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**CyRADARS**

# Usage of Decision Support Systems for Modeling of Conflicts during Recognition of Information Operations

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# Presentation Outline

1. Intro: information operation concept, problem description, solution idea.
2. Why information operation is a weakly structured complex system.
3. Information operation as a conflict between two subjects. Reflexive model of subjects in conflict.
4. Concept of DSS application to information operation modelling. Hierarchical model of information operation.
5. Example.
6. Concept of Information-analytical System for Information Operations Recognition.

# Problem

- In the competitive environment, reputational losses are of great significance for business
- Information operations, attacks, and influences damage reputation

Research objective: development of tools allowing information struggle participants to detect and counteract information operations in time

# Information Operation

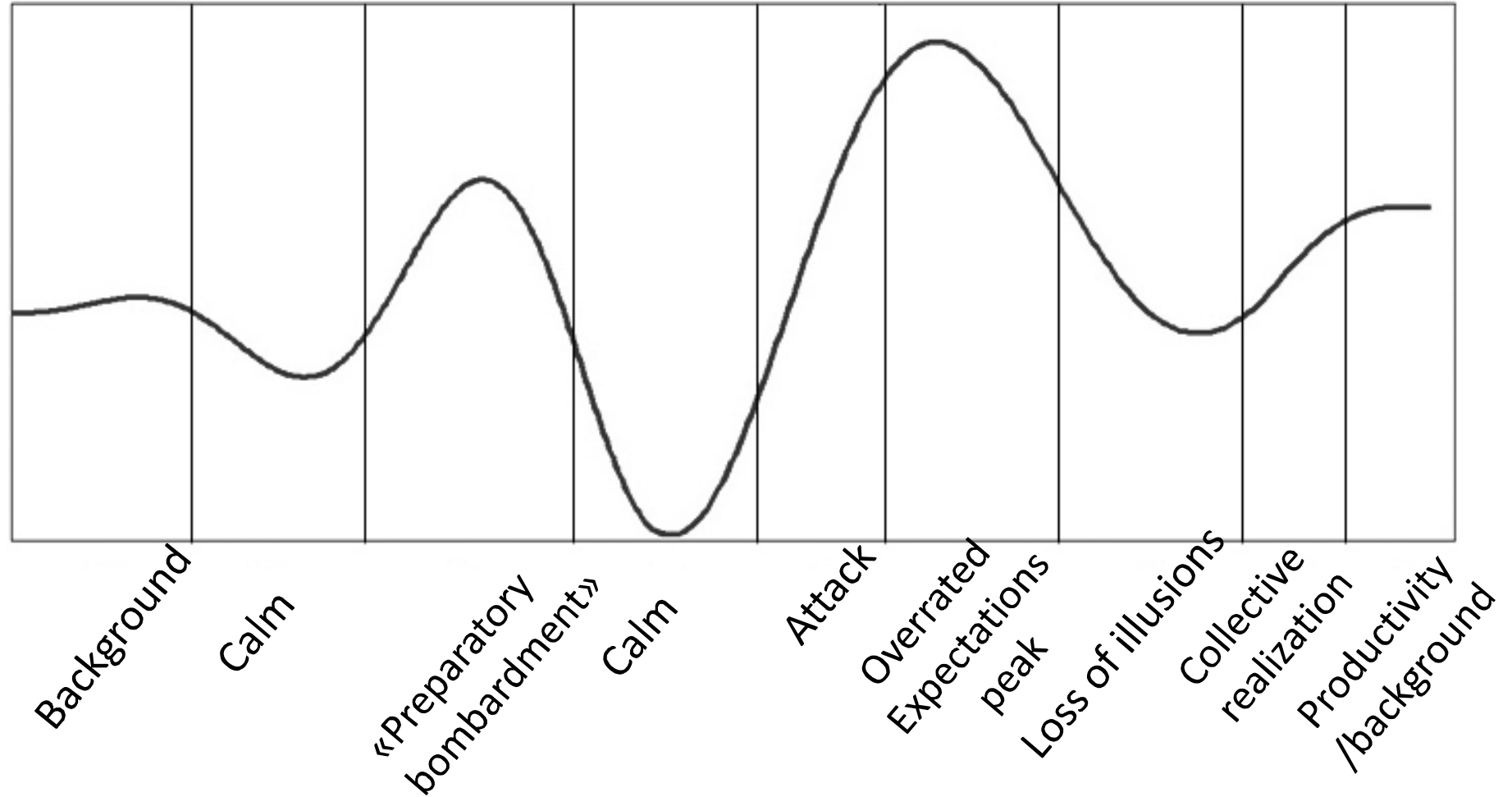
By information operation we mean the complex of information activities in the media (news articles in Internet and papers, news on TV, comments in social networks, forums, etc.) aimed to change the public opinion about a target object (person, organization, institution, country, etc.).

