How Complex Systems Studies Could Help in Identification of Threats of Terrorism?

Czeslaw Mesjasz
Cracow University of Economics
Cracow, Poland
mesjaszc@ae.krakow.pl

1. Introduction

The terrorist attacks of 11 September 2001 have once again reminded that limitations of prediction constitute the key factor in security theory and policy. In addition to fundamental epistemological limitations of prediction, one specific reason must be taken into account. Threats are often unpredictable, not because of objective barriers of their predictability, but due to the impact of social context and subsequent mental constraints, which make perception biased and eventually limit validity of prediction.

The main aim of the paper is to assess what could be the use of complex systems studies in improving predictive instruments of security theory.[1] The concepts of securitization of threats and vulnerability of social systems are used as a point of departure of analysis. Special stress is put upon analogies and metaphors drawn from complexity studies which are used in security theory and policy. Attention is focused on the threats of terrorism yet conclusions can be extended to other domains of security studies.

2. Concepts of Security

In the realist, and later, neorealist approach, military security is an attribute of relations of a state, a region or a grouping of states (alliance) with other state(s), regions, groupings of states. Security is viewed as an absence of threat or a situation in which occurrence of consequences of that threat could be either prevented or state (region, alliance) could be made isolated from that.

[1] According to the author's views, the term "complex systems science" seems premature.

Broadening the neorealist concept of security means inclusion of a wider range of potential threats, beginning from economic and environmental issues, and ending with human rights and migrations. Deepening the agenda of security studies means moving either down to the level of individual or human security or up to the level of international or global security, with regional and societal security as possible intermediate points. Parallel broadening and deepening of the concept of security has been proposed by the constructivist approach associated with the works of the Copenhagen School [Buzan *et al.* 1998].

Prediction, or identification of threats is undoubtedly the core issue in analytical approaches to security. It should make possible subsequent future actions ("emergency measures").

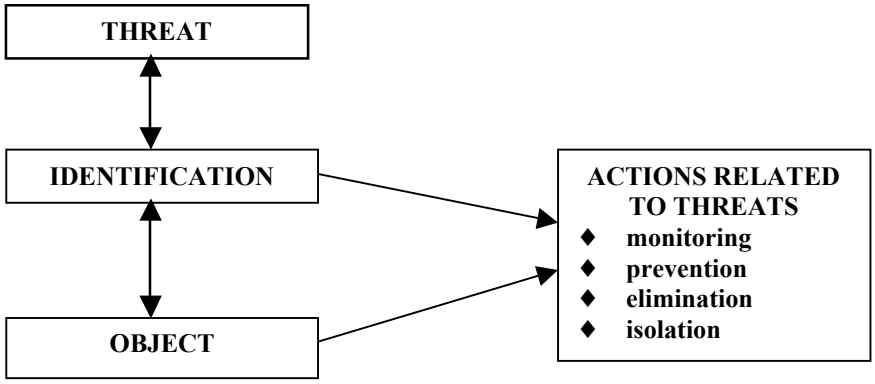

Fig. 1. The core of the concept of security

In order to preserve and develop analytical properties of the concept of security, a specific "middle-of-the-road", eclectic approach is proposed. It combines at least declarative objective value of widened neorealist broadened security concept with the constructivist, and at the same time "deepened" idea of security viewed as an "act of speech" [Buzan *et al.* 1998].

In the eclectic approach security is referred to the following sectors: military, economic, political, environmental and societal. Following Buzan *et al.* (1998] the concepts of existential threat and securitization are used. Any public issue can be securitized (meaning the issue is presented as an existential threat, requiring emergency measures and justifying actions outside the normal limits of political procedure). Security is thus a self-referential practice, because it is in this practice that the issue becomes a security issue - not necessarily because a real existential threat exists, but due to the fact that the issue is depicted as a threat [Buzan *et al* 1998].

A mirror concept of desecuritization can be defined as a process in which a factor (threat) which under one "speech act" compels extraordinary measures in another "speech act" is presented as not requiring such measures [Wæver 1995].[2]

The proposed approach to security allows to find a compromise between a neorealist assumption of predictability of objective threats, and constructivism's denial of any possibilities of prediction. Inspiration for solution of this dilemma can be found in other normative social sciences, especially in economics and management. Possibility of reconceptualisation of prediction in those disciplines was mainly resulting from abandonment of mechanistic views of social processes. Instead of refining extrapolations, computer models, scenarios and forecasts, stress is being put on the mechanisms of learning which result in making predictions, like in management [van der Heijden 1996], or in refining methods applied in forecasting like in the future studies [Glenn & Gordon 2006].

