsystems, however, little has been exploited about the effects caused by a more rapid cycle of learning, adapting and introducing changes in an organisation in the competition of countering terrorism, insurgency or violent extremism.

The source of power (centre of gravity) of terrorist organisations is their ability to make irrelevant the strength and power of their adversaries which is precisely the centre of gravity of the counterterrorism forces. Because terrorist organisations are weak, when they receive a setback, they need to adapt and change in order to avoid being annihilated but also, they need to adapt and change to maintain their leverage through coercion and terror when a nation protects itself.

The qualitative approach to the causes that provoke innovation, adaptation and change in violent extremist organisations has been the most widely used. Quantitative means is much less widespread,[37] due to the difficulty of collecting data on tactics, techniques and procedures of this type of organisations. The complexity of accessing extremist subjects who are willing to explain the real motivations or intentions behind their actions is another factor explaining the scarcity of quantitative methods. In addition, some of the most popular databases for quantitative studies have serious drawbacks that make it necessary to use them with caution if the results of the research are to be valid. This is the case of the Global Terrorism Database, a database of the University of Maryland[38] used by numerous researchers and governmental and non-governmental institutions.

In Europe, the research produced by the International Centre for Counter-Terrorism in The Hague is noteworthy. This centre has worked in close coordination with NATO as well as with several UN agencies such as, for example, the Counter-Terrorism Executive Directorate (CTED) and the Counter-Terrorism Implementation Task Force (CTITF). In relation to the subject of study, Schmid's (2013)[39] review of specialised literature on radicalisation, de-radicalisation and violent extremism is particularly remarkable. The Nordic countries also have a prolix production, although many of them have kept it classified for several years.[40]

On the one hand, Jordan's established model for innovation in the military[41] has been the starting point for the adaptation of the model proposed in this paper. On the other hand, in the American academia, Horowitz maintains a prominent role, which has been taken into account, in his contribution to innovation and diffusion of knowledge in terrorist organisations.

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37 See Silke, Andrew (2001): The Devil You Know: Continuing Problems with Research on Terrorism. *Terrorism and Political Violence,* 13(4), 1–14.

38 Although there are multiple factors, consider, for example, the number of unclaimed attacks in certain countries such as Iraq, or the difficulty of differentiating what is insurgency from terrorism in numerous events in the periods 2003 to 2011 also in Iraq or in Afghanistan.

39 Schmid, Alex P. (2013): Radicalisation, De-Radicalisation, Counter-Radicalisation: A Conceptual Discussion and Literature Review. *ICCT Research Paper,* March 2013. 22.

40 E.g. the report of the Norwegian Defence Research Establishment (FFI, for its acronym in Norwegian) by Brynjar, Lia – Skjølberg, Katja: *Why Terrorism Occurs: A Survey of Theories and Hypotheses on the Causes of Terrorism.* [online], Norwegian Defence Research Establishment, 2000. Source: ffi.no [01.11.2022].

41 Jordán, Javier (2017): Un modelo explicativo de los procesos de cambio en las organizaciones militares: la respuesta de estados unidos después del 11-s como caso de estudio. *Revista de ciencia política (Santiago),* 37(1), 203–226.

Organisational learning is another aspect developed extensively by U.S. academia. It is an important element in the processes of adaptation, innovation and intentional change. Farrell[42] was one of the first to bring organisational learning to terrorism in his study of violent organisations operating in the United Kingdom. Fiol and Lyles[43] further elaborated on the distinction between organisational learning and organisational adaptation, demonstrating that change did not necessarily involve learning. Fiol and Lyles also established levels of learning, each of which has a different impact on the strategic management of the firm, which is possible and useful to transpose to violent extremist organisations to understand or predict their strategies. Hedberg and Jönsson[44] contributed knowledge on stabilising and destabilising factors of organisations in relation to the environment, which promotes or slows down adaptation, learning or intentional change, an important issue when assessing and implementing counterterrorism policies and strategies. Finally, Shrivastava's[45] contribution to the formulation of a typology of organisational learning must be noted.