# Solution

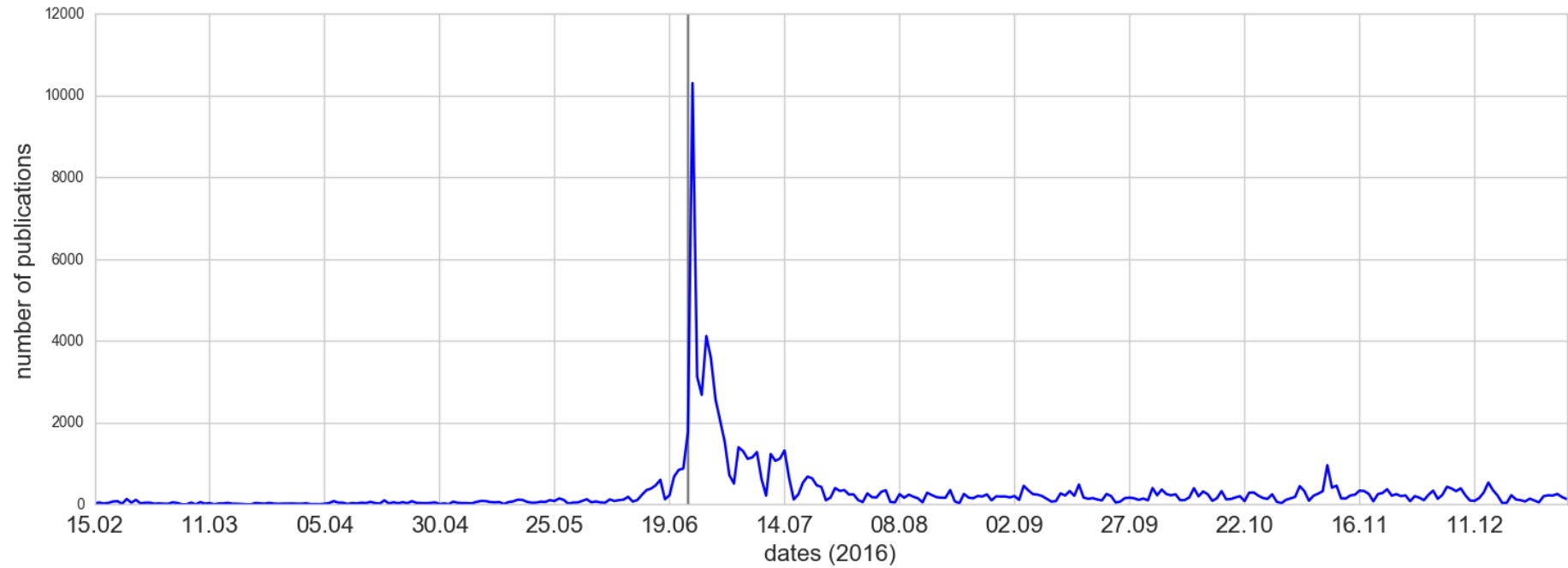
## Software for:

- detection of information operations, attacks, influences
- identification of primary sources and reasons
- estimation of dissemination scale
- providing recommendations