2. Applications of Complex Systems Studies in Security Theory and Policy

Some of the founders of the concept of "systems thinking" or "systems approach", etc. were also engaged in various domains of security-related studies - peace research - Anatol Rapoport, Kenneth Boulding, international relations - Karl W. Deutsch [1964], Morton Kaplan [1957]. Similarly many modern works on security exposes the links with systems thinking and complexity studies, for example:

1. Direct references - [Rosenau 1990, 1997], [Snyder & Jervis 1993], and indirect, introductory references [Kauffman 1993, 1995].
2. The links between broadly defined security and "complexity paradigm" presented frequently in a different manner, for example in a book edited by Alberts & Czerwinski [2002] reflecting the interest of the US military in universal issues of security and in specific, combat and command solutions; similarly the interest of the US policy making centers can be quoted, e.g. the RAND Corporation [RAND Workshop 2000].
3. Studies of specific security oriented issues with non-linear mathematical models [Saperstein 1984, 1991, 1999], [Alberts & Czerwinski 2002], [Center for Naval Analyses 2002].
4. Studies of specific security oriented issues with analogies and metaphors deriving from various non-linear mathematical models (complexity models) - see, for example, an interesting discussion on Clausewitz and complexity initiated by Beyerchen [1992], chapters in the book of Alberts & Czerwinski [2002], [Center for Naval Analyses 2002].
5. Applications of systems thinking and complexity studies in research on terrorism which have been given special attention after 11 of September 2001 [Ilachinski 2002].

Ideas originated in systems thinking and complexity studies are used in social sciences as models, analogies and metaphors - the term "models" is used herein only for mathematical structures. The main attention in theory, and particularly in practice,

[2] These concepts are supplemented with complacency - nonsecuritization of apparent threats (Buzan *et al*. 1998, p. 57).

is paid to analogies and metaphors deriving from systems thinking and complexity studies. They are treated as "scientific" and obtain supplementary political influence resulting from "sound" normative (precisely prescriptive) approach. In applications of models, analogies and metaphors the following approaches can be identified: descriptive, explanatory, predictive, normative, prescriptive, retrospective, retrodictive, control and regulatory.

A question is thus arising: How systems thinking and complexity studies can be applied in theory and policy of security? Focusing attention upon prevention of terrorism, the following problem has to be taken into account. Since security is an outcome of social discourse (securitization), it is necessary to ask how the ideas drawn from systems thinking and complexity studies can be used in all aspects of securitization - identification of threats and in their prevention.

The uses of ideas taken from systems thinking and complexity studies include mathematical models and analogies and metaphors. Bearing in mind the state-of-the-art of systems thinking and complexity studies their mathematical apparatus can be only partly helpful in anti-terrorist research. The recent review of writings on that topic only reaffirms this assertion [Ilachinsky 2002]. Some methods are useful - models taken from operations research and agent based modeling, specific computer based information systems for data storage and processing, e.g. fuzzy reasoning applied in cross-referencing, more advanced methods of “data mining”, etc. could be helpful in enriching descriptions and analyzes. However, one can hardly expect that they will substantially help in predictions.

The second area of applications of systems thinking and complexity studies in security theory and policy is associated with the analogies and metaphors. Similarly as in management, in addition to description and analysis, they can be used even for prediction and identification of threats as well as in actions allowing to eliminate those threats.

Since anti-terrorist actions require separate research, the following problems of prediction must be studied:

1. Identification of threats of terrorism.
2. Securitization and desecuritization of threats of terrorism.
3. Methods of prediction of potential terrorist attacks - strategic and operational, day-to-day basis.

3. Terrorism and Vulnerability of Social Systems

3.1. How to Define Terrorism?

Definitions of terrorism vary widely and are contested as inadequate. Frequently the basic U.S. Department of State definition of terrorism is quoted "Premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience."
In another interpretations a terrorist action is the calculated use of unexpected, shocking, and unlawful violence against noncombatants (including, in addition to civilians, off-duty military and security personnel in peaceful situations) and other symbolic targets perpetrated by a clandestine member(s) of a subnational group or a clandestine agent(s) for the psychological purpose of publicizing a political or religious cause and/or intimidating or coercing a government(s) or civilian population

into accepting demands on behalf of the cause [The sociology and psychology of terrorism.....1999].