Among the most recent quantitative studies where organisational learning and terrorism are interrelated are those of Jackson et al. (2005)[46] where case studies were conducted for five organisations considered at the time as terrorist. These studies and the research findings were aimed at improving the fight against terrorism according to the Detect–Anticipate–Act formula. Nevertheless, Jackson et al. case studies have been conducted on violent extremist organisations that are not jihadist, which would require a contextualisation and it is precisely where this paper finds its place by proposing a simplified model specific for jihadist organisations that will be validated or refuted in future research with case studies.

In order for the literature review of the subject to be holistic, it is also necessary to talk about the process of violent radicalisation and extremism. In this field it is necessary to cite Moghaddam (2005)[47] for his contribution that the process of radicalisation is incremental. Doosje et al. (2016)[48] explicitly introduced reversibility in the model of the process and the macro, meso and micro dimensions in the psychosocial aspects of the process. In the Spanish academia Peco (2016)[49] detailed the psychological process by which beliefs

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[42] Farrell, Theo (1996): Figuring out Fighting Organisations: The New Organisational Analysis in Strategic Studies. *The Journal of Strategic Studies,* 19(1), 122–135.

[43] Fiol, C. Marlene – Lyles, Marjorie A. (1985): Organizational Learning. *The Academy of Management Review,* 10(4), 803–813.

[44] See e.g. Hedberg, Bo – Jönsson, Sten (1978): Designing Semi-Confusing Information Systems for Organizations in Changing Environments. In Emmanuel, Clive – Otley, David – Merchant, Kenneth (eds.): *Readings in Accounting for Management Control.* Boston: Springer. 149–173.

[45] Shrivastava, Paul (1983): A Typology of Organizational Learning Systems. *Journal of Management Studies,* 20(1), 7–28.

[46] Jackson, Brian A. et al. (2005): *Aptitude for Destruction. Volume 2: Case Studies of Organizational Learning in Five Terrorist Groups.* Santa Monica: Rand Corporation.

[47] Moghaddam, Fathali M. (2005). The Staircase to Terrorism: A Psychological Exploration. *American Psychologist,* 60(2), 161.

[48] Doosje, Bertjan et al. (2016): Terrorism, Radicalization and De-Radicalization. *Current Opinion in Psychology,* 11, 79–84.

[49] Peco, Miguel (2016): A Functional Approach to Violent Radicalization. Building a Systemic Model Based on a Real Case. *Revista de Estudios en Seguridad Internacional,* 2(1), 63–76.

are accommodated and violent radicalisation is achieved. Lorenzo (2018)[50] proposed two models, one of which permits to be computed and adapts to the approach of adaptive complex systems and mechanics of nonlinear systems.

Summing up, after studying the specialised literature, 17 possible causes of intentional change in violent extremist jihadist organisations were detected, as depicted in Table 1. After a process of analysis, synthesis, comparison, induction, deduction and interviews with experts, it was determined that three independent variables could explain the intentional change: efficiency, survival and emulation.

- The efficiency variable is the amount of terror that the organisation can produce, based on causing damage to people or infrastructure. This variable allows the violent extremist organisation achieve their objectives through terror or simply by eliminating their opponents.
- The survival variable refers to the actions that the organisation takes to protect itself from the actions of its adversaries, mainly armed forces and police but also other competing organisations or actors.
- Emulation, a variable that does not follow logic, refers to intentional changes motivated by feelings, emotions or aesthetics, such as contagion theory or mass phenomena.