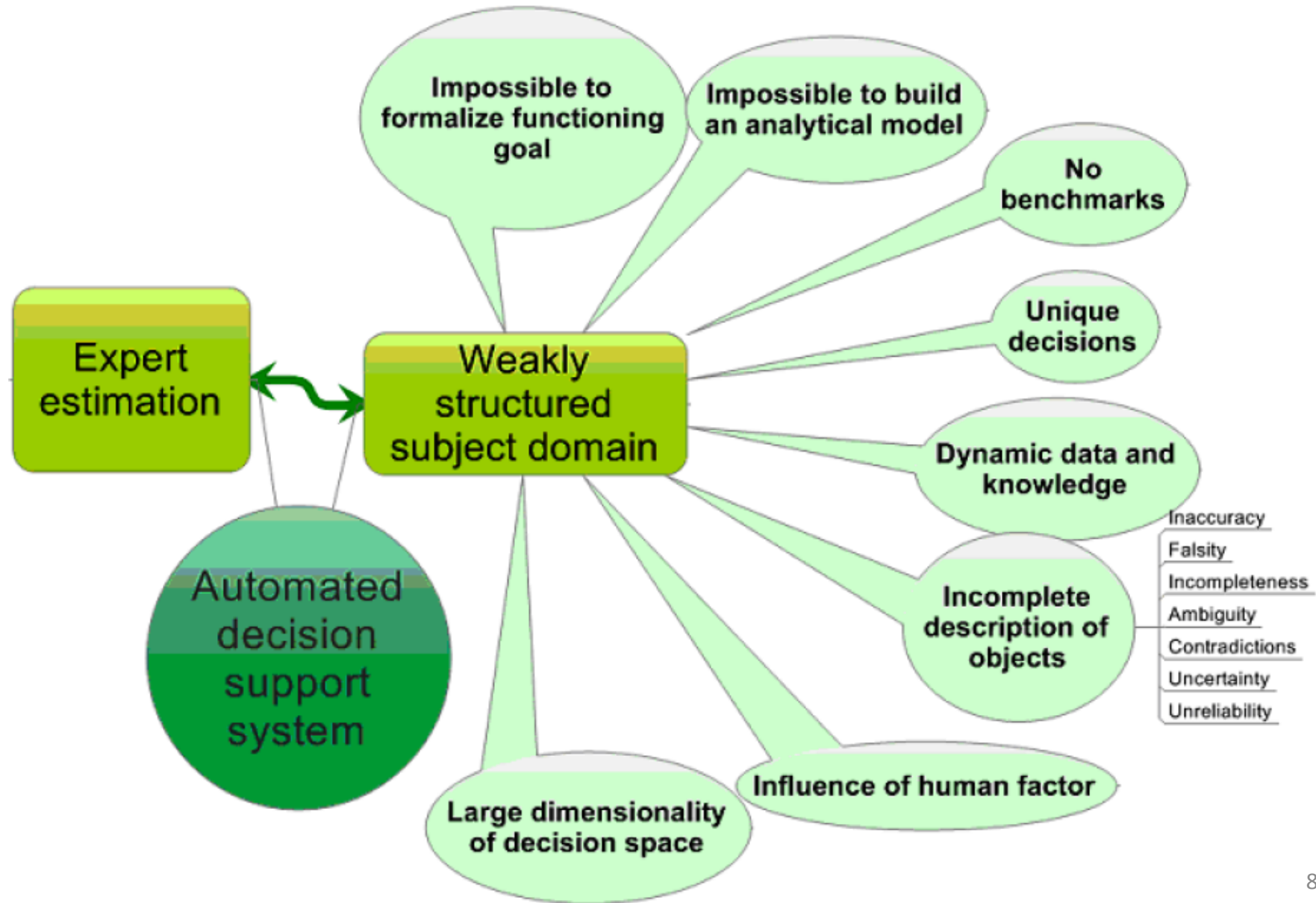
# Information Operation Roadmap



# Publication Dynamics on Target Issue



# Weakly Structured Domains





# Reflexive Model of Subjects in Conflict

$$A = (a_3 \& b_3 \rightarrow a_2) \vee (a_4 \& b_4 \rightarrow b_2) \rightarrow a_1$$

where  $A$  is the subject A choice readiness;  $a_1$  is the influence of the environment on both subjects;  $a_2$  is expected by subject A influence of the environment;  $b_2$  is expected by subject B influence of the environment from the point of view of subject A;  $a_3$  – intentions of subject A;  $b_3$  – intentions of subject B from the point of view of subject A;  $a_4$  is the impression of subject A of how subject B imagines the intentions of subject A;  $b_4$  is the impression of subject A of how subject B imagines his own intentions.

$$A_1 = (a_3 \& b_3 \rightarrow a_2) \vee (a_4 \& b_4 \rightarrow b_2)$$

where  $A_1$  is the self-estimate of subject A in the conflict situation with subject B.

$$B = (c_3 \& d_3 \rightarrow c_2) \vee (c_4 \& d_4 \rightarrow d_2) \rightarrow a_1$$

where  $B$  is the subject B choice readiness;  $a_1$  is the influence of the environment on both subjects;  $c_2$  is the expected by subject B influence of the environment;  $d_2$  is the expected by subject A influence of the environment from the point of view of B;  $c_3$  – intentions of subject B;  $d_3$  – intentions of subject A from the point of view of subject B;  $c_4$  is the impression of subject B about how subject A imagines the intentions of subject B;  $d_4$  is the impression of subject B about how subject A imagines his own intentions.

$$B_1 = (c_3 \& d_3 \rightarrow c_2) \vee (c_4 \& d_4 \rightarrow d_2)$$

where  $B_1$  is the self-estimate of subject B in the conflict situation with subject A.