Three categories of terrorism may be discerned:

- unexpected attacks against military forces in the combat situations under the conditions of an open military conflict - for the supporters, the "terrorists" are "guerillas", “patriots”, “freedom fighters”, etc.,
- the surprising terrorist attacks against unprepared civilians or members of armed forces out of combat ,
- a new category - mega-terrorism and genocide - the attacks on New York and Washington.

Terrorism understood herein solely as an attack on unprepared civilians or members of any kind of armed forces in out of combat situations, usually exploits vulnerabilities existing in social systems. The more open and complex are the social systems, the more vulnerable they are.

3.2. Vulnerability of Social Systems

The vulnerabilities the terrorist use result from inadequate securitization and/or from implementation of irrelevant preventive and/or protective measures. The attacks of 11 September 2001 could be accomplished not because of the lack of potential adequate measures of prevention but because of the insufficient securitization, and especially because of inadequate identification of vulnerabilities and impossibility of subsequent prediction.

The eclectic approach to security can be made more specific by narrowing the sense of securitization to identification of vulnerabilities. Securitization relates to a system and its environment while in a long-term prevention of terrorism it is of a special importance to identify weak points (loopholes) of the system which could be prone to any threats from inside and from outside.

According to the New Webster's Dictionary and Thesaurus of the English Language [1992] vulnerable means "...open to attack, hurt or injury; a vulnerable position - capable of being hurt or wounded (either because insufficiently protected or because sensitive and tender)".

Vulnerability of social systems, similarly as security, can be described in three ways: objective vulnerability, vulnerability as an effect of social discourse, and as a result of the eclectic interpretation

3.3. Identification and Possible Prevention of Threats of Terrorism

As an introduction to the discussion on the links between unpredictability and security, the case of the lack of prediction of the end of the Cold War can be quoted. Scholarly disputes after the collapse of the USSR, and especially the works by Gaddis [1992], reflected methodological weaknesses of social sciences. In the writings by Hopf [1993] and by Singer [1999], an opinion was expressed that unpredictability of the end of the Cold War was resulting from a social context of research and policy making.

As to show the limits of securitization treated as a social discourse, it is worthwhile to recall a quotation from Hopf [1993, p. 207]: “Can anyone imagine a senior international relations scholar applying to the Carnegie Endowment in 1972 for a research grant to

investigate the conditions under which Moscow would most likely voluntarily relinquish control over Eastern Europe? Predicting the end of the Cold War was an unimaginable research question during the Cold War. But, had it been asked, no methodological or theoretical barriers would have stood in the way of formulating an answer".

By the same token, the terrorist attacks of 11 September 2001 can be reminded. Any security analyst trying to make a study of feasibility of a scenario of a mega-terrorist genocide attack before that date would likely have had problems with preserving his/her professional reputation. Attempts to sell a similar screenplay to the Hollywood filmmakers would have likely been vain as going beyond any acceptable limits of imagination.

Mechanisms of counterproductive self-imposed limits on prediction and/or rationality are not unknown. Tuchmann [1992] in her "March of Folly" showed several historical examples of that kind. Maybe the time is ripe to conduct study what social phenomena lead to the situations when societies and individuals blind themselves against major security threats.

It can be argued that systems thinking and complexity studies may provide some insights how to avoid that kind of inertia in perception and in prediction. They allow to enrich a broadly defined language of research with mathematical models as well as with analogies and metaphors.

In the attacks of 11 September the terrorists have exploited the vulnerabilities which generally resulted from inadequate securitization. It was a mixture of systemic properties of the US society - openness, purposive decision of relevant US institutions responsible for flight security, and likely, everyday negligence. Mistakes made by the US intelligence services and law enforcement agencies also were of a great importance.

The situation is easy to grasp in terms of securitization, desecuritization and vulnerabilities. An implicit decision was made by all parts concerned, who consciously left the room for a threat of a single hijacking and subsequent suicidal aggressive use by a terrorist or by a mentally impaired person. It was thus implicitly accepted that there could have been an incident involving a single passenger plane. But nobody expected four simultaneous suicidal attacks against the places of vital importance - it was beyond imagination in any potential securitization discourse.