Table 1: Summary of specialised literature and final decision of the independent variables of the model after applying qualitative methods

Dependent variable	Specialised literature possible causes	Independent variables	Remarks
Intentional Change (Adaptation, innovation, learning)	Reaction to the adversary	**Efficiency** / **Survival** / **Emulation**	Many of the causes in the specialised literature will remain intervening causes.
	Organisational flexibility/rigidity		
	Survival of the organisation		
	Reach the level of violence		
	Competition between VEO		
	Opportunity		
	Deliberate learning		
	Time available		
	Anticipation		
	Leader of the organisation		
	Strategic or tactical changes		
	New technologies or inventions available		
	Collaboration between VEO		
	Alteration of identity traits VEO		
	Social contagion		
	Narcissism		
	Emulation		
	Unintentional change		Not applicable (outside the study).

Source: Compiled by the author.

[50] Lorenzo-Penalva, Lucas José: *Situational Understanding on Violent Radicalization that Results in Terrorism. Two Graphic Models that Provide Clarity on the Topic*. [online], Grupo de Estudios en Seguridad Internacional, 02.07.2018. Source: seguridadinternacional.es [12.10.2022].

Conclusions

As a final result it can be said that until proven otherwise, intentional change in violent extremist organisations can be explained in terms of three variables which are efficiency, survival and emulation.

To validate the model, mixed methods should be used. Since the model is the first step of a broader investigation the validation has already been done but the research paper of the validation is pending publication. To try to refute or validate the model more than 20 case studies accompanied by qualitative analysis and interviews with experts have been done.

The model, presented in this paper as simplified, is being developed into a model suitable for complex adaptive systems, which will allow decision-makers to obtain metrics and predictions for the lines of effort for counterterrorism strategies and policies.

Treating terrorism, insurgency or violent extremism as a system of systems and using the right tools and holistic, interdisciplinary approaches will help to gain efficiency in dealing with such phenomena, leading to save lives and resources and to reduce unnecessary suffering.

REFERENCES

Ahmed, E. M. E. Sayed E. – Elgazzar, Ahmed S. – Hegazi, Ahmed Sadek (2005): On Complex Adaptive Systems and Terrorism. *Physics Letters A,* 337(1–2), 127–129. Online: https://doi.org/10.1016/j.physleta.2005.01.059

Anderson, Edward G. Jr. (2006): *A Preliminary System Dynamics Model of Insurgency Management: The Anglo–Irish War of 1916–21 as a Case Study.* University of Texas.

Brynjar, Lia – Skjølberg, Katja: *Why Terrorism Occurs: A Survey of Theories and Hypotheses on the Causes of Terrorism.* [online], Norwegian Defence Research Establishment, 2000. Source: ffi.no [01.11.2022].

Carley, Kathleen M. (2004): *Estimating Vulnerabilities in Large Covert Networks.* Carnegie Mellon University Pittsburgh, PA, Institute for Software Research International.

Chamberlain, Todd (2007): Systems Dynamics Model of al-Qa'ida and United States "Competition". *Journal of Homeland Security and Emergency Management,* 4(3). Online: https://doi.org/10.2202/1547-7355.1225

Deffuant, Guillaume – Amblard, Frédéric – Weisbuch, Gérard – Faure, Thierry (2002): How Can Extremism Prevail? A Study Based on the Relative Agreement Interaction Model. *Journal of Artificial Societies and Social Simulation,* 5(4). Online: https://www.jasss.org/5/4/1.html

Dombroski, Matthew J. – Carley, Kathleen M. (2002): NETEST: Estimating a Terrorist Network's Structure – Graduate student best paper award, CASOS 2002 Conference. *Computational & Mathematical Organization Theory,* 8(3), 235–241. Online: https://doi.org/10.1023/A:1020723730930

Doosje, Bertjan – Moghaddam, Fathali M. – Kruglanski, Arie W. – de Wolf, Arjan – Mann, Liesbeth – Feddes, Allard R. (2016): Terrorism, Radicalization and De-Radicalization. *Current Opinion in Psychology,* 11, 79–84. Online: https://doi.org/10.1016/j.copsyc.2016.06.008