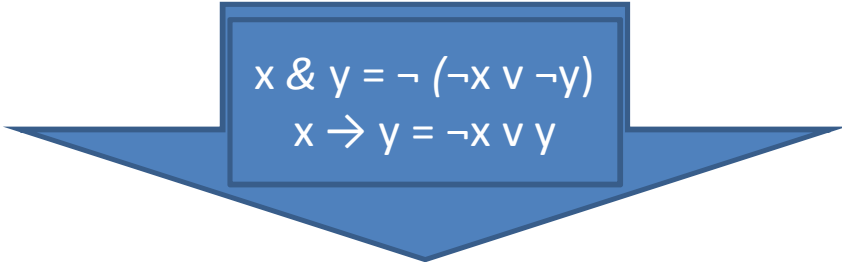
# Transformed Subject $a$ Choice Readiness Functions

$$A = (a_3 \& b_3 \rightarrow a_2) \vee (a_4 \& b_4 \rightarrow b_2) \rightarrow a_1$$

$$A_1 = (a_3 \& b_3 \rightarrow a_2) \vee (a_4 \& b_4 \rightarrow b_2)$$

$$B = (c_3 \& d_3 \rightarrow c_2) \vee (c_4 \& d_4 \rightarrow d_2) \rightarrow a_1$$

