

Simulating the Interrelationships of Military Plan Activities

Frida Harrysson Hinshaw

Farshad Moradi

Johan Schubert



Introduction

- Test and develop a simulation-based method for generating input to a decision support tool
- Providing information on how military activities affect their environments
- Deliver a cross-impact matrix displaying the interrelationships of military plan objects

Background

1. Why do we need to enable the work of our decision makers?
 - Changing warfare → new challenges
2. What can we do to facilitate?
 - Need for understanding and evaluating our plans
3. How shall we solve our task?
 - Providing a comprehensive picture
 - Inconsistencies
 - Weaknesses
 - Feedback loop

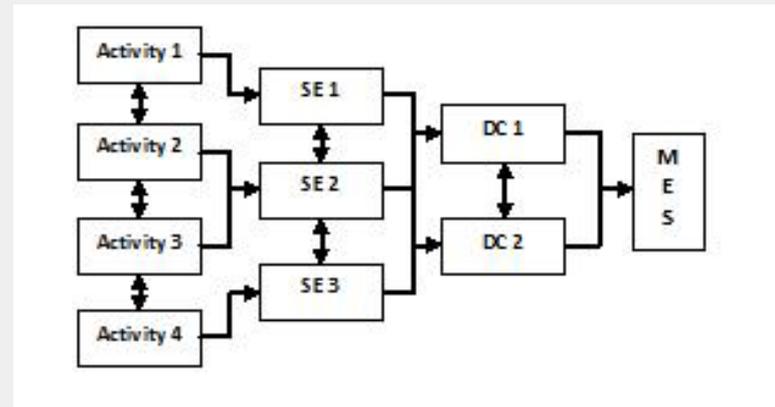
Collaborative Synchronization Management Tool (CSMT)

- Operations analysis tool
 - Analysis of plan stabilities
 - Detecting inconsistencies
 - Enables comparisons of plans



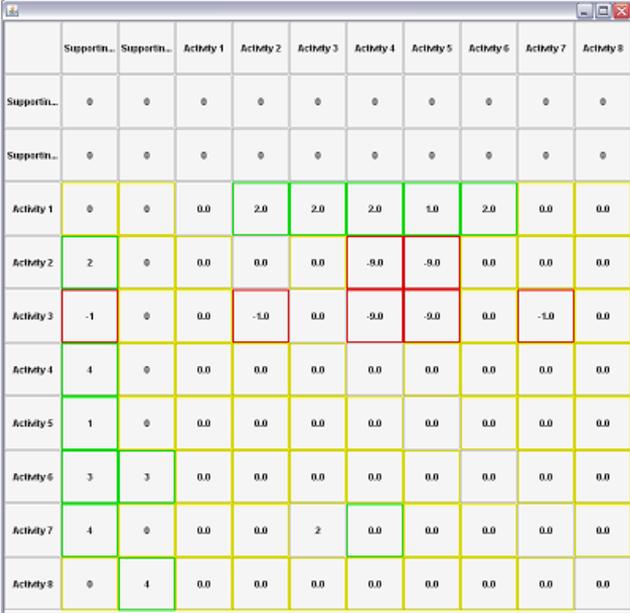
Cross Impact Matrix (CIM)

- Developed within the framework of EBAO
- Relationships between plan components
- Entities
 - Activities
 - Supporting Effects
 - Decisive Conditions
 - Military End State



Proposed method

- Current method: subject matter experts
 - Traceability problems
 - Issues related to subjectivity among the experts
- Proposed method: simulation
 - Traceable
 - Consistent
 - Cost-saving
- Process
 - Modeling
 - Simulating
 - Evaluating



	Supportin...	Supportin...	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7	Activity 8
Supportin...	0	0	0	0	0	0	0	0	0	0
Supportin...	0	0	0	0	0	0	0	0	0	0
Activity 1	0	0	0.0	2.0	2.0	2.0	1.0	2.0	0.0	0.0
Activity 2	2	0	0.0	0.0	0.0	-9.0	-9.0	0.0	0.0	0.0
Activity 3	-1	0	0.0	-1.0	0.0	-9.0	-9.0	0.0	-1.0	0.0
Activity 4	4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Activity 5	1	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Activity 6	3	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Activity 7	4	0	0.0	0.0	2	0.0	0.0	0.0	0.0	0.0
Activity 8	0	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Modeling