Farrell, Theo (1996): Figuring out Fighting Organisations: The New Organisational Analysis in Strategic Studies. *The Journal of Strategic Studies,* 19(1), 122–135. Online: https://doi.org/10.1080/01402399608437629

Fiol, C. Marlene – Lyles, Marjorie A. (1985): Organizational Learning. *The Academy of Management Review,* 10(4), 803–813.Online: https://doi.org/10.2307/258048

Franke, Volker (2011): Decision-Making under Uncertainty: Using Case Studies for Teaching Strategy in Complex Environments. *Journal of Military and Strategic Studies,* 13(2). Online: https://digitalcommons.kennesaw.edu/cgi/viewcontent.cgi?article=4036&context=facpubs

Freedman, Lawrence (2002): Conclusion: The Future of Strategic Studies. In Baylis, John – Wirtz, James J. – Gray, Colin S. (eds.): *Strategy in the Contemporary World. An Introduction to Strategic Studies.* Oxford: Oxford University Press. 356–369.

Gell-Mann, Murray (1994): Complex Adaptive Systems. In Cowan, George A. – Pines, David – Meltzer, David (eds.): *Complexity. Metaphors, Models and Reality.* Mexico: Addison-Wesley. 17–45.

Gil, Luis V. Pérez (2021): La Unión Política Europea y las grandes potencias en un sistema internacional complejo e inestable. *bie3: Boletín IEEE,* (22), 895–912. Online: https://www.ieee.es/contenido/noticias/2021/06/DIEEEO80_2021_LUISPER_Union.html

Gray, Colin S. (1982): *Strategic Studies and Public Policy. The American Experience.* Lexington: University Press of Kentucky.

Hedberg, Bo – Jönsson, Sten (1978): Designing Semi-Confusing Information Systems for Organizations in Changing Environments. In Emmanuel, Clive – Otley, David – Merchant, Kenneth (eds.): *Readings in Accounting for Management Control.* Boston: Springer. 149–173. Online: https://doi.org/10.1007/978-1-4899-7138-8_8

Helman, Christopher – Tucker, Hank: *The War in Afghanistan Cost America $300 Million Per Day for 20 Years, with Big Bills yet to Come.* [online], Forbes, 16.08.2021. Source: forbes.com [25.04.2023]

Holland, John H. (1992): Complex Adaptive Systems. *Daedalus,* 121(1), 17–30. Online: https://www.ecbproject.org/system/files/content/resource/files/main/Holland%201992.pdf

Jackson, Brian A. – Baker, John C. – Chalk, Peter – Cragin, Kim – Parachini, John V. – Trujillo, Horacio R. (2005): *Aptitude for Destruction. Volume 2: Case Studies of Organizational Learning in Five Terrorist Groups.* Santa Monica: Rand Corporation. Online: https://doi.org/10.7249/MG332

Jordán, Javier (2017): Un modelo explicativo de los procesos de cambio en las organizaciones militares: la respuesta de estados unidos después del 11-s como caso de estudio. *Revista de ciencia política (Santiago),* 37(1), 203–226. Online: https://doi.org/10.4067/S0718-090X2017000100009

Kaminskiy, Mark P. – Ayyub, Bilal M. (2006): Terrorist Population Dynamics Model. *Risk Analysis,* 26(3), 747–752. Online: https://doi.org/10.1111/j.1539-6924.2006.00780.x

Klir, George J. – Yuan, Bo eds. (1996): *Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems. Selected Papers by Lotfi A. Zadeh.* Singapore: World Scientific. Online: https://doi.org/10.1142/2895

LeBaron, Blake (2008): Review of *Complex Adaptive Systems: An Introduction to Computational Models of Social Life* by John H. Miller and Scott E. Page. *Journal of Economic Literature,* 46(2), 427–429. Online: http://www.jstor.org/stable/27647002

Lekunze, Manu (2019): *Complex Adaptive Systems, Resilience and Security in Cameroon.* London – New York: Routledge. Online: https://doi.org/10.4324/9780429273445