$$B_1 = (c_3 \& d_3 \rightarrow c_2) \vee (c_4 \& d_4 \rightarrow d_2)$$


$$x \& y = \neg (\neg x \vee \neg y)$$
$$x \rightarrow y = \neg x \vee y$$

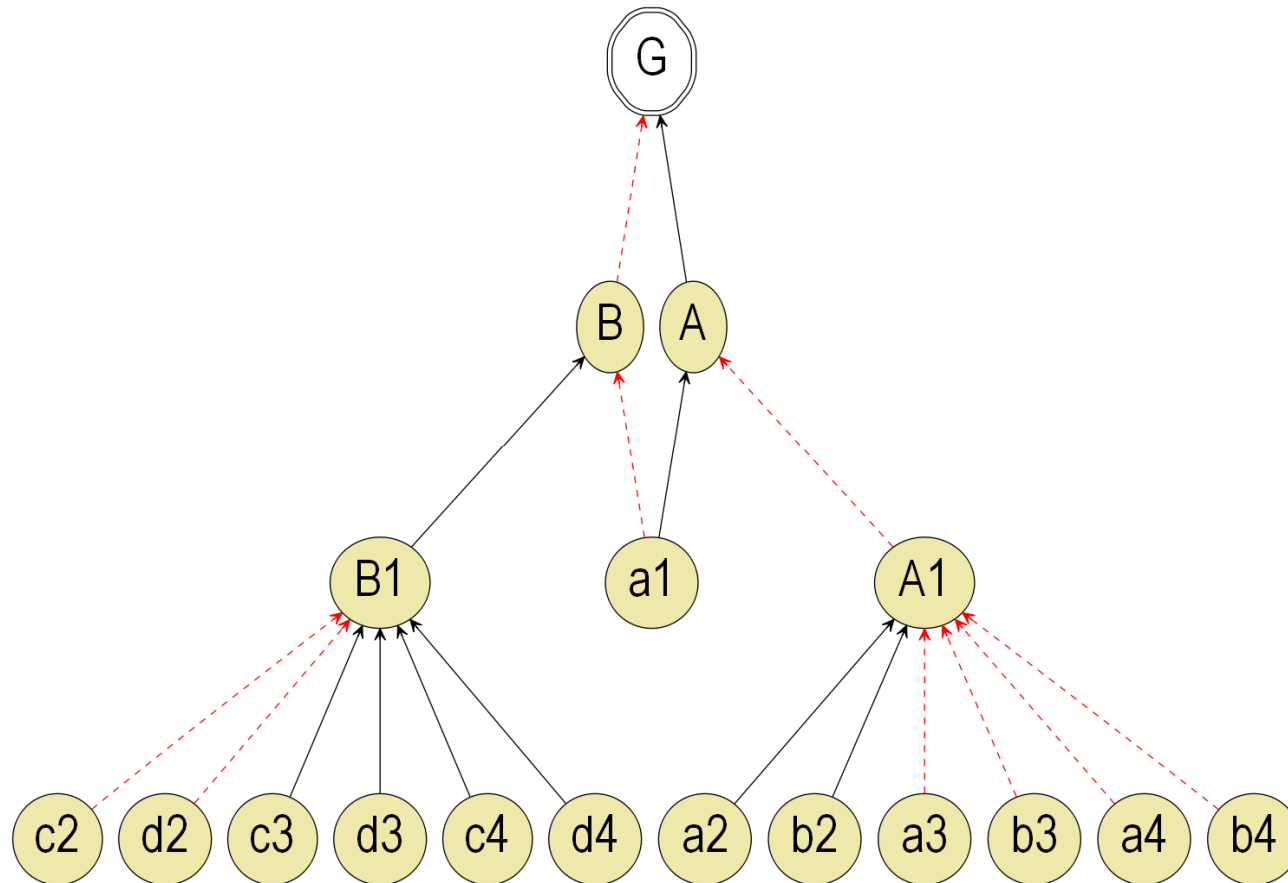
$$A = \neg A_1 \vee a_1$$

$$B = \neg B_1 \vee a_1$$



$$A_1 = a_2 \vee b_2 \vee \neg a_3 \vee \neg b_3 \vee \neg a_4 \vee \neg b_4$$

$$B_1 = c_2 \vee d_2 \vee \neg c_3 \vee \neg d_3 \vee \neg c_4 \vee \neg d_4$$

# DSS Knowledge Bases Design Pattern for the Conflict of Two Subjects



# Consensus-2 System

Consensus-2  System for distributed collecting expert information oleh.andriichuk@i.ua Logout 

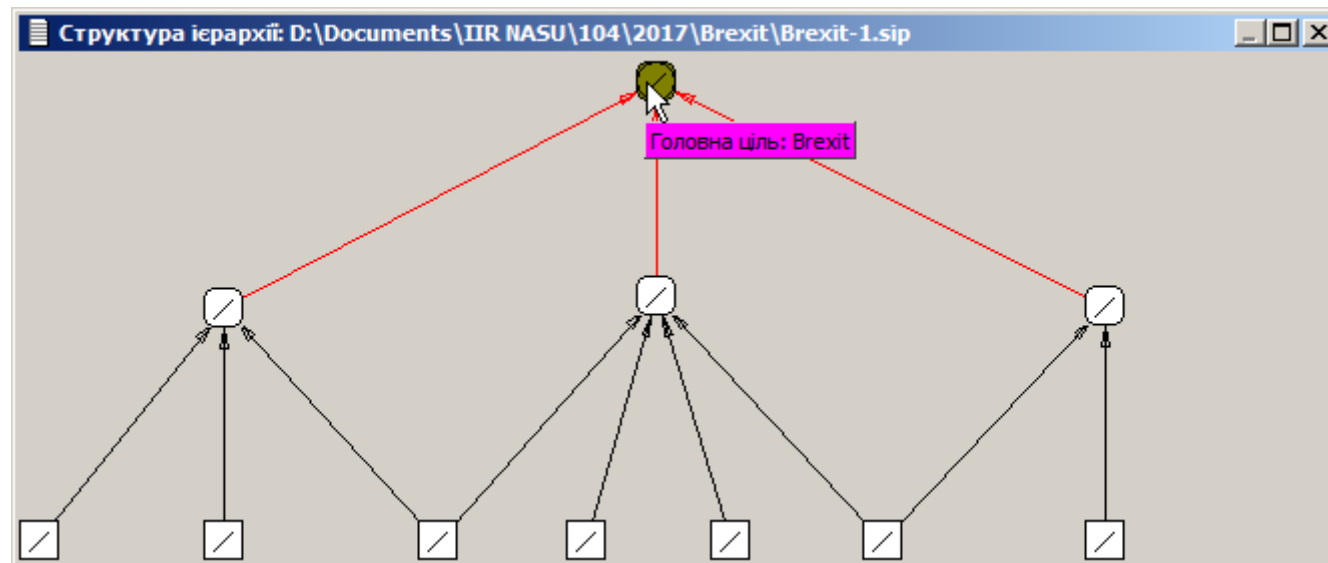
Manage Decompositions  
Experted Decompositions