- Environment consists of
 - Actors
 - Environmental objects
- Simulation state
 - The states of actors and environmental objects collectively make up the simulation state
- Plan
 - A sequence of *activities* that together lead to a desired *end-state* which is set by a military force

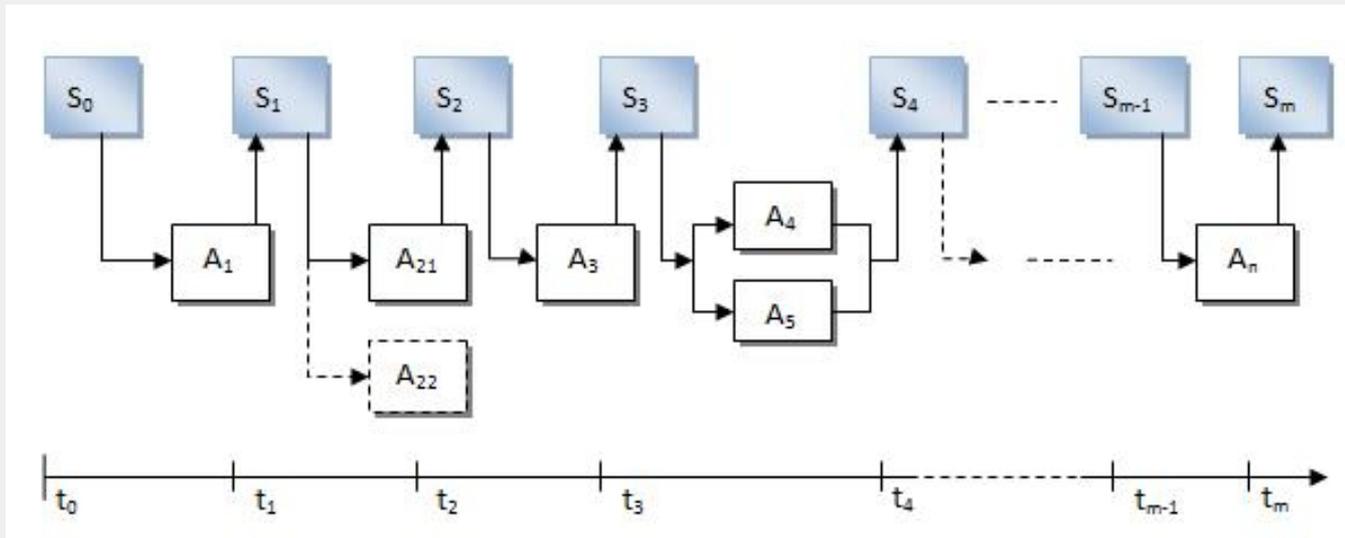
Models

- Activities
 - Involved actors and environmental objects
 - Necessary conditions
 - Activity Weights
 - Describes how important an actor is to the activity
 - Attribute Weights
 - Describes how important other attributes than strength are to the activity
- Actors
 - Actor weights
 - Describes how important an attribute is to the actor
 - Strength

$$S_i = \frac{1}{n} \sum_{j=1}^n r_j * w_j,$$

Modeling

- Simulation state and activities



State change of the simulation state

- Contextual variable change
 - Effect of the activity on actors and environmental objects
 - Primary changes
 - Secondary changes
 - Based on the relation between actors
 - Covering the cascade effects

Impact calculation

- Parallel activities →
comparison between pre-activity state and state during activity
- Sequential activities →
comparison between pre-activity state and post-activity state
- Conditions in different states