4. Vulnerability of Social Systems, Terrorism and Complex Systems Studies

The most important problem with terrorism is that some vulnerabilities of social systems cannot be identified due to social and mental constraints of creative thinking (thinking about the yet non-existing, or even unthinkable), which are relatively well-known in social sciences.

The question is thus arising - how systems thinking and complexity studies could be helpful in predicting the unpredictable in the process of securitization of threats of terrorism?

Since applications of mathematical models in security studies have still limited usefulness attention must be paid to the use of concepts deriving from systems thinking and complexity studies as heuristic instruments - metaphors and analogies.

Securitization and identification of vulnerabilities are learning processes in which ideas taken from systems thinking and complexity studies have been already used in the

micro-scale in management theory and practice, e.g. [Senge 1990], [van der Heijden 1996] and other following writings. Perhaps experiences stemming from preparation of objectivized scenarios will be equally useful [Glenn & Gordon 2006]. Using this inspiration it seems reasonable to ask what are the barriers hampering the social learning processes, or in other words, what are the limitations of securitization of vulnerabilities?

5. Barriers of Social Learning

Securitization of vulnerabilities of social systems should be helpful in better prediction and prevention of threats of terrorism. For the use of analogies and metaphors taken from systems thinking and complexity studies in the securitization, a specific condition must be fulfilled. Source field and target field have to be properly defined. It means that in addition to a trivial demand that ideas of complexity must be well understood by the users, there should not be any limitations in access to information concerning social systems (target field of metaphor). For mechanistic metaphor of social systems, the information about those systems could be limited to those features which could be used in building analogy/metaphor possessing the facets of a machine.

For the metaphor of learning system referring to the concepts of complex adaptive systems any limitations of access to information about the target field of metaphor make the reasoning worthless. Although information is always incomplete yet securitization of vulnerabilities (social discourse) is impeded by the specific barriers: political correctness and tabooization, and secrecy.

5.1. Political Correctness and Tabooization

In a simplified approach political correctness will be treated as attempts to limit normative description of a person, a group, an institution or a social phenomenon. The key issue with political correctness is that the source of the norms is frequently not well-known and properly identified. The rules of political correctness may frequently create their eigendynamik, independent from the initial intentions of the authors. Tabooization as understood herein goes even further, by making evaluation of some aspects of social life not only forbidden but even unthinkable.

It must be stressed that political correctness and tabooization are not necessarily connected with ethnicity or nationality. The group or the person must always have an equal chance for self-defense. The point is that it should not be accomplished by imposing new rules limiting language and eventually, thinking and behavior of the others, but rather through topical argument. Experience from complex systems studies tell us that systems evolve in a spontaneous manner. Why then some issues cannot be discussed openly, especially in the democratic countries which cherish the freedom of speech?

Tabooization and political correctness are methods of control of the language and subsequently of the actions. It is well-known that control of spontaneity of the language and of the actions is counterproductive in learning social systems. Complex adaptive systems provide additional arguments for this assertion even with the simplest metaphors of bifurcations and "organization at the edge of chaos".

Political correctness and tabooization are resulting from a static (mechanistic) view of society since some views are to be rejected without reflection upon their consequences. It

is rooted in simplifying applications of mechanistic metaphors in which equilibrium and stability are viewed as dominant characteristics of social systems.

As to illustrate this conclusion it is easy to guess that anybody who would have earlier produced and publicized a scenario of 11 September would have been criticized both because of offending an ethnic group, and because of undermining reputation of the airlines and of the US government agencies.

Of course one may raise an argument that terrorist propaganda can also exploit the freedom of speech under the claims for adequate securitization discourse. The argument is however not symmetric. Terrorism by definition acts in a hidden form. Arguments supporting terrorism as a method of struggle for no matter what cause are never treated as legitimate. Therefore abandonment of limitations of open discussions caused by political correctness will not lead to open promotion of terrorism as a method of gaining political goals.

The lessons of 11 September 2001 can be reduced to the following conclusion. As to facilitate learning of social systems, the process of securitization/desecuritization of any threats must be free of any artificial semantic barriers. The discourse on vulnerabilities among the public, in the media and among the specialists must be moved to a higher level of thoroughness, specificity and objectivity.