**Final Stage**  
**Decomposition:** Brexit  
**Goal:** Brexit

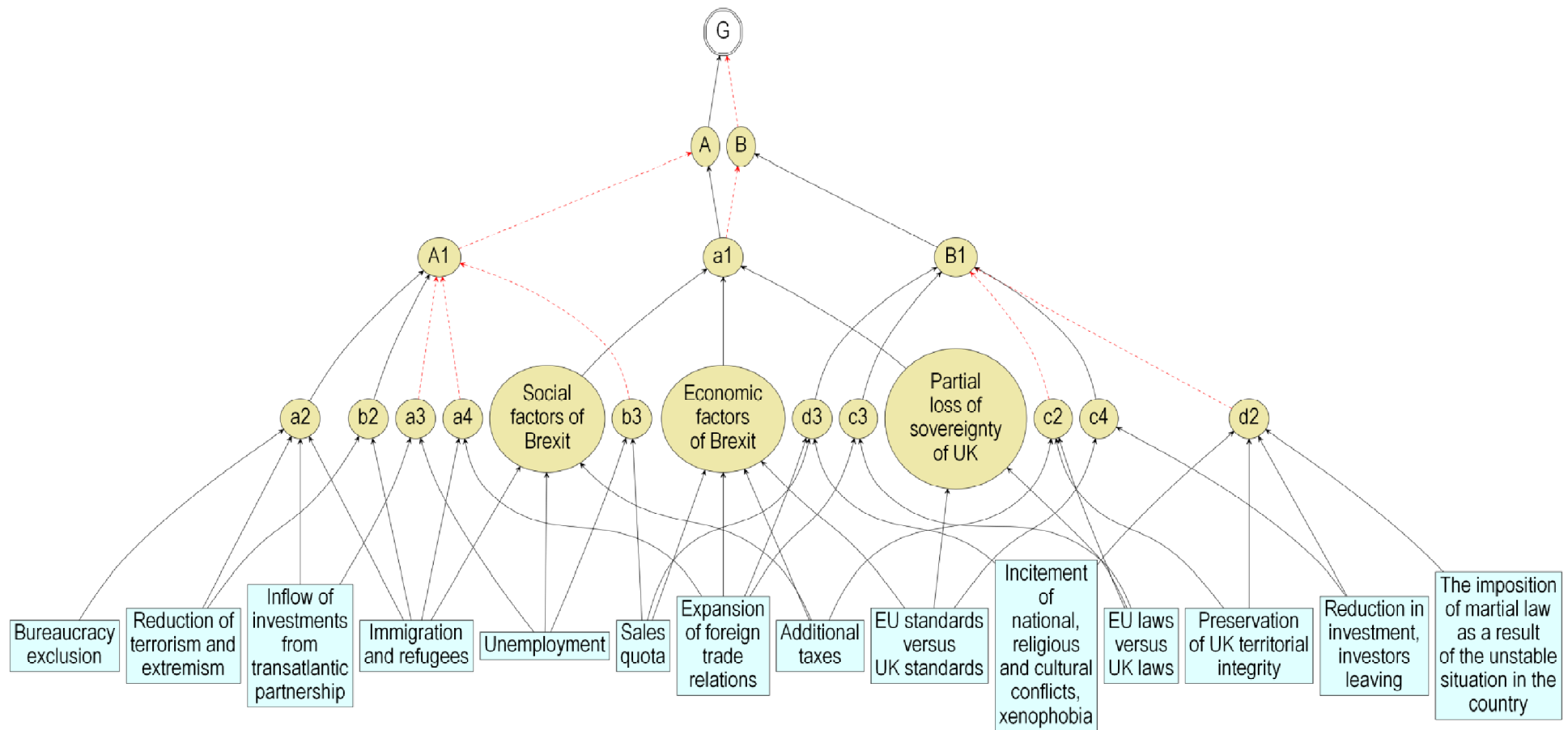
Green nodes means that decomposition for them can be created, just double click.  
Goals withing blue nodes are also clickable: you can see their decomposition.

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graph BT; Brexit((Brexit)) --> Social((Social factors of Brexit)); Brexit --> Economic((Economic factors of Brexit)); Brexit --> Sovereignty((Partial loss of sovereignty of UK)); Social --> Social1((Brexit and UK citizens)); Social --> Social2((Brexit and UK)); Social --> Social3((Brexit and EU)); Economic --> Economic1((Brexit and UK)); Economic --> Economic2((Brexit and EU)); Economic --> Economic3((Brexit and UK citizens)); Economic --> Economic4((Brexit and EU citizens)); Sovereignty --> Sovereignty1((EU standard and UK citizens)); Sovereignty --> Sovereignty2((EU and UK citizens));
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# Knowledge Bases of Solon-3 Decision Support Systems