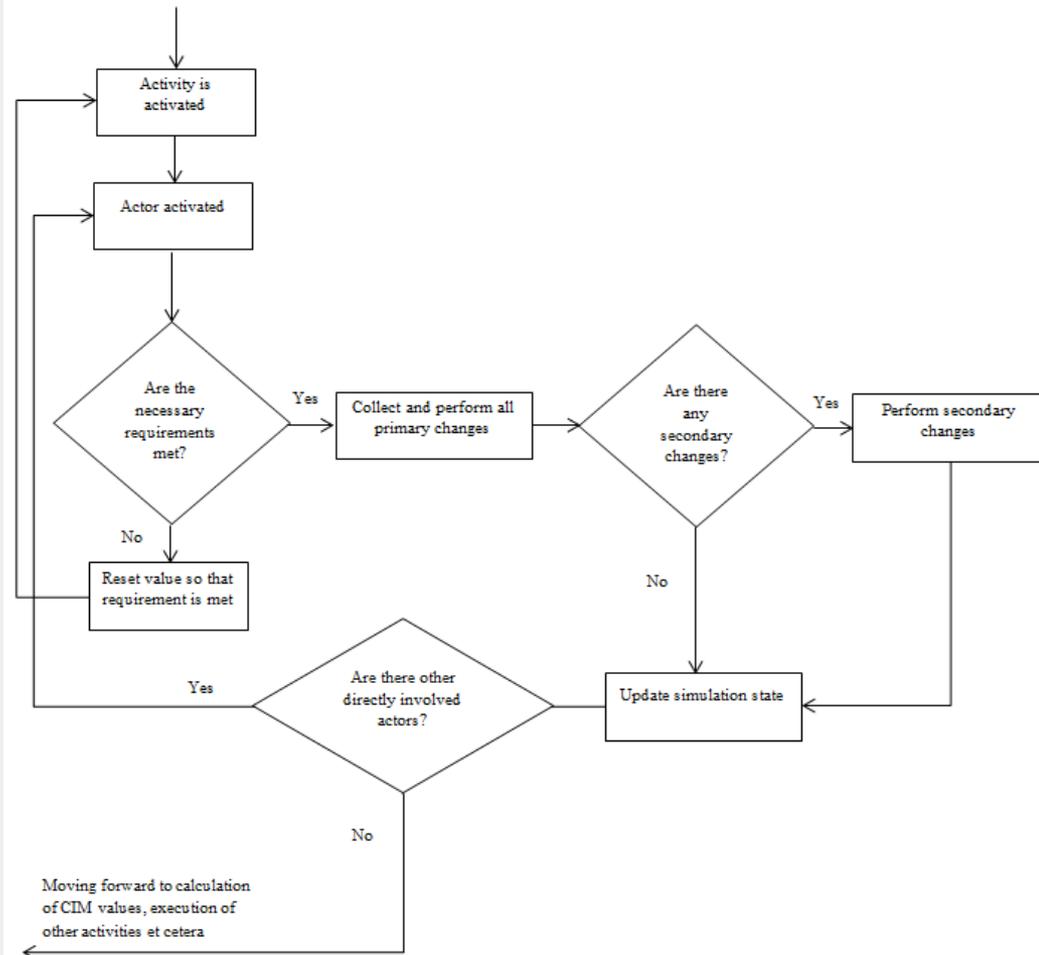
$$C_k = \frac{1}{m} \sum_{i=1}^m s_i * v_i + \frac{1}{p} \sum_{j=1}^p t_j * a_j$$

- CIM Value

$$CIM \text{ value} = 9 * \left\{ \frac{C_2 - C_1}{6} \right\}.$$

Simulation process

- For each activity the "stakeholders" are identified
 - Roles
 - Initial values
- The simulation run consists of:
 - Collecting all necessary activity resources and other requirements that makes the execution possible and check if they are met
 - Collecting all changes associated with the execution,
 - Collecting all secondary effects associated with each attribute state change



Testing the method

- Test case
 - Bogaland
 - 2 supporting effects
 - 9 activities
 - Establish area surveillance and identify key leaders of DSD (irregular actor)
 - Arrest DSD key leader
 - Handover civilian security to the UN
 - ...
 - Actors
 - BFOR
 - Influential single actor
 - Neighboring country
 - Irregular actor
 - International forces
 - Local population
 - ...

Testing the method

- Modeling tool
 - Creating templates of
 - Activities
 - Actors
 - Environmental objects
 - Creating interrelationship database
- Simulation

Results & Evaluation

- Validation was difficult
- Comparisons of strength changes give positive indications
- Small CIM values could indicate that more detailed models are required
- The method is a possible alternative but very time-consuming initially

Conclusions

- Our method was
 - Practicable
 - Beneficial
- But we need to
 - Examine the costly process of producing model templates
 - Test a more suitable scenario and perform a proper validation
- Future work
 - Could include more detailed models, for example linking *weights* to activities

Questions?

- frida.harrysson@foi.se
- farshad.moradi@foi.se
- www.foi.se