Leweling, Tara – Sieber, Otto: *Using Systems Dynamics to Explore Effects of Counterterrorism Policy*. [online], 40th Annual Hawaii International Conference on System Sciences (HICSS'07), 2007. Source: ieeexplore.ieee.org [04.12.2022] Online: https://doi.org/10.1109/HICSS.2007.597

Lorenzo-Penalva, Lucas J.: *Situational Understanding on Violent Radicalization that Results in Terrorism. Two Graphic Models that Provide Clarity on the Topic.* [online], Grupo de Estudios en Seguridad Internacional, 02.07.2018. Source: seguridadinternacional.es [12.10.2022]

Moghaddam, Fathali M. (2005): The Staircase to Terrorism: A Psychological Exploration. *American Psychologist,* 60(2), 161–169. Online: https://doi.org/10.1037/0003-066X.60.2.161

NATO (2012): *Allied Command Operations Comprehensive Operations Planning Directive COPD V.2.*

NATO (2018): *Allied Tactical Planning for Land Operations, APP-28 Ed. A. V.1.*

NATO (2019): *Allied Joint Doctrine for Planning Operations, AJP-5 Ed. A. V.1.*

Newton, Isaac (1687): *Philosophiae Naturalis Principia Mathematica.* London: Knight and Compton. Online: https://doi.org/10.5479/sil.52126.39088015628399

Peco, Miguel (2016): A Functional Approach to Violent Radicalization. Building a Systemic Model Based on a Real Case. *Revista de Estudios en Seguridad Internacional,* 2(1), 63–76. Online: https://doi.org/10.18847/1.3.4

Raczynski, Stanislaw (2004): Simulation of the Dynamic Interactions between Terror and Anti-Terror Organizational Structures. *Journal of Artificial Societies and Social Simulation,* 7(2). Online: https://www.jasss.org/7/2/8.html

Schmid, Alex P. (2013): Radicalisation, De-Radicalisation, Counter-Radicalisation: A Conceptual Discussion and Literature Review. *ICCT Research Paper,* March 2013. Online: http://dx.doi.org/10.19165/2013.1.02

Smith, Roger: Modeling and Simulation Adds Insight on Terrorism. [online], Signal Magazine, 01.12.2001. Source: afcea.org [01.11.2022]

Smith, Roger (2002): Counter Terrorism Simulation: A New Breed of Federation. *Simulation Interoperability Workshop,* Spring 2002. Online: http://www.simulationfirst.com/papers/02S-SIW-004.pdf

Shrivastava, Paul (1983): A Typology of Organizational Learning Systems. *Journal of Management Studies,* 20(1), 7–28. Online: https://doi.org/10.1111/j.1467-6486.1983.tb00195.x

Silke, Andrew (2001): The Devil You Know: Continuing Problems with Research on Terrorism. *Terrorism and Political Violence,* 13(4), 1–14. Online: https://doi.org/10.1080/09546550109609697

Shan, Yin – Yang, Ang eds. (2008): *Applications of Complex Adaptive Systems.* Hershey: IGI Global. Online: https://doi.org/10.4018/978-1-59904-962-5

Torres-Soriano, Manuel Ricardo (2020): Democracia vs. desinformación: Propuestas para la protección de las sociedades abiertas. *Colección Actualidad, Centro de Estudios Andaluces,* (87), 1–18. Online: https://doi.org/10.54790/actualidad.0010

U.S. Army (2014): *FM6-0 Commander and Staff Organization and Operations. P. D-1.*

Van Riper, Paul (2009): *An Introduction to System Theory and Decision-Making.* E(C) 2510 ANX A. U.S. Marine Corps University.

Van Riper, Paul – Scales, Robert H. Jr. (1997): Preparing for War in the 21st Century. *The US Army War College Quarterly: Parameters,* 27(3). Online: https://doi.org/10.55540/0031-1723.1845