# DSS Knowledge Base for the Conflict of Two Subjects



# Example of Queries for Content Monitoring System

<b>Immigration and refugees</b>	(immigra   migra   refugee) & (brexit]   (United~Kingdom~/3/leave~/3/European~Union)   (United~Kingdom~/3/leave~/3/EU])   (United~Kingdom~/3/exit~/3/European~Union)   (United~Kingdom~/3/exit~/3/EU])   (United~Kingdom~/3/withdrawal~/3/European~Union)   (United~Kingdom~/3/withdrawal~/3/EU])  (UK]~/3/leave~/3/European~Union)   (UK]~/3/leave~/3/EU])   (UK]~/3/exit~/3/European~Union)   (UK]~/3/exit~/3/EU])   (UK]~/3/withdrawal~/3/European~Union)   (UK]~/3/withdrawal~/3/EU])
<b>Sales quota</b>	(trade   sales) & (quot   limit) & (brexit   (United~Kingdom~/3/leave~/3/European~Union)   (United~Kingdom~/3/leave~/3/EU])   (United~Kingdom~/3/exit~/3/European~Union)   (United~Kingdom~/3/exit~/3/EU])   (United~Kingdom~/3/withdrawal~/3/European~Union)   (United~Kingdom~/3/withdrawal~/3/EU])  (UK]~/3/leave~/3/European~Union)   (UK]~/3/leave~/3/EU])   (UK]~/3/exit~/3/European~Union)   (UK]~/3/exit~/3/EU])   (UK]~/3/withdrawal~/3/European~Union)   (UK]~/3/withdrawal~/3/EU])
<b>Expansion of foreign trade relations</b>	((foreign~/2/trade)   (foreign~/2/business)   (overseas~/2/trade)   (external~/2/trade)   (overseas~/2/business)   (overseas~/2/commerc)   (overseas~/2/econom)   export   (external~/2/econom)   (foreign~/2/econom)   (foreign~/2/commerc)   (external~/2/commerc)) & (brexit   (United~Kingdom~/3/leave~/3/European~Union)   (United~Kingdom~/3/leave~/3/EU])   (United~Kingdom~/3/exit~/3/European~Union)   (United~Kingdom~/3/exit~/3/EU])   (United~Kingdom~/3/withdrawal~/3/European~Union)   (United~Kingdom~/3/withdrawal~/3/EU])  (UK]~/3/leave~/3/European~Union)   (UK]~/3/leave~/3/EU])   (UK]~/3/exit~/3/European~Union)   (UK]~/3/exit~/3/EU])   (UK]~/3/withdrawal~/3/European~Union)   (UK]~/3/withdrawal~/3/EU])
<b>EU standards versus UK standards</b>	(standards   norms   normative~documents   regulatory~document   standard~regulation   regulatory~act   standard~act   commercial~act   normative~documents   normative~act   regulations) & (brexit   (United~Kingdom~/3/leave~/3/European~Union)   (United~Kingdom~/3/leave~/3/EU])   (United~Kingdom~/3/exit~/3/European~Union)   (United~Kingdom~/3/exit~/3/EU])   (United~Kingdom~/3/withdrawal~/3/European~Union)   (United~Kingdom~/3/withdrawal~/3/EU])  (UK]~/3/leave~/3/European~Union)   (UK]~/3/leave~/3/EU])   (UK]~/3/exit~/3/European~Union)   (UK]~/3/exit~/3/EU])   (UK]~/3/withdrawal~/3/European~Union)   (UK]~/3/withdrawal~/3/EU])

# Effectiveness of Topics

Rank #	Topic	Effect., %
1	Immigration and refugees	27
2	EU standards versus UK standards	15
3	EU laws versus UK laws	13
4	Expansion of foreign trade relations	9
5	Additional taxes	8
6	Sales quota	7
7	Unemployment	5
8	Incitement of national, religious and cultural conflicts, xenophobia	4
9	Inflow of investments from transatlantic partnership	3
10	Reduction in investment, investors leaving	3
11	Preservation of UK territorial integrity	2
12	Reduction of terrorism and extremism	2
13	Bureaucracy exclusion	1
14	The imposition of martial law as a result of the unstable situation in the country	1