5.2. Secrecy

Unrestricted access to information is a precondition of effective social learning. There exists a deficiency of discussion on terrorism conducted by any outsider who uses publicly available sources. Truly significant information, which could be important in anti-terrorist policy is obviously unavailable to any outsider who is but a careful “media watcher”. Therefore any studies of terrorism with applications of complex systems could become a GI-GO (garbage in - garbage out) enterprise. It is obvious that this remark concerns all security studies, both technical and more general, accomplished by the less informed "analysts(?)".

Assuming hypothetically that, for instance, it is known to the government agencies in various countries that terrorist groups have successfully attempted to obtain anthrax or weapons of mass destruction from different sources, e.g. from the inventory of post-Soviet arsenals.

Those who have such knowledge can produce more relevant predictions yet frequently not for the public use. For the analysts who do not have access to this kind of information, the research on the links between complexity studies and security, including terrorism, provides but an inspiration for better informed analysts and policy makers.

The following example mixes up political correctness and secrecy. After the 11 September 2001 attacks the officials in NATO countries have warned against new terrorist attacks, especially chemical, biological and even nuclear ones.

So what happened to the voices about incomplete inventories of Russian nuclear arsenals, biological and chemical weapons after the collapse of the Soviet Union? Maybe in the early 1990s the terrorist groups exploited havoc in Russia and obtained what they needed? Maybe they keep mass destruction weapons as a means of the ultimate resort?

The fate of the post-Soviet mass destruction weapons after 1991 has become a textbook example of desecuritization of an objective security threat. Some writings on that topic were neglected for the sake of maintaining good relations with Russia and for the sake of not spreading panic among the Western societies, e.g. [Allison *et al.* 1996].

6. Vulnerability of Social Systems and Implicit Contracting

Since ordinary negligence, institutional problems and typical barriers to creative thinking are well-known in political science, security theory and policy, attention is paid to a specific phenomenon leading to negligence of some terrorist threats.

Humans and social systems are limitlessly vulnerable to various unpredictable and unthinkable threats. However, in some cases vulnerabilities to terrorist attacks are well-known but due to physical limitations and/or conscious decisions a kind of "implicit contracts" are made with potential terrorists.

As an example the protection of airports can be quoted. Before the 11 September 2001 it could not be ruled out that some day a suicide terrorist attack with the use of an airplane (maybe even spectacular) could take place. It was implicitly assumed, however, that such an accident could be isolated. The terrorists of 11 September have broken the implicit contract firstly by a group suicide (irrational behavior), and secondly, by exploiting well-known vulnerabilities of the US aviation security system, which was more liberal in comparison with that one in Europe.

It may be easily guessed that similar situational implicit contracting is still quite common in most of the airports although at present more security protection measures have been introduced, and direct actions against the known terrorist organizations and individual terrorists have been taken. Many other situations of implicit contracts still exist in social systems and we have to search for them ("securitize" them) as to prevent new sophisticated terrorist attacks.

Bearing in mind the above it can be proposed that incomplete contracting should be regarded as an element of vulnerabilities of social systems which should be implemented in mathematical models of collective behavior used in security studies, e.g. agent based modeling. The models should be supplemented with game theory models of implicit contracting. Similarly, awareness of the role of implicit contracting in prediction of threats of terrorism should be supported with relevant analogies and metaphors, such as for example, the core metaphor of implicit contracting, the common knowledge - "I know that you know, you know that I know that you know....., etc., *ad infinitum*".

7. Conclusions

The ideas presented in the paper are but preliminary answers to the questions about security theory and policy after 11 September 2001. The main conclusion is that systems thinking and complexity studies can and should become instruments of security theory and policy in the 21st Century. It concerns both prediction associated with the social mechanisms of securitization/desecuritization, as well as actions aiming at preventing and eliminating threats, not only the already known ones. This assertion concerns also new threats such as mega-terrorist genocide, and "cyber-wars" and emergence of "intelligent machines" [Joy 2000], [Kurzweil 2000], casting shadow on the future of the

world social and political system. The ideas presented in the paper can be treated solely as an inspiration for further discussion on the links between complex systems studies, and security theory and policy.

Perhaps they could be helpful in the anti-terrorist policy making and in building future anti-terrorist strategy, as well as in elaborating a new security theory and policy recommendations meeting the challenges of yet unthinkable threats of the 21st Century.

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