## Values of Goals Achievement Degrees of Conflict's Subjects

Subject A: 0.597

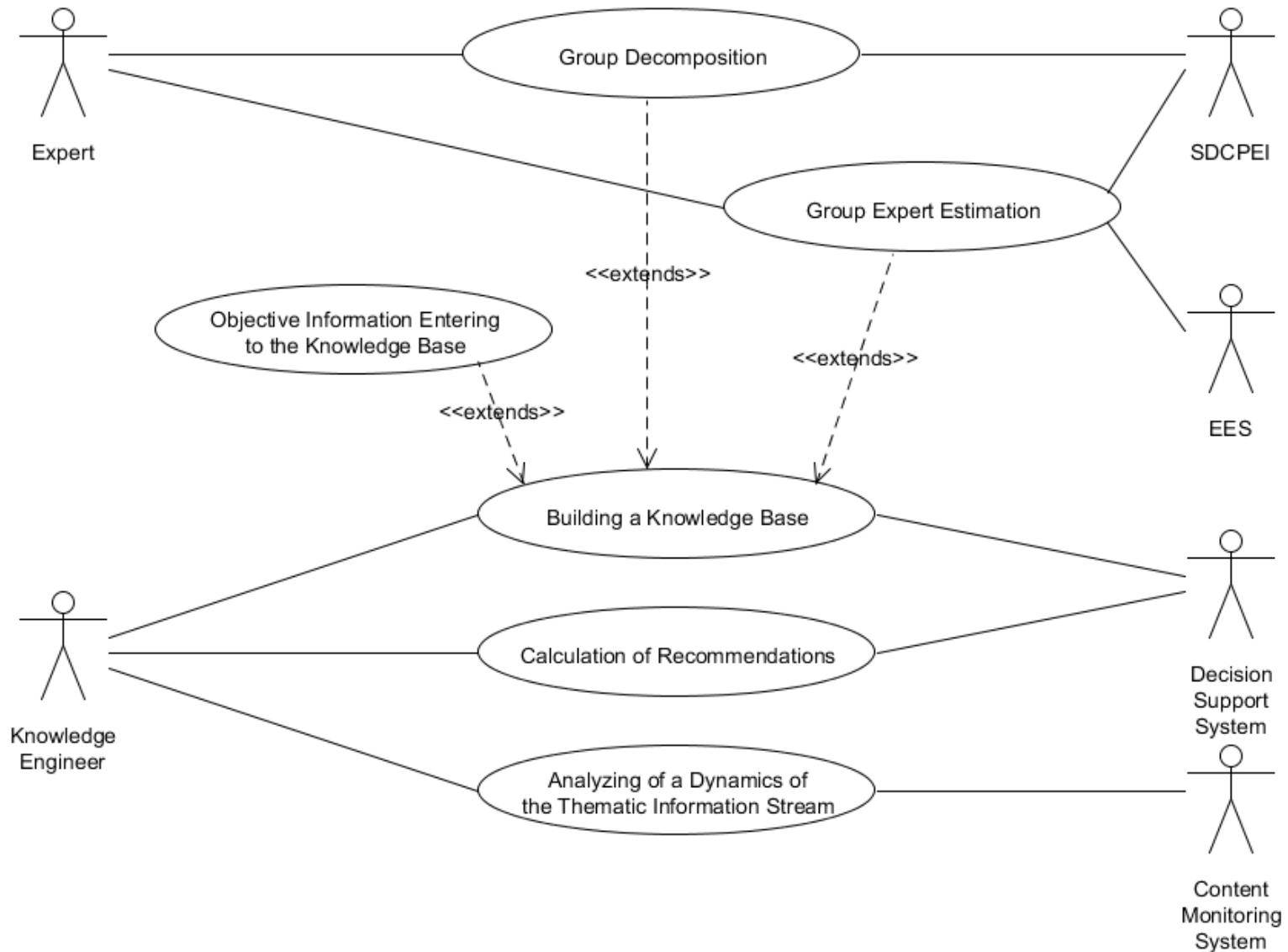
Subject B: 0.426



# Core of the Methodology for Conflicts Modelling by Decision Support Systems in Information Operations Recognition

1. The preliminary study of the Information Operation (IO) object is carried out, the subjects of the conflict are determined, together with their goals, related to the subjects of the conflict, persons, organizations, companies. In the process of informational and analytic research a common problem, often faced by analysts is compiling a ranking of a set of objects or alternatives (products, electoral candidates, political parties etc) according to some criteria.
2. The respective design pattern for DSS KB is selected and modified if necessary. In modification of the design, one should take into account the features of modelling of logical operations in DSS KB.
3. The selected design pattern for DSS KB is complemented to full-range KB. The group expertise on determination and decomposition of IO goals is carried out. Thus, the decomposition of IO as of complex weakly structured system is taking place. For this purpose, the system for distributed acquisition and processing of expert information (SDAPEI) is used.
4. The respective KB is complemented using DSS tools taking into account the results of the group expertise, carried out by means of SDAPEI, and available objective information. For clarification of queries to content monitoring systems (CMS) and for complementation of DSS KB with lacking objects and links the keyword network of the subject area of respective IO is used.
5. Using CMS tools the analysis of dynamics of the thematic data stream is carried out. DSS KB is complemented with partial influence coefficients.
6. Using DSS tools based on the constructed KB the recommendations are calculated.

# Use Case Diagram of the Concept of Information-analytical System for Information Operations Recognition



# Summary

- We substantiated the advantages of DSS usage for modelling of conflicts during information operations recognition. We considered an information operation as a complex weakly structured system.
- We described the model of conflict between two subjects based on the second-order rank reflexive model.
- We introduced the method for DSS's knowledge base construction using the model of the conflict between two subjects.
- We suggested a method for application of DSS to modelling of conflicts during information operation recognition. And defined the area of the method's application.



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Thank you for